Via Email

March 1, 2024

Kern County Planning and Natural Resources Department
Attn: Keith Alvidrez, Planner II
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Bakersfield, CA 93301
CTV1EIRComments@kerncounty.com
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Re: Comments on the Draft Environmental Impact Report for Carbon TerraVault I

Dear Mr. Alvidrez:

On behalf of Center for Biological Diversity, Center on Race, Poverty & the Environment, Central California Environmental Justice Network, Central Valley Air Quality Coalition, and Sierra Club, we are writing to submit the following comments regarding the Draft Environmental Impact Report (the Draft EIR) for the Carbon TerraVault I Project (the CTV I Project) for carbon capture and storage (CCS) in the Elk Hills oil field. These comments are offered to ensure that Kern County (the County) complies with the California Environmental Quality Act (CEQA)[1] and CEQA Guidelines[2] in its consideration of the CTV I Project.

In addition, we submit technical expert analyses prepared by Ron Sahu, PhD, QEP, CEM (Attachment A); Dominic DiGiulio, PhD (Attachment B); and Richard Kuprewicz (Attachment C). We refer the County to these reports, both here and throughout these comments, for further discussion of the Draft EIR's inadequacies.

As an initial matter, we urge the County to redress key deficiencies in the Draft EIR that inhibit public comment and participation. In particular, the Draft EIR fails to provide an "Appendix 1" that is repeatedly referenced throughout the document and relied upon for key information about existing oil and gas wellbores and planned monitoring wells at the Project site.[3] The County must recirculate the Draft EIR, include the missing Appendix 1, and provide a

[1] Pub. Resources Code, § 21000 *et seq*.
[2] Cal. Code Regs., tit. 14, § 15000 *et seq*. (CEQA Guidelines).
[3] See, e.g., Draft EIR, Vol. 1 at 4.7-1 (noting "Geology and Soils" analysis in section 4.7 is based on U.S. Environmental Protection Agency's (EPA's) Class VI Underground Injection Control (UIC) Permit Application for CTV I); Draft EIR, Vol. 2, App'x E.2: EPA Class VI UIC Permit Application Narratives for the Elk Hills 26R Storage Project and the A1A2 Storage Project at 2240 ("Appendix 1 provides a complete list of all API-12 wellbores within the [area of review]. As required by 40 CFR 146.84(c)(2), the well table in Appendix 1 describes each well's type, construction, date drilled, location, measured depth, true vertical depth, completion record relative to the A1-A2 injection zone, record of plugging, requirement for corrective action, if necessary. CTV also identifies well work to be completed during the pre-operational testing phase.").

minimum 45-day comment period to give the public sufficient time to review and comment on the CTV I Project as required by CEQA.[4]

Beyond the obvious error of failing to include Appendix 1, the Draft EIR is generally missing critical details about the CTV I Project and vague throughout, making it impossible to sufficiently analyze the range of impacts due to the Project and to adopt adequate mitigation measures. The Draft EIR therefore fails in its basic purpose of being an informational document "to provide public agencies and the public in general with detailed information about the effect that a proposed project is likely to have on the environment; to list ways in which the significant effects of such a project might be minimized; and to indicate alternatives to such a project."[5]

These errors are particularly inappropriate because this Project will be the first in California to deploy CCS in order to facilitate continued fossil fuel extraction and combustion, which is an application of this technology that threatens to seriously derail progress toward state and federal climate commitments.[6] Indeed, not only will the CTV I Project extend the life of the decades-old Elk Hills oil field and the existing gas plant and power plant supporting the field, the Project will also justify the build-out of multiple new polluting facilities as future CO_2 sources, including a blue hydrogen plant, a renewable dimethyl ether production facility, a gasoline plant, and a waste-to-energy production facility.[7] Rather than doubling down on counterproductive and risky projects that will allow the Elk Hills field to continue operating for years longer than necessary, and further lock in the County's dependence on the fossil fuel industry, the County should be investing in the transition to renewable clean energy solutions.

In the past, initial projections of specific CCS proposals have frequently overestimated the level of capture that those projects ended up achieving in practice.[8] The Draft EIR neither grapples with this possibility in the context of CTV I nor demonstrates how it plans to avoid the pitfalls that hindered earlier projects. And by allowing fossil fuel facilities to keep operating, CTV I will ultimately serve to exacerbate pollution and ongoing harms to the County's frontline communities.[9] The process of capturing, transporting, injecting, and storing CO_2 also poses serious public health and safety threats, including from toxic releases and catastrophic accidents

[4] CEQA Guidelines, § 15105(a).
[5] See Pub. Resources Code, § 21061.
[6] See Inst. for Energy Economics & Fin. Analysis (IEEFA), *The Carbon Capture Crux* (Sept. 2022) at 73–74, https://ieefa.org/sites/default/files/2022-09/The%20Carbon%20Capture%20Crux.pdf.
[7] Cal. Resources Corp. (CRC), *Carbon TerraVault Vaults*, https://www.crc.com/carbon-terravault/vaults/default.aspx (last accessed Feb. 23, 2024).
[8] See, e.g., IEEFA, *The Carbon Capture Crux*; IEEFA, *Carbon Capture and Storage*, https://ieefa.org/ccs#:~:text=Yet%20an%20IEEFA%20review%20of,low%20carbon%2C%20not%20a%20solution (last updated Dec. 5, 2023).
[9] See Jacobson, M.Z., *The Health and Climate Impacts of Carbon Capture and Direct Air Capture*, Energy Environ. Sci. 12 (2019), 3567–74, https://doi.org/10.1039/C9EE02709B; Concerned Health Professionals of N.Y. & Physicians for Social Responsibility, *Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking and Associated Gas and Oil Infrastructure* (Apr. 2022) at 80–81, https://www.psr.org/wp-content/uploads/2022/04/compendium-8.pdf.

that endanger the homes, schools, and other sensitive locations near Elk Hills.[10] The Draft EIR fails to demonstrate how the CTV I Project will minimize these harms, nor does it indicate that the Project's alleged benefits are justified in light of them.

These harms will disproportionately fall on people of color and lower income residents who have long been overburdened by the same oil and gas operations and polluting industries that CTV I now threatens to prolong.[11] The Elk Hills oil field neighbors environmental justice communities in Buttonwillow, Taft, and Tupman that cannot afford the air, climate, energy, water, health and safety, geologic, biological, and other impacts from the CTV I Project.[12]

After carefully reviewing the Draft EIR, we have concluded that it fails in numerous respects to comply with CEQA. As explained below, the Draft EIR violates CEQA because it fails to: (1) properly define the project description and the scope of the CTV I Project's foreseeable impacts; (2) properly consider reasonably foreseeable projects; (3) adequately analyze and mitigate growth-inducing impacts; (4) employ appropriate Project objectives; (5) properly consider alternatives to the Project; and (6) adequately analyze and mitigate numerous foreseeable environmental impacts and cumulative impacts. As the first environmental impact report prepared for a CCS project in California, the Draft EIR falls far short of establishing appropriate standards and safeguards should these projects move forward in the future.

For these and the additional reasons expressed below, we strongly urge the County to reject the Draft EIR as an informational document, and to prepare and circulate a revised Draft EIR that complies with CEQA.

We include a table of contents on the next page to facilitate review.

[10] See DiGiulio Report at 3–5; Zegart, *The Gassing of Satartia*, Huffington Post (Aug. 26, 2021), https://www.huffpost.com/entry/gassing-satartia-mississippi-co2-pipeline_n_60ddea9fe4b0ddef8b0ddc8f.

[11] See Lam, Y. et al., *Briefing: Analysis of Proposed Carbon Capture Projects in the US Power Sector and Co-Location with Environmental Justice Communities* (Sept. 2023) at 4, https://static1.squarespace.com/static/5d14dab43967cc000179f3d2/t/64f9df23792cce775bf32100/1694097188142/Map_Proposed+CCS+Projects+-+Two+Pager_CURRENT.pdf (showing 94.3% of planned CCS projects in the U.S. power sector are located within 3 miles of an environmental justice community, including CTV I).

[12] Numerous studies have found a significant association between proximity to oil and gas production and adverse health outcomes in the San Joaquin Valley. See, e.g., Gonzalez, D.J.X. et al., *Oil and Gas Production and Spontaneous Preterm Birth in the San Joaquin Valley, CA* (2020), Environmental Epidemiology, 4(4), https://journals.lww.com/environepidem/Fulltext/2020/08000/Oil_and_gas_production_and_spontaneous_preterm.1.aspx?context=LatestArticles.

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I. THE DRAFT EIR'S ANALYSIS AND MITIGATION ARE BASED ON AN IMPROPER PROJECT DESCRIPTION

CEQA aims to foster greater transparency to ensure that decisionmakers and stakeholders are informed of potentially harmful environmental consequences of proposed projects, receive a clear and robust analysis of those consequences, and are assured that feasible mitigation is implemented. This level of transparency requires a complete understanding of the project and an analysis that encompasses the project's full scope. "Only through an accurate view of the project may outsiders and public decision-makers balance the proposal's benefits against its environmental cost, consider mitigation measures, assess the advantage of terminating the proposal . . . and weigh other alternatives in the balance."[13] Here, the County does not achieve the level of transparency required by CEQA because of an inappropriately narrow project description.

Under CEQA, a "project" is defined as the whole of an action that has the potential to cause direct or indirect physical changes to the environment.[14] A project description that omits integral components of the full project may result in an EIR that fails to disclose all the impacts of the project.[15] EIR project descriptions have been rejected as inadequate when, as is the case here, the EIR limited the scope of environmental review by artificially narrowing the project description, thus minimizing the project's impacts and undermining public review.[16]

A proper description and analysis must include "future action" that is "a reasonably foreseeable consequence of the initial project" and would "be significant in that it will likely change the scope or nature of the initial project or its environmental effects."[17] As explained below, the Draft EIR fails to include the whole of the action in its analysis, and to analyze reasonably foreseeable and significant consequences of the CTV I Project.

The Draft EIR's scope is too narrow because it fails to address critical components of the CTV I Project, including the interrelationship between the Project and the development of industries in Kern County that will send CO_2 for sequestration to the Elk Hills oil field, and between the Project and development of CO_2 transportation infrastructure. And the inadequate

[13] *County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 192.
[14] CEQA Guidelines, § 15378(a); see *Habitat Watershed Caretakers v. City of Santa Cruz* (2013) Cal.App.4th 1277, 1297.
[15] *Santiago County Water Dist. v. County of Orange* (1981) 118 Cal.App.3d 818, 829 (project description for sand and gravel mine omitted water pipelines serving project); *City of Santee v. County of San Diego* (1989) 214 Cal.App.3d 1438, 1454 (concluding that complete project description is necessary to ensure that environmental impacts of entire project are considered).
[16] See, e.g., *Rural Landowners Assn. v. City Council* (1983) 143 Cal.App.3d 1013, 1024 (EIR for city general plan amendment and rezoning that failed to describe or analyze the impacts of development that would follow annexation to the city); *County of Inyo, supra*, 71 Cal.App.3d at 193 (EIR for groundwater pumping and water export project that failed to describe or analyze groundwater exports and instead improperly sought to characterize expanding groundwater exports as a separate, ongoing project).
[17] *Laurel Heights Improvement Assn. v. Regents of Univ. of Cal* (1988) 47 Cal.3d 376, 396, as modified on denial of reh'g (Jan. 26, 1989).

specification of the project description and scope also renders the Draft EIR informationally inadequate.

The project description states that the Project includes "the construction and operation of an approximately 9,130-acre CCS facility with related capture facilities and pipelines for the initial source."[18] That "initial source," according to the Draft EIR, would be the pre-combustion Elk Hills oil field gas, which is processed at the natural gas plant (CGP-1) facility and used at the Elk Hills power plant. The Draft EIR goes on to say that "[n]o additional sources of CO_2 (from outside Elk Hills) or other new development are proposed for the CCS Surface Land Area or injection into the project."[19]

However, the "initial source" that the Draft EIR analyzes is only the first among several sources that are proposed to send CO_2 for storage in the Project. The storage reservoirs have the capacity to store almost 50 million metric tons (MMT) of CO_2 and the Project proponent is seeking to approve *the whole project's storage capacity* in the Draft EIR.[20] The Draft EIR's analysis discloses that at a maximum, the initial source's CO_2 will add up to about 31 MMT of captured CO_2.[21] And even this number is hypothetical and might in fact be much lower, as it assumes continuous operations of the power plant into the year 2045, while the Draft EIR admits that the plant "may be forced to close sooner" due to California's fossil fuels policies.[22]

While the Draft EIR notes that other sources could be sending CO_2 to the Project, it fails to disclose *any* meaningful information regarding these sources. The Draft EIR makes only a few passing references throughout to future sources, claiming that "[a]ll future sources are required to be permitted with a separate CUP process and environmental review for compliance with CEQA."[23] It further argues that because these sources "have not been permitted or completed CEQA, information cannot be provided" regarding the CO_2 they will be storing or potential emissions.[24]

The project description section of the Draft EIR lists under "Cumulative Projects" several projects in the County. The Draft EIR provides nothing more than the name, location, type, acreage, and status of these projects. Some of the projects are listed as "Carbon Capture and Storage" projects, while others, such as the NLC Energy "Waste to Energy" or the Lone Cypress "Blue Hydrogen" projects, may be potential CO_2 sources for the CTV I Project. The Draft EIR does not provide any other useful information regarding these potential sources anywhere in its analysis.[25]

An accurate and stable project description is necessary so that the lead agency and the public have enough information to "ascertain the project's environmentally significant effects,

[18] Draft EIR, Vol. 1 at 3-1.
[19] Draft EIR, Vol. 1 at 3-1.
[20] Draft EIR, Vol. 1 at 4.8-19.
[21] Draft EIR, Vol. 1 at 4.8-24 (Table 4.8-4).
[22] Draft EIR, Vol. 1 at 4.8-24.
[23] Draft EIR, Vol. 1 at 4.8-19
[24] Draft EIR, Vol. 1 at 4.8-25.
[25] Draft EIR, Vol. 1 at 3-43 to 3-44.

assess ways of mitigating them, and consider project alternatives."[26] Information about the sources for the CO_2 that will be injected into the Project's storage facility is crucial for this very reason. The specific industrial processes that will emit the CO_2, the capture technology, the CO_2 properties, and the mode of transportation to the Project all have major implications for the CTV I Project's impacts on air pollution, greenhouse gas emissions, hazardous materials, and the public's health, to name just a few categories.

As just one example, whether CO_2 will be transported to the Project by trucks or pipelines, and the routes of such trucks or the locations of the pipelines, are all critical pieces of information necessary to assess the Project's potential impacts. Courts have held that an EIR for a mining operation failed as an informational document because it failed to include a "description of the facilities that will have to be constructed to deliver water to the mining operation."[27] In the same way, the Draft EIR fails to describe the methods and facilities that will be used to send CO_2 into the Project. As discussed below, an expert report attached to these comments also found that important information regarding pipelines is missing from the Draft EIR.

While the Draft EIR provides no information on the methods of CO_2 transportation from its potential sources, its project description section states that "[i]t is anticipated that diesel heavy heavy [sic] duty trucks would make 40 trips per day following the access routes designated for travel"[28] as part of the Project's operational traffic. The Draft EIR fails to include *any* explanation as to the reason for these heavy-duty truck trips. Moreover, these trips are not mentioned or analyzed in the transportation analysis section or in the air quality section.

Another example of the failure to properly include all related actions and reasonably foreseeable consequences is the Golden State Hydrogen project. On January 30, 2024, the Tulare County Board of Supervisors approved a Notice of Exemption for Golden State Hydrogen, a new hydrogen plant in Pixley, California, some 60 miles north of the CTV I Project. That project was approved without any CEQA review under the ministerial decision exemption.[29] The Golden State Hydrogen operating statement contemplates the building of a potential facility in Tulare County to capture and store CO_2 from this facility, but there is no guarantee it will ever be built. The statement states that until such project is built "the Applicant plans to sequester CO_2 by liquefying it on site and delivering it to the proposed Carbon Terravault I (CTV) at Elk Hills, California."[30] Despite the fact that there is a known facility that explicitly plans on sending its CO_2 for storage at the CTV I Project, this component of transporting CO_2 to the Project is missing from the Draft EIR completely.

Even beyond specific known facilities, the Draft EIR must include within its scope a discussion of potential industries that will be sending CO_2 to be stored, not only because these industries and the CO_2's modes of transportation are integral components of the "whole" CTV I

[26] *Sierra Club v. City of Orange* (2008) 163 Cal.App.4th 523, 533.
[27] *Santiago County Water Dist. v. County of Orange* (1981) 118 Cal.App.3d 818, 829.
[28] Draft EIR, Vol. 1 at 3-36.
[29] Tulare County Resource Management Agency, *Notice of Exemption No.., CEQ 23-013 - Golden State Hydrogen Plant Pixley* (Jan. 30, 2024), https://ceqanet.opr.ca.gov/2024010948.
[30] Padre Associates, Inc., prepared for Proteum Energy, LLC, *Operating Statement – Golden State Hydrogen Plant Project* (Oct. 2023) at 9.

Project, but also to address the CTV I Project's potential impacts on the development of CO_2-sending industries in the County and beyond. These impacts include both incentivizing new CO_2-emitting industries, and extending the life of fossil fuel sources that would continue to operate under the guise of "zero emission" when they would have been phased out but for the Project.

The Draft EIR further argues in the greenhouse gas (GHG) section that information about future sources of CO_2 is unknown, and at the same time, that future sources will come from "essential but hard to decarbonize" industries.[31] Nothing in the Draft EIR indicates how this "essential but hard to decarbonize" category is defined or suggests the County will condition future sources on falling within it. The only disclosed source in the Draft EIR is a fossil fuel plant that sends power to oil production activities.[32]

Notably, the Project has no practical or financial justification without its CO_2-sending industries. As the Draft EIR itself admits, "[t]he life of the project is dependent on the sources permitted for injection into the storage, the ability of the project year by year to obtain CO_2 and inject at the maximum 2,210,000 million tons per year."[33] The lack of information or standards regarding CO_2-sending industrial facilities creates a serious concern that instead of reducing and sequestering current CO_2 emissions, the Project will attract and incentivize the construction of new CO_2 generating facilities. This concern is illustrated by the fact that the cumulative projects table includes the "CTV energy park", described only as including "Multiple Projects" in an "[u]nknown (Elk Hills)" location.

Moreover, according to California Resource Corporation's (CRC's) website, a number of Carbon Dioxide Management Agreements (CDMAs) have been finalized to assure sequestration at the Project site by specific industrial facilities. All the projects that have entered into a CDMA should be included in the project description. These projects include: the Lone Cypress Blue Hydrogen project (CDMA entered into in May 2023), a new renewable dimethyl ether (rDME) production facility by InEnTec, Inc. (CDMA entered into in May 2023), a renewable gasoline plant by Verde Clean Fuels (CDMA entered into in July 2023), and a waste-to-energy production facility by NLC Energy (CDMA entered into in November 2023). All these projects are planned to be co-located at Elk Hills.[34] Moreover, and importantly, several of these projects contemplate CRC, CTV, or affiliated companies possessing an "equity stake" in the CO_2-sending facilities.[35]

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[31] Draft EIR, Vol. 1 at 4.8-26

[32] "The Elk Hills Power plant provides about one third of its power for oilfield operations and the remainder is distributed to the California power grid." Draft EIR, Vol. 1 at 3-3.

[33] Draft EIR, Vol. 1 at 4.8-24.

[34] CRC, *Carbon TerraVault Vaults*.

[35] CRC, *Carbon TerraVault Provides Second Quarter 2023 Update* (July 31, 2023), https://www.crc.com/news/news-details/2023/Carbon-TerraVault-Provides-Second-Quarter-2023-Update/default.aspx ("CTV JV and Verde are discussing CRC's potential financial participation in the RG facility, including potentially a significant equity stake") (accessed Mar. 1, 2024); CRC, *Carbon TerraVault Announces Two New Storage-Only Carbon Dioxide Management Agreements and Submission of Another Class VI Permit to the EPA* (May 1, 2023), https://www.crc.com/news/news-details/2023/Carbon-TerraVault-Announces-Two-New-Storage-Only-Carbon-Dioxide-Management-Agreements-and-Submission-of-Another-Class-VI-Permit-to-the-EPA/default.aspx ("CTV and InEnTec are discussing CRC's potential financial participation in the rDME facility, including potentially a significant equity stake").

As CRC has noted publicly, these projects "play an important role within Carbon TerraVault's strategy" in developing the Project.[36]

Another project which must be included in the project description is the Avnos Direct Air Capture (DAC) project. This project is included in CRC's application to the U.S. Environmental Protection Agency (EPA) for a Class VI injection well permit and, should that permit be approved, will be an approved source of CO_2 for sequestration. In its 2023 operations updates, CTV describes the California DAC Hub as being "led by CTV's subsidiary CTV Direct, LLC" and states it was selected to receive approximately $12 million in DOE funding.[37]

The Draft EIR appendix includes a 350-page report prepared in June 2023 for the County's Planning and Natural Resources Department and titled "Envisioning a Carbon Management Park."[38] This "Carbon Management Park", whose location is undisclosed, includes various industries, some of which have potential serious environmental impacts, such as hydrogen and steel mills. The report prepared for the carbon management park is clear about the financial dependency of a carbon sequestration project on its sources, stating that "[f]or those wells to be cost effective, there will need to be a significant source of CO_2 – on the scale of millions of metric tons annually – available for injection."[39]

The Draft EIR must be revised to include a meaningful discussion of all the potential industries that will be sending CO_2 for sequestration in the CTV I Project, the CO_2 transportation modes for the Project, and their environmental impacts. It must also discuss the Project's potential to incentivize the creation of more GHG emissions sources and new industries, including fossil fuel facilities. Only by doing so would it potentially properly reflect the whole of the action that is being proposed for approval.

II. THE DRAFT EIR IMPROPERLY PIECEMEALS THE PROJECT

The Draft EIR is engaging in impermissible piecemealing under CEQA by failing to analyze at least two projects that should be analyzed as part of the Project: The Avnos DAC Project and Lone Cypress Blue Hydrogen Project.

Courts have used a two-prong test to determine whether an EIR must include an analysis of the environmental effects of future expansion or other action: whether (1) it is a reasonably foreseeable consequence of the initial project; and (2) the future expansion or action will be significant in that it will likely change the scope or nature of the initial project or its

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[36] CRC, *Carbon TerraVault Provides Second Quarter 2023 Update* ("This project highlights the value proposition of our CTV Clean Energy Park and its important role within Carbon TerraVault's strategy . . . . We welcome NLCE as a trusted partner in developing and furthering California's decarbonization efforts and supporting Kern county's ambitions to become the leading carbon sequestration area in the state.").

[37] Business Wire, *Carbon TerraVault Provides 2023 Update* (Feb. 27, 2024), https://www.businesswire.com/news/home/20240227366330/en/Carbon-TerraVault-Provides-2023-Update.

[38] Draft EIR, Vol. 2, App'x K.2: Carbon Management Business Park 2023 Report, Envisioning A Carbon Management Business Park (June 2023).

[39] Draft EIR, Vol. 2, Envisioning A Carbon Management Business Park at 3.

environmental effects.[40]

Both the Avnos DAC Project and Lone Cypress Blue Hydrogen Project are included in CRC's application to the U.S. EPA for a Class VI injection well permit: "CTV plans to source carbon dioxide initially from Lone Cypress, a proposed hydrogen plant, Elk Hills pre-combustion gas treatment, and the proposed Avnos direct air capture facility."[41] Should EPA approve the Class VI permit for the CTV I Project (for which it already issued a draft permit for comments), it will include the DAC and the Lone Cypress Hydrogen facilities as approved source of CO_2.[42]

CTV I describes itself as responsible for assembling "a consortium of organizations across industry, technology, academia, national labs, community, government, and labor, to pursue U.S. Department of Energy (DOE) funding under its Regional Direct Air Capture (DAC) Hubs Initiative to create the California DAC Hub, the state's first full-scale DAC plus storage (DAC+S) network of regional DAC+S hubs."[43]

For the Lone Cypress Project, CRC's website states the company entered into a CDMA with Lone Cypress Energy Services, LLC in December 2022.[44]

Both projects, while in different stages, are in advanced enough stages to be a reasonably foreseeable consequence of the CTV I Project and are not speculative or uncertain.[45]

In a quarterly report to the California Public Utilities Commission from January 31, 2024, SoCalGas discloses that it is a member of the California Direct Air Capture Hub Consortium working toward the DAC project in Kern County and that the consortium was awarded an $11.8 million grant from DOE. It further states that the DAC facility's project manager "is currently in contract negotiations and expects to finalize the negotiation in early 2024, allowing for an expected project kickoff thereafter."[46]

As for the status of Lone Cypress, documents obtained through a California Public Records Act (PRA) request show that the project's application was deemed complete by Kern County in September 2023,[47] and a draft Notice of Preparation was already prepared for the

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[40] *Laurel Heights*, *supra*, 47 Cal. 3d 376 at 396.
[41] EPA, *Public Comments Sought on Class VI UIC Injection Well Carbon Storage Draft Permits* (Dec. 2023) at 1.
[42] EPA, *Public Comments Sought on Class VI UIC Injection Well Carbon Storage Draft Permits*.
[43] CRC, *California DAC Hub*, https://www.crc.com/carbon-terravault/projects/california-dac-hub/default.aspx (last accessed Mar. 1, 2024).
[44] CRC, *Lone Cypress CDMA*, https://www.crc.com/carbon-terravault/projects/lone-cypress-cdma/default.aspx (last accessed Mar. 1, 2024).
[45] *Save Round Valley Alliance v. County of Inyo* (2007) 157 Cal.App.4th 1437, 1450.
[46] SoCalGas, *Quarterly Report on Status of Infrastructure Investment and Jobs Act (IIJA), Inflation Reduction Act (IRA), or Creating Helpful Incentives to Produce Semiconductors and Science Act (CHIPS) Projects Pursuant to Resolution E-5254* (Jan. 31, 2024) at 2.
[47] Email from Jamal Ferguson, Kern County, to Greg Brooks, *PLN23-00800 Project Meeting* (Sept. 13, 2023).

project EIR in December 2023.[48]

Both projects are not only a reasonably foreseeable consequence of the initial CTV I Project, but they are also dependent on the Project.[49] A DAC project, by definition, must be tied to a carbon sequestration reservoir to operate. In the same way, Lone Cypress relies on the CTV I Project's sequestration for its operations.

The June 2023 "Environmental Information Form" for Lone Cypress includes the following description of the project from the project proponent:

> The Lone Cypress Hydrogen Project will produce 65 Metric Tonnes (MT) per Day of liquid hydrogen using proven technology. The hydrogen will be manufactured by feeding approximately 13MM sdd of natural gas and 0.32 acre-feet per day (2,440 bpd) of water into a Steam Methane Reformer (SMR) (…) *The CO2 produced as a byproduct from the hydrogen generation will be captured, compressed to supercritical state, and transported via pipeline to a sequestration EPA Class VI well at CRC's CTV Project*. The Lone Cypress Hydrogen Project will sequester over 200,000 MT of carbon dioxide annually.[50]

In the same document, under "[a]sociated project", the applicant lists CTV I, and goes on to say that "CTV 1 will sequester CO_2 from the proposed project; therefore, *CTV must be completed before this project can commence operations*."[51]

Both the DAC and the Lone Cypress Hydrogen projects come with their own set of environmental impacts related to both construction and operations, which will likely affect the CTV I Project's environmental effects. Both projects must therefore be included in the Draft EIR, and their potential impacts must be disclosed and analyzed.

III. THE DRAFT EIR FAILS TO ANALYZE GROWTH-INDUCING IMPACTS

CEQA requires the Draft EIR to describe growth-inducing impacts of the CTV I Project,[52] including ways in which the Project could directly or indirectly foster economic growth that could lead to an adverse physical change to the environment.[53]

In a one-paragraph discussion, the Draft EIR explains that because Project operation would include five regular full-time employees, with five potential additional maintenance

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[48] Kern County Planning & Natural Res. Dept., *Draft Notice of Preparation/Initial Study Checklist, Elk Hills Blue Hydrogen by Lone Cypress Energy Services, LLC* (Dec. 2023).
[49] *Paulek v. Dept. of Water Res.* (2014) 231 Cal.App.4th 35.
[50] Environmental Information Form, *Elk Hills Blue Hydrogen Plant by Lone Cypress Holding* (filed June 1, 2023) at 2–3 (emphasis added).
[51] *Id.* at 3 (emphasis added).
[52] Pub. Resources Code, § 21100(b)(5); CEQA Guidelines, § 15126(d).
[53] CEQA Guidelines, §§ 15126.2(d), 15064(e); *Bakersfield Citizens for Local Control v. City of Bakersfield* (2004) 124 Cal.App.4th 1184, 1205.

employees, the Project "would not result in a substantial influx of people" and "is not likely to induce any growth within Kern County."[54]

By focusing on the projected number of employees in the CTV I Project alone, the Draft EIR ignores the requirement to discuss the ways in which a proposed project could foster *economic growth*, not only population growth, directly or indirectly.[55] Clearly, as described above, the CTV I Project is just the first step in a much larger development, for which CTV already signed multiple CDMAs. In addition, the storage capacity proposed for approval can accommodate many more metric tons of CO_2 than the Draft EIR analyzes. Further economic growth from the Project is clearly what the Project proponents and the County envision, and it should be analyzed.

Moreover, a report prepared for the County to analyze the potential fiscal and economic benefits of a carbon management park found significant economic growth from such a park development: The potential volume ("output") associated with the carbon management park and related offsite activities is projected in the report to range from $4.5 billion to $6.9 billion per year. Regarding employment, the report finds that, at full buildout, the park and related offsite activities would directly and indirectly support 13,500 to 22,000 permanent jobs.[56] While this report does not directly analyze the specific projects envisioned for the Elk Hills oil field, it shows the potential economic growth that needs to be discussed under a proper growth-inducing analysis.

IV. THE DRAFT EIR FAILS TO PROVIDE ADEQUATE PROJECT OBJECTIVES

The Draft EIR does not provide an adequate set of project objectives. The document articulates no purpose, need, or objectives for the CTV I Project independent of a list of "the applicant's objectives" for the Project.[57] Because, as discussed below, the integrity and validity of an alternatives analysis depends in significant part on the articulation and assessment of the lead agency's project objectives, an EIR that lacks an adequate statement of those objectives will not be in compliance with CEQA. This deficiency is compounded by the likelihood that the Project will both attract and incentivize the construction of new CO_2-generating facilities instead of focusing on reducing and sequestering CO_2 emissions from existing facilities, and also be used as a rationale to extend the life of existing fossil-fuel infrastructure whose utility otherwise may cease sooner.

Here, the Draft EIR states:

The following are the applicant's project objectives:

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[54] Draft EIR, Vol. 1 at 5-7.
[55] CEQA Guidelines, § 15126.2(e).
[56] The Natelson Dale Group Inc., *Analysis of Potential Fiscal and Economic Benefits of Kern County Carbon Management Industry* (Apr. 4, 2023) at 6, https://psbweb.kerncounty.com/planning/pdfs/cmbp/CMBP_Potential_Fiscal_Economic_Benefit_Analysis.pdf.
[57] Draft EIR, Vol. 1 at 3-7, 6-7.

- Construct and operate a permanent underground storage facility for CO_2, in an economically feasible manner.
- Contribute to CRC's adopted goals of Full-Scope Net Zero emissions for Scope 1 (direct greenhouse gas emissions), Scope 2 (indirect greenhouse gas emissions associated with the purchase of electricity/steam/heat/cooling) and Scope 3 (all other indirect greenhouse gas emissions resulting from the company's business operations) emissions by 2045.
- Support California's Executive Order B-55-18, for California to achieve carbon neutrality by 2045 and net negative emissions thereafter.
- Site and design the project in an environmentally responsible manner consistent with current Kern County and California guidelines.
- Promote economic development and bring living-wage jobs to Kern County.[58]

The Draft EIR articulates no purpose, need, or objectives for the CTV I Project independent of this list of "the applicant's objectives" for the Project. But without a purpose, need, and objectives adopted by the lead agency, the Draft EIR cannot meaningfully assess impacts and develop or compare a reasonable range of alternatives to the proposed Project.[59] Because the applicant operates the oil field that will be a major source of CO_2 for the storage facility, and this facility appears to be designed at least in part to enable the oil field operations to continue to emit Scope 1, 2, and 3 emissions and to facilitate the development and operation of new GHG-emitting facilities, working against state carbon neutrality goals, it is particularly important to scrutinize the project objectives and ensure they reflect public agency goals.

V. THE DRAFT EIR FAILS TO ANALYZE ADEQUATE ALTERNATIVES

The Draft EIR is also unlawful for failing to properly put forward, describe, and analyze a reasonable range of alternatives. Under CEQA, a proper analysis of alternatives is essential to comply with the Act's mandate that significant environmental impacts be avoided or substantially lessened where feasible.[60] The analysis of alternatives lies at the "core of an EIR,"[61] and an EIR must "ensure that all reasonable alternatives to proposed projects are thoroughly assessed by the responsible official."[62]

The purpose of the requirement to contemplate alternatives is to identify ways to mitigate or avoid the significant effects of a project.[63] "[A]n agency may not approve a proposed project if feasible alternatives exist that would substantially lessen its significant environmental

[58] Draft EIR, Vol. 1 at 3-7, 6-7.
[59] *North Coast Rivers Alliance v. Kawamura* (2015) 243 Cal.App.4th 647, 666 (citing Pub. Resources Code, §21001(g) (internal quotation omitted)) ("[t]he process of selecting the alternatives to be included in the EIR begins with establishment of project objectives by the lead agency"); see also CEQA Guidelines, §15124(b) (stating an EIR requires a statement of the objectives sought by the proposed project).
[60] Pub. Resources Code, § 21002; CEQA Guidelines, §§ 15002(a)(3), 15021(a)(2), 15126(d); *Citizens for Quality Growth v. City of Mount Shasta* (1988) 198 Cal.App.3d 433, 443–45.
[61] *Citizens of Goleta Valley v. Bd. of Supervisors* (1990) 52 Cal.3d 553, 564.
[62] *San Joaquin Raptor/Wildlife Rescue Center v. County of Stanislaus* (1994) 27 Cal.App.4th 713, 735; see also Pub. Resources Code, § 21002.1(a).
[63] Pub. Resources Code, § 21002.1.

effects."[64] The alternatives discussion must be "meaningful" and must "contain analysis sufficient to allow informed decision making."[65] The alternatives analysis is critical to the integrity of an EIR.[66] An EIR must "ensure that all reasonable alternatives to proposed projects are thoroughly assessed by the responsible official."[67] An alternatives analysis under CEQA must focus on potentially feasible alternatives to the project, even if these alternatives would impede to some degree the attainment of project objectives, or would be more costly.[68]

As explained below, the Draft EIR's alternatives discussion fails to comply with CEQA. The alternatives discussion is flawed for at least seven reasons: (1) it relies on an inadequate project description; (2) it relies on an inadequate set of project objectives; (3) it relies on an inadequate understanding of the Project's own impacts; (4) it fails to consider a reasonable range of alternatives; (5) it fails to properly or coherently discuss the "no project" alternative and compare it to the Project; (6) it fails to meaningfully describe or analyze the action alternatives it considers; and (7) it fails to provide substantial evidence to support its comparisons of alternatives to the proposed Project. The Draft EIR must be revised to properly analyze project alternatives, as required by CEQA.

A. The Draft EIR Cannot Properly Consider Alternatives Without an Adequate Project Description, Adequate Description of the Lead Agency's Project Objectives, and Adequate Analysis of Project Impacts.

The Draft EIR's alternatives analysis fails in three threshold ways: it is not based on an adequate project description, it does not articulate a public purpose and need for the Project, and it does not describe, assess, or analyze impacts properly. These deficiencies render the alternatives analysis inadequate.

First, the Draft EIR's alternatives analysis is flawed because it is not based on a stable, accurate project description. As demonstrated above, the Draft EIR's analysis and mitigation are based on an improper project description that understates and misstates the CTV I Project's scope, and omits integral components of the full Project. Without a proper project description, it is not possible to effectively develop alternatives or compare Project impacts with alternatives in a way that is coherent and supported by substantial evidence.

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[64] *Save Panoche Valley v. San Benito County* (2013) 217 Cal.App.4th 503, 52 (citations omitted); see also Pub. Resources Code, §21081(a); CEQA Guidelines, §15091(a)(3); *Cal. Native Plant Society v. City of Santa Cruz* (2009) 177 Cal.App.4th 957, 1002.

[65] *Laurel Heights*, *supra*, 47 Cal.3d at 403–04.

[66] *In re Bay-Delta Programmatic Envtl. Impact Report Coordinated Proceedings*, 43 Cal.4th 1143, 1162 (2008) ("The EIR is the heart of CEQA, and the mitigation and alternatives discussion forms the core of the EIR.").

[67] *San Joaquin Raptor/Wildlife Rescue Center*, *supra*, 27 Cal.App.4th at 735; see also Pub. Resources Code, § 21002.1(a).

[68] CEQA Guidelines, § 15126.6(b), (f); see also Pub. Resources Code, § 21102.1(a) ("The purpose of an environmental impact report is to identify the significant effects on the environment of a project, to identify alternatives to the project, and to indicate the manner in which those significant effects can be mitigated or avoided.").

Second, without a proper description of the Project's purpose and need and a set of project objectives adopted by the lead agency, it is impossible to adequately assess alternatives to the Project in a way that complies with CEQA.

A proper statement of the lead agency's project objectives is essential to the development of an adequate alternatives analysis. This principle is apparent throughout the Guidelines and caselaw. For example, "[t]he process of selecting the alternatives to be included in the EIR begins with establishment of project objectives by the lead agency."[69] The Draft EIR must include "[a] clearly written statement of objectives," as this will guide the County in developing a reasonable range of alternatives.[70] CEQA Guidelines section 15124(b) notes that a "clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision makers in preparing findings or a statement of overriding considerations, if necessary."[71] That statement of the *lead agency's* objectives, in informing the *lead agency's* reasonable range of alternatives to a proposed project, cannot simply be delegated to a project proponent.

Moreover, "[a] lead agency may not give a project's purpose an artificially narrow definition. An agency 'may structure its EIR alternative analysis around a reasonable definition of underlying purpose and need not study alternatives that cannot achieve that basic goal. For example, if the purpose of the project is to build an oceanfront resort hotel or a waterfront aquarium [citation], a lead agency need not consider inland locations.'"[72] This principle requires, again, that the lead agency take responsibility for articulating the project purpose and need as well as the project objectives.

Here, as noted above, the Draft EIR articulates no purpose, need, or objectives for the Project independent of a list of "the applicant's objectives" for the Project.[73] The Draft EIR contains no further discussion of purpose, need, or objectives beyond this list. But, as reflected in the case law and Guidelines,[74] it is not possible for a lead agency to meaningfully undertake an independent evaluation of alternatives if the agency uncritically uses an applicant's objectives as the benchmark for evaluation, and fails to include its own statement of purpose and objectives. A range of alternatives that is based exclusively on "the applicant's project objectives," and not incorporating any public purpose, need, or objectives that have been adopted by the lead agency, thus cannot comply with CEQA. Moreover, reliance exclusively on applicant project objectives is particularly inappropriate where there are unmitigable significant impacts that will require the

[69] *North Coast Rivers Alliance*, *supra*, 243 Cal. App.4th at 666 (citing Pub. Resources Code, §21001(g) (internal quotation omitted)); see also CEQA Guidelines, §15124(b) (stating an EIR requires a statement of the objectives sought by the proposed project).
[70] CEQA Guidelines, §15124(b).
[71] CEQA Guidelines, § 15124(b).
[72] *North Coast Rivers Alliance*, *supra*, 243 Cal.App.4th at 668 (citing *Bay–Delta*, *supra*, 43 Cal.4th at 1166 [internal citations omitted]).
[73] Draft EIR, Vol. 1 at 3-7, 6-7.
[74] *North Coast Rivers Alliance*, *supra,* 243 Cal.App.4th at 666 (citing Pub. Resources Code, §21001(g) (internal quotation omitted)); see also CEQA Guidelines, §15124(b).

County to find overriding considerations, given the need for the objectives to "aid the decision makers in preparing findings or a statement of overriding considerations, if necessary."[75]

Third, without a proper analysis of the Project's impacts, any alternatives analysis is necessarily flawed because the comparison of Project impacts to the anticipated impacts of alternatives will be unsupported by substantial evidence. Here, the significant deficiencies in the Draft EIR's analysis of Project impacts make any comparison of those impacts with the impacts of proposed alternatives meaningless.

This deficiency in the Draft EIR—flawed impact analysis leading to flawed alternatives analysis—is apparent across multiple impact areas, discussed throughout these comments. Any comparison of the impacts of the Project with the impacts of alternatives will fail if the Project impacts are misstated or improperly analyzed. But the deficiency is most glaring in the context of GHG impacts, where the Draft EIR's alternatives analysis asks its readers to accept a paradox: first, the Project will have significant unmitigable impacts on GHG emissions.[76] Second, the no-project alternative will have less-than-significant impacts on GHG emissions.[77] And third, at the same time, according to the Draft EIR, the no-project alternative's impacts are "greater than project" impacts.[78] On its face, this analysis cannot stand scrutiny, since it is internally inconsistent. This internal inconsistency, in turn, is a consequence of a fundamental failure in the underlying Project GHG analysis and conclusions, as discussed in section VI.B of these comments.

These analytical failures render the Draft EIR deficient. And beyond that, the failures also constitute fundamental informational deficiencies in the Draft EIR. It is not possible for the public or a decisionmaker to compare the alternatives meaningfully if the conclusions being compared are incoherent or internally inconsistent, as is the case here.

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[75] CEQA Guidelines, § 15124(b); see *Preservation Action v. San Jose* (2006) 141 Cal.App.4th 1336, 1351–52 ("Since CEQA charges the agency, not the applicant, with the task of determining whether alternatives are feasible, the circumstances that led the applicant in the planning stage to select the project for which approval is sought and to reject alternatives cannot be determinative of their feasibility. The lead agency must *independently* participate, review, analyze and discuss the alternatives in good faith." [citing *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 736]).

[76] Draft EIR, Vol. 1 at 4.8-28 ("Level of Significance After Mitigation: [GHG] Impacts would be significant and unavoidable."), 4.8-31 (same), 6-5 ("the project would conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing emissions of GHG, thus causing a significant and unavoidable impact, even with mitigation. Finally, the project would make a cumulatively considerable contribution to a cumulative GHG emissions impact, even with mitigation, and this impact is therefore significant and unavoidable"), 6-21 (Project GHG impacts "significant and unavoidable").

[77] Draft EIR, Vol. 1 at 6-13 ("Impacts would be less than significant under this alternative [Alternative 1, the "no project" alternative]").

[78] Draft EIR, Vol. 1 at 6-21 (no-project alternative's GHG impacts identified as "Greater Than Project"), 6-23 ("Alternative 1, the No Project Alternative[,] would be environmentally superior to the project on the basis of the minimization or avoidance of physical environmental impacts but *would have greater impacts than the project for GHG emissions*" [emphasis added]).

B. The Draft EIR Fails to Adequately Consider a Reasonable Range of Alternatives.

An EIR must consider a reasonable range of alternatives which "offer substantial environmental advantages over the project proposal."[79] The Public Resources Code makes it clear that proper alternatives need to "substantially lessen" the significant environmental effects of a project.[80] Here, the Draft EIR rejects without analysis several alternatives that meet that criterion and satisfy at least some project objectives. This improper failure to consider alternatives appears to have occurred, at least in part, because the applicant's project objectives are drawn too narrowly[81], and the applicant's conception of "feasibility" is improperly constrained.[82]

The lead agency, not the applicant, bears the responsibility to evaluate alternatives based on project objectives, as demonstrated above.[83] "[A]n agency may not approve a proposed project if feasible alternatives exist that would substantially lessen its significant environmental effects."[84] The lead agency also must evaluate feasibility based on objective criteria. "Feasible" means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors."[85]

Here, the Draft EIR should have considered a wider range of alternatives that minimize or avoid impacts from the proposed Project. Alternatives that involve eliminating or reducing oil extraction from CRC's oil fields, for example, satisfy most of even the applicant's project objectives, including contributing to CRC's adopted goals of Full-Scope Net Zero emissions by 2045, supporting California's Executive Order B-55-18, and siting and designing the Project in an environmentally responsible manner. If the goal is to keep oil field-generated CO_2 out of the atmosphere, there are alternative ways to accomplish this that the Draft EIR fails to consider.

The Draft EIR should be revised to consider these and other reasonable alternatives, as required under CEQA.

C. The Draft EIR's Discussion of Alternative 1, the "No Project" Alternative, is Inadequate Under CEQA.

The Draft EIR's "no project" alternative discussion provides a brief examination, unsupported by evidence or analysis, of the environmental consequences of not permitting the Project or any alternative. This summary discussion of Alternative 1 is inadequate under CEQA because it fails to include basic information about the no-project alternative.

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[79] *Citizens of Goleta Valley*, *supra*, 52 Cal.3d at 566.
[80] Pub. Resources Code, § 21002; see also CEQA Guidelines, § 15126.6(a).
[81] *North Coast Rivers Alliance*, *supra*, 243 Cal.App.4th at 668.
[82] *Preservation Action*, *supra*, 141 Cal.App.4th at 1351–52.
[83] *Kings County Farm Bureau*, *supra*, 221 Cal.App.3d at 736; *Preservation Action*, *supra*, 141 Cal.App.4th at 1351–52.
[84] CEQA Guidelines, § 21081; *Mountain Lion Foundation v. Fish Game Com.* (1997) 16 Cal.4th 105, 134.
[85] Pub. Resources Code, § 21061.1; *Cal. Native Plant Society*, *supra*, 177 Cal.App.4th at 960.

The CEQA Guidelines require that the no project analysis discuss "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services."[86] Here, however, the discussion lacks "adequate information regarding the no-project alternative" that would allow the decisionmakers to make "an informed, reasoned decision on whether this Project should go forward."[87] In *Save the Hill Group v. City of Livermore*, the court found that a "no-project" alternative that failed to provide adequate information as to what would be reasonably expected to occur if a project would not go forward was in violation of CEQA, and set the EIR approval aside.[88]

The same reasoning applies here. The Draft EIR should contrast the impacts of the proposed Project with the impacts of the no-project alternative, with specificity and, where possible, quantification, across all impact categories. It should provide a "factually based forecast of the environmental impacts of preserving the status quo."[89] Instead, the Draft EIR includes a cursory narrative discussion, with no supporting evidence or analysis, articulating only what the applicant asserts the consequences of the no-project alternative would be. The Draft EIR then bases its comparison with the proposed Project on this thin discussion.

This missing information is, in the words of the *Save the Hill Group* court, "just the sort of information CEQA intended to provide those charged with making important, often irreversible, environmental choices on the public's behalf."[90] The alternatives analysis must be revised to provide a robust discussion of the "no-project" reasonable consequences.

Additionally, as discussed above, the analysis of the no-project alternative is inadequate because the comparison between the no-project alternative and the proposed Project is misleading, inconsistent, and incoherent. The Draft EIR's characterization of Alternative 1 as having greater GHG impacts than the Project, in particular, reflects a failure to adequately and coherently describe and analyze this alternative as well as a failure to coherently analyze the Project's impacts.[91]

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[86] CEQA Guidelines, § 15126.6(e)(2).
[87] *Save the Hill Grp. v. City of Livermore* (2022) 76 Cal.App.5th 1092, 1113, review denied (July 13, 2022).
[88] *Id.* at 1113.
[89] *Ctr. for Biological Diversity v. Dept. of Fish & Wildlife* (2015) 234 Cal.App.4th 214, 253.
[90] *Save the Hill Grp.*, *supra*, 76 Cal.App.5th at 1113.
[91] Compare Draft EIR, Vol. 1 at 4.8-28 ("Level of Significance After Mitigation: [GHG] Impacts would be significant and unavoidable."), 4.8-31 (same), 6-5 ("the project would conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing emissions of GHG, thus causing a significant and unavoidable impact, even with mitigation. Finally, the project would make a cumulatively considerable contribution to a cumulative GHG emissions impact, even with mitigation, and this impact is therefore significant and unavoidable"); 6-21 (Project GHG impacts "significant and unavoidable"), 6-13 ("Impacts would be less than significant under this alternative [Alternative 1, the "no project" alternative]") with Draft EIR, Vol. 1 at 6-21 (no-project alternative's GHG impacts identified as "Greater Than Project"), 6-23 ("Alternative 1, the No Project Alternative[,] would be environmentally superior to the project on the basis of the minimization or avoidance of physical environmental impacts but *would have greater impacts than the project for GHG emissions*" [emphasis added]).

Finally, Alternative 1 would also address the failures, highlighted elsewhere in these comments, in framing project objectives and in neglecting to analyze the fact that the Project is designed to facilitate and justify the continued extraction of oil and burning of fossil fuels for energy. An adequate comparative analysis between the impacts of Alternative 1 and the Project would require analysis of the Project's sources of CO_2 and of the Project's facilitation of fossil fuel extraction and combustion.

D. The Draft EIR Fails to Adequately Describe or Analyze Alternatives 2 and 3.

The Draft EIR's discussion of the two "action" alternatives, DAC (Alternative 2) and nature-based carbon storage (Alternative 3), is cursory and lacking in specificity and support.[92] The Draft EIR not only fails to describe either alternative with specificity, but also fails to disclose or even meaningfully attempt to discuss the projected impacts of either alternative. As a consequence, the Draft EIR fails to support its conclusions—where it compares alternatives' impacts with the Project's impacts—with substantial evidence.

First, Alternative 2, the DAC Alternative, fails to specify any of the major features of the hypothetical DAC facility that forms the basis of the alternative. The Draft EIR does not specify, for example, what technology will be used, the size and throughput of the facility, what infrastructure would be built and where, or what resources it would take to build and maintain that infrastructure and operate the facility. Instead, the document presents only a discussion of the generalized features of DAC technology and facilities, with not one word about how those features might or might not appear in the application of DAC as an alternative to the proposed Project, as discussed in sections I and II of these comments.[93] The Draft EIR then fails even to make a serious attempt to assess the impacts of the DAC alternative in each impact category[94]—a task that would have been fruitless, given the lack of specificity about the alternative's basic features. Correspondingly, the Draft EIR and appendices do not contain evidence, methodology, modeling, or calculations regarding any such impacts. And following from this, there is no substantial evidence—indeed, no evidence at all—supporting the Draft EIR's comparison of Project impacts with the purely speculative conclusions about the DAC alternative's impacts. Nor is the brief discussion of whether Alternative 2 meets project objectives[95] supported by substantial evidence, for the same reasons—and additionally because, as explained above, the project objectives themselves are fatally flawed.

Second, Alternative 3, the "Nature Based Carbon Storage" alternative, also fails to meaningfully specify any of the features of the alternative. While the Draft EIR sets forth some general ideas about what types of features this potential alternative might include, the alternative remains completely unformed.[96]

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[92] Draft EIR, Vol. 1 at 6-17 to 6-20 (containing the Draft EIR's entire discussion of these two alternatives).
[93] Draft EIR, Vol. 1 at 6-17 to 6-19 (containing the Draft EIR's discussion of Alternative 2, in full).
[94] Draft EIR, Vol. 1 at 6-17 to 6-19.
[95] Draft EIR, Vol. 1 at 6-17 to 6-19.
[96] Draft EIR, Vol. 1 at 6-19 to 6-20 (containing the Draft EIR's discussion of Alternative 3, in full).

This text, with the "example" of "planting of trees," comes closest to articulating the features of Alternative 3:

> The most applicable nature-based carbon storage alternative for the area of the project site would be regenerative agriculture, as it coincides with the current zoning. Planting of trees would be one example of regenerative nature-based carbon storage for the highest ability to store atmospheric carbon.[97]

It is clear on its face that this statement does not present a specific alternative to the proposed Project. As with Alternative 2, the Draft EIR lacks any discussion, beyond the speculation above, of what technology will be used, much less how the alternative would be configured or what, specifically, it would entail.[98] And the closest the Draft EIR comes to articulating the scope or size of this alternative is in a purely conditional, hypothetical statement: "If 9,000 acres of the project site were remediated of all oil and gas facilities and prepared for planting, an estimated 400 to 1,000 trees per acre could be planted, resulting in a new forest area of 3.6 million to 9 million trees."[99] Notably, even all these hypothetical statements in the Draft EIR lack any evidence or foundation in the Draft EIR or appendices, but instead just appear as assertions, without any references or citations to articulate or support any methodology, analysis, or conclusions.

Accordingly, there is no meaningful analysis of either the features or impacts of the alternative, making it impossible to compare the Project's impacts with the alternative's impacts, and making the conclusions in that attempted comparison lacking in substantial evidence for support. Nor is the brief discussion of whether Alternative 3 meets project objectives[100] supported by substantial evidence, for the same reasons—and additionally because, as explained above, the project objectives themselves are fatally flawed.

VI. THE DRAFT EIR FAILS TO ANALYZE AND MITIGATE SIGNIFICANT IMPACTS

The discussion of a proposed project's environmental impacts is an essential component of an EIR.[101] The fundamental purpose of CEQA is to "inform the public and its responsible officials of the environmental consequences of their decisions *before* they are made."[102] To do so, an EIR must contain facts *and* analysis, not just an agency's bare conclusions.[103]

As explained in detail below, the Draft EIR's environmental impacts analysis is deficient under CEQA because it fails to provide the necessary facts and analysis to allow the County and the public to make informed decisions about the CTV I Project.

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[97] Draft EIR, Vol. 1 at 6-19.
[98] Draft EIR, Vol. 1 at 6-19 to 6-20.
[99] Draft EIR, Vol. 1 at 6-19 to 6-20.
[100] Draft EIR, Vol. 1 at 6-19 to 6-20.
[101] See CEQA Guidelines, § 15126.2(a) ("An EIR *shall* identify and focus on the significant effects of the proposed project on the environment.") (emphasis added).
[102] *Laurel Heights Improvement Assn. v. Regents of Univ. of Cal.*, 6 Cal.4th 1112, 1123.
[103] *Citizens of Goleta Valley*, *supra*, 52 Cal.3d at 568.

CEQA also requires an EIR to describe and adopt all feasible mitigation measures to address a project's significant environmental impacts.[104] Mitigation measures must be "fully enforceable through permit conditions, agreements, or other legally binding instruments."[105]

Generally, the "[f]ormulation of mitigation measures should not be deferred until some future time."[106] As an exception, "measures may specify performance standards which would mitigate the significant effect of the project and which may be accomplished in more than one specified way."[107] Crucially, there is a "distinction between stating a generalized goal and adopting specific performance criteria," and "[s]imply stating a generalized goal for mitigating an impact does not allow the measure to qualify for the exception to the general rule against the deferred formulation of mitigation measures."[108] Further, even where the deferred formulation of mitigation might be allowable, there is a point beyond which delayed implementation is not allowed: "[o]nce the project reaches the point where activity will have a significant adverse effect on the environment, the mitigation measures must be in place."[109]

"Where several measures are available to mitigate an impact, each should be discussed and the basis for selecting a particular measure should be identified."[110]

As discussed below, throughout the Draft EIR, the County's proffered mitigation measures are insufficient, riddled with inconsistencies, and ultimately not adequate to satisfy CEQA's legal requirements.

A. The Draft EIR's Analysis and Mitigation of Air Quality Impacts is Inadequate.

1. The Draft EIR states heavy-duty truck traffic is expected for Project operations but does not describe or analyze the impacts of such traffic.

Within the chapter on project description, in the section for "Operational and Maintenance Activities," the Draft EIR describes five full-time employees who will be onsite at all times and another five employes who may need to be onsite when repairs or other maintenance is required.[111] The Draft EIR calculates "Operational Traffic" for these employees, who are expected to collectively make 20 daily trips in "Passenger Vehicles."[112]

Separately, the discussion of "Operational Traffic" includes a heading for "Truck Traffic," which is followed by one sentence that states: "It is anticipated that diesel heavy heavy [sic] duty trucks would make 40 trips per day following the access routes designated for

[104] Pub. Resources Code, § 21002; CEQA Guidelines, § 15126.4(a)(1).
[105] CEQA Guidelines, § 15126.4(a)(1)(B), (a)(2).
[106] CEQA Guidelines, § 15126.4(a)(1)(B).
[107] *King & Gardiner Farms, LLC v. County of Kern* (2020) 45 Cal.App.5th 814, 856.
[108] *Id.* at 856.
[109] *Id.* at 860, quoting *POET, LLC v. Cal. Air Resources Bd.* (2013) 218 Cal.App.4th 681, 738.
[110] CEQA Guidelines, § 15126.4(a)(1)(B).
[111] Draft EIR, Vol. 1 at 3-35.
[112] Draft EIR, Vol. 1 at 3-35 to 3-36.

travel."[113] No further information on the nature, purpose, or impacts of this operational heavy-duty truck traffic is provided in the project description chapter. Nor is there any further discussion anywhere else in the Draft EIR.

As noted above, the Draft EIR must be revised to thoroughly explain this aspect of the CTV I Project. Based on the Notice of Preparation/Initial Study as well as other available information, it seems likely these trucks will be carrying CO_2 from offsite industrial sources, perhaps including but not limited to the Golden State Hydrogen Project that has been proposed in Pixley, California.[114]

In addition to fully explaining the nature and purpose of the operational heavy-duty truck trips in the project description, the impacts of such heavy-duty truck traffic during Project operation must be analyzed and mitigated consistent with CEQA's requirements. As acknowledged in the Notice of Preparation/Initial Study, truck and other vehicle traffic threatens significant direct and cumulative impacts in at least the following categories: air quality, energy demand and consumption, greenhouse gas emissions, hazards and hazardous materials, noise, and transportation and traffic.[115] Depending on the nature and purpose of the operational heavy-duty truck traffic, additional significant impacts are possible.

2. The Draft EIR must be updated to address the revised national ambient air quality standard for $PM_{2.5}$.

The Air Quality section of the Draft EIR must be updated to reflect the U.S. EPA's issuance of a new national ambient air quality standard (NAAQS) for fine particulate matter, also known as $PM_{2.5}$. On February 7, 2024, U.S. EPA strengthened the annual health-based NAAQS for $PM_{2.5}$ from a level of 12 micrograms per cubic meter to 9 micrograms per cubic meter.[116]

Beyond just acknowledging the new standard, the Draft EIR should also address the implications of the new annual $PM_{2.5}$ NAAQS: air quality in Kern County currently does not

[113] Draft EIR, Vol. 1 at 3-36.
[114] *Notice of Preparation/Initial Study* at 4 ("The proposed project would take local industrial sources of CO_2 that are transported by a combination of truck, pipeline and/or rail to the dedicated Class VI injection wells for the project."); *Operating Statement – Golden State Hydrogen Plant Project*, *supra*, at 9 (noting that CO_2 emissions from new hydrogen plant in Pixley, CA will be liquefied and delivered to the CTV I Project until a CCS facility is developed in Tulare County).
[115] *Notice of Preparation/Initial Study* at 24–25, 29, 32, 34–35, 40, 44–45.
[116] See generally EPA, *Reconsideration of the National Ambient Air Quality Standards for Particulate Matter* (prepublication version, signed Feb. 5, 2024), https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-final-frn-pre-publication.pdf; accord, EPA, *EPA Finalizes Stronger Standards for Harmful Soot Pollution, Significantly Increasing Health and Clean Air Protections for Families, Workers, and Communities* (Feb. 7, 2024), https://www.epa.gov/newsreleases/epa-finalizes-stronger-standards-harmful-soot-pollution-significantly-increasing.

meet the new standard[117] and is not expected to meet it in 2032,[118] meaning the San Joaquin Valley Air Pollution Control District (Air District) will have to institute further restrictions on polluting projects and activities through the San Joaquin Valley airshed, including in Kern County.[119]

3. The Draft EIR must be updated to make clear the full danger posed by increased $PM_{2.5}$ emissions.

a. The Draft EIR should disclose that there is no safe level of exposure to $PM_{2.5}$.

Along with U.S. EPA's issuance of its revised $PM_{2.5}$ NAAQS, the agency also summarized the latest scientific studies on the health effects of $PM_{2.5}$.

The Draft EIR should update its discussion of the health effects of $PM_{2.5}$ to reflect the latest science summarized by U.S. EPA in its standard-setting decision. Such an update is necessary because CEQA requires that an EIR conduct "an analysis that connect[s] the air quality effects to human health consequences."[120]

Of key importance to disclose to Kern County residents and decisionmakers: currently available evidence indicates there is no safe level of exposure to $PM_{2.5}$.[121] Consequently, it is essential that the County adopt all feasible mitigation for increased $PM_{2.5}$ emissions.

b. The Draft EIR should better address the relationship between $PM_{2.5}$ and DPM.

The Draft EIR's description of air pollutants and health effects discusses "Particulate Matter (PM_{10} and $PM_{2.5}$)" separately from "Diesel Particulate Matter."[122]

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[117] See EPA, *EPA Finalizes Stronger Standards for Harmful Soot Pollution, Significantly Increasing Health and Clean Air Protections for Families, Workers, and Communities* at Figure 1; accord EPA, *Fine Particle Concentrations for Counties with Monitors Based on Air Quality Data from 2020 – 2022* at 1, https://www.epa.gov/system/files/documents/2024-02/table_annual-pm25-county-design-values-2020-2022-for-web.pdf (last accessed Mar. 1, 2024).

[118] EPA, *EPA Projects More than 99% of Counties Would Meet the Revised Fine Particle Pollution Standard* (Feb. 7, 2024), https://www.epa.gov/system/files/documents/2024-02/2024-pm-naaqs-final-2032-projections-map.pdf.

[119] Lazo, *California's Pursuit of Clean Air Just Got Much Harder: New Soot Standards Set*, Cal Matters (Feb. 7, 2024) ("Achieving the new target will take wide-ranging new state and local regulations aimed at cutting emissions"), https://calmatters.org/environment/2024/02/california-new-soot-standards.

[120] *Sierra Club v. County of Fresno* (2018) 6 Cal.5th 502, 522.

[121] According to EPA: "[t]he currently available evidence does not identify particular PM2.5 concentrations that do not elicit health effects. Rather, health effects can occur over the entire distribution of ambient PM2.5 concentrations evaluated, and epidemiologic studies conducted to date do not identify a population-level threshold below which it can be concluded with confidence that PM2.5-related effects do not occur." EPA, *Reconsideration of the National Ambient Air Quality Standards for Particulate Matter* (prepublication version) at 168.

[122] Compare Draft EIR, Vol. 1 at 4.3-13 to 4.3-15 with *id.* at 4.3-25 to 4.3-26.

The discussion of $PM_{2.5}$ notes that "$PM_{2.5}$ constitutes a large portion of combustion particulates, including diesel particulate matter (DPM)," (p. 4.3-14) but does not direct the reader to the separate, further discussion of the dangers of DPM.

To prevent confusion and to convey the full extent of the health risks posed by $PM_{2.5}$, the Draft EIR's discussion of $PM_{2.5}$ should include a cross reference to the more detailed discussion of DPM in the section that addresses "Health Effects and Risks of Toxic Air Contaminants."

Confusingly, the Draft EIR's discussion of $PM_{2.5}$ currently includes an erroneous cross reference. At Volume 1, page 4.3-15, the text states: "The section below entitled 'Oil and Gas Operations and Health Effects' further discusses potential health effects of $PM_{2.5}$ emissions, among other things." But no such section with that title exists.

c. The Draft EIR should address how $PM_{2.5}$ exacerbates illness and death from COVID-19.

The Draft EIR's discussion of the health effects of $PM_{2.5}$ fails to adequately address "the nature and magnitude"[123] of the CTV I Project's increased emissions because it does not acknowledge the studies that demonstrate that exposure to $PM_{2.5}$ has been found to lead to an increase in the death rate for COVID-19, especially for people of color.[124] Indeed, one recent study determined that thousands of COVID-19 deaths could have been prevented during the first year of the COVID-19 pandemic in California, especially in the San Joaquin Valley, if ambient levels of $PM_{2.5}$ pollution were lower.[125]

The Draft EIR therefore should be updated with a discussion of the health risks posed by COVID-19 generally, along with a further discussion of the COVID-19 morbidity and mortality increased by exposure to $PM_{2.5}$.

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[123] *Sierra Club*, *supra*, 6 Cal.5th at 522.

[124] See Cal. Dept. of Public Health, *State Officials Announce Latest COVID-19 Facts* (News Release No. NR20-111) (June 3, 2020), https://www.cdph.ca.gov/Programs/OPA/Pages/NR20-111.aspx; Chow, D.S. et al., *The Disproportionate Rise in COVID-19 Cases Among Hispanic/Latinx in Disadvantaged Communities of Orange County, California: A Socioeconomic Case-Series*, Johns Hopkins Bloomberg School of Public Health (2020), https://www.medrxiv.org/content/10.1101/2020.05.04.20090878v1.full.pdf; Goyal, M.K. et al., *Racial/Ethnic and Socioeconomic Disparities of SARS-CoV-2 Infection Among Children*, Pediatrics (2020), https://pediatrics.aappublications.org/content/pediatrics/early/2020/08/03/peds.2020-009951.full.pdf; Petroni, M., et al., *Hazardous Air Pollutant Exposure As a Contributing Factor to COVID-19 Mortality in the United States*, Environ. Res. Lett., Vol. 15, no. 9 (Sept. 11, 2020), https://iopscience.iop.org/article/10.1088/1748-9326/abaf86; Tian, H. et al., *Risk of COVID-19 is Associated with Long-term Exposure to Air Pollution*, medRxiv (Apr. 24, 2020), https://doi.org/10.1101/2020.04.21.20073700; Wu, X. et al., *Exposure to Air Pollution and COVID-19 Mortality in the United States: A Nationwide Cross-Sectional Study* (updated Nov. 4, 2020), https://projects.iq.harvard.edu/covid-pm/home; Zhu, Y., *Association Between Short-Term Exposure to Air Pollution and COVID-19 Infection: Evidence from China*, 727 Science of the Total Environment (Apr. 2020), https://doi.org/10.1016/j.scitotenv.2020.138704.

[125] English, P.B. et al., *Association Between Long-Term Exposure to Particulate Air Pollution with SARS-CoV-2 Infections and COVID-19 Deaths in California, U.S.A.*, Environmental Advances 9 (2022) 100270, https://doi.org/10.1016/j.envadv.2022.100270.

Notably, the Draft EIR includes a proposed mitigation measure (MM 4.3-6) that addresses COVID-19, stating that: "Owner/operators shall implement all orders related to the COVID-19 pandemic or any other pandemic mandated by Kern County Public Health on well sites and related to worker safety." To provide context for this mitigation measure, the Draft EIR should be revised as recommended above to make clear why COVID-19 is a health concern, particularly for a project that is expected to significantly increase $PM_{2.5}$ emissions.

4. The Draft EIR contradicts earlier statements about the nearest sensitive receptor.

The Draft EIR states: "The closest sensitive receptor to the project site is McKittrick Elementary School, which is 2.5 miles southwest of the facility pipeline and 4.46 miles from injection well 357-7R. The nearest residence is approximately 4.5 miles southeast of the injection line and 4.4 miles from injection well 345-36R."[126] In contrast, the Initial Study/Notice of Preparation states: "The sensitive receptor closest to the project site is the rural residence approximately 1 mile to the south of the project site."[127]

It is important for purposes of both impact analysis and mitigation that the Draft EIR correctly identifies the nearest sensitive receptor. The County must explain the discrepancy between the Draft EIR and the Initial Study/Notice of Preparation and, if the nearest sensitive receptor is actually only one mile away, revise its impacts analysis and mitigation measures accordingly.

5. The Draft EIR's air quality impact analysis is premised on unexplained and/or faulty assumptions.

As set forth in the attached report prepared by Dr. Ranajit Sahu (attached as Attachment A, hereafter "Sahu Report"), the Draft EIR's assessment of impacts and formulation of mitigation measures is inadequate because it is premised on assumptions that are unexplained if not faulty. For example:

- The data provided on "Existing Air Quality" is dated—covering 2019 to 2021—and therefore may not be representative of current air quality in Kern County.

- Nowhere does the Draft EIR or accompanying report prepared by Trinity Consultants explain the assumptions upon which the emissions estimates are made. It is unclear how the various emissions factors were selected and whether they are representative of expected activities and equipment for the CTV I Project.

- Further, assumptions about the expected project activities are unexplained despite their uncanny precision (e.g., well pad construction is expected to take 11 days; every well to be drilled is identified with a specific and unique depth; five hydrocranes are expected to operate exactly 1968.75 hours).

[126] Draft EIR, Vol. 1 at 1-5.
[127] *Notice of Preparation/Initial Study* at 3.

- The Draft EIR suggests false precision by failing to disclose quantitative error ranges and/or to qualitatively explain the uncertainty inherent in the emission estimates.

- Additionally, page 4-6 of the Trinity Consultants' report is completely blank. It is unclear whether this was intentional, or perhaps a formatting issue? To the extent information is missing—it should be provided to the public with appropriate time for review.

6. The Draft EIR fails to adequately address cumulative air quality impacts.

The Draft EIR acknowledges that the CTV I Project will contribute to cumulatively significant air quality impacts. It states: "Because the project's specific emissions would contribute to Kern County's 2020 emissions inventory and to the 2025 projected emissions of Kern County, *the project's incremental effects on air quality would be cumulatively considerable* and, even with mitigation, this potentially significant cumulative impact would be cumulatively significant and unavoidable."[128]

Although the Draft EIR acknowledges a significant cumulative impact on air quality, it does not evaluate or explain the severity of the impact or its consequences for local residents. The Draft EIR's bare conclusion—without further analysis—violates CEQA because "a sufficient discussion of significant impacts requires not merely a determination of whether an impact is significant, but some effort to explain the nature and magnitude of the impact."[129] Further, the Draft EIR is inadequate because, for an analysis of air quality impacts, an EIR must explain the "connection . . . between the two segments of information presented in the EIR—potential project emissions and human health impacts."[130]

To adequately address the CTV I Project's cumulative air quality impacts, the Draft EIR should address "how the environmental and public health burdens of a project might specially affect certain communities."[131] As part of this analysis, the Draft EIR should account for increased emissions from the Project "together with any pollution burdens [nearby] communities already are bearing, or may bear from probable future projects."[132]

A thorough analysis of cumulative air quality impacts is crucial because Kern County already experiences some of the worst and unhealthiest air quality in the country.[133] Such poor air quality is particularly burdensome because "Kern County has a higher percentage of Hispanic, linguistically isolated, and pollution burdened populations than do other areas of

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[128] Draft EIR, Vol. 1 at 1-11 to 1-12, 5-3 (italics added).
[129] *Sierra Club*, *supra*, 6 Cal.5th at 519.
[130] *Id.* at 520.
[131] Office of the Cal. Attorney General, *Environmental Justice at the Local and Regional Level* (2012) at 3, https://oag.ca.gov/sites/all/files/agweb/pdfs/environment/ej_fact_sheet.pdf.
[132] *Id.* at 4.
[133] American Lung Assn., *State of the Air* (2023) at 14–18 (listing Bakersfield, CA as the most polluted city in U.S. for daily and annual particulate matter and the third-most polluted city for ozone), https://www.lung.org/getmedia/338b0c3c-6bf8-480f-9e6e-b93868c6c476/SOTA-2023.pdf.

California."[134] Indeed the majority-Hispanic residents (63.9 percent) nearest to the proposed CTV I Project are particularly overburdened already: the Project has been proposed for a census tract that already faces one of the highest pollution burdens in the state (96th percentile) as well as challenges posed by unemployment (89th percentile), poverty (86th percentile), and linguistic isolation (83rd percentile).[135]

Notably, in addition to thoroughly addressing the existing air pollution burden in the Project area, the Draft EIR must also address "probable future projects."[136] As discussed elsewhere in these comments, the CTV I Project represents merely one component of extensive further industrial development that is expected in the area.

In addition to adequately analyzing cumulative effects of the CTV I Project in the context of the existing pollution burden on frontline communities and expected future projects, the County must then reassess the Draft EIR's evaluation of alternatives and identification of all feasible mitigation measures. As explained by the Office of the Attorney General, "[w]here a local agency has determined that a project may cause significant impacts to a particular community or sensitive subgroup, the alternative and mitigation analyses should address ways to reduce or eliminate the project's impacts to that community or subgroup."[137] Pursuant to CEQA's requirements and consistent with the Office of the Attorney General's guidance, the County should work with the public and affected communities to develop mitigation measures that will adequately address the CTV I Project's cumulative impacts.

7. The Draft EIR fails to adopt all feasible mitigation to control fugitive dust.

The Draft EIR acknowledges that PM_{10} is largely emitted as fugitive dust, often generated by construction, demolition, excavation, extraction, and/or other earthmoving activities.[138] Such activities—as well as vehicle traffic, another source of PM_{10}—will occur at the CTV I Project site, and the Draft EIR concludes that the Project's construction and operational activities will cause a significant increase in PM_{10} emissions.[139] Consequently, all feasible mitigation for PM_{10} must be adopted.

Mitigation Measure (MM) 4.3-2 specifies that "The Owner/operator shall develop and implement a Fugitive Dust Control Plan in compliance with San Joaquin Valley Air Pollution

[134] Kern County Planning & Natural Resources Dept., *Final Supplemental Recirculated Environmental Impact Report (October 2020) for Revisions to Title 19-Kern County Zoning Ordinance–(2020 A), Focused on Oil and Gas Local Permitting* (Jan. 2021), section 7.2.6 (Response to Comments of Interested Parties), response to comment 0010-3.
[135] Office of Environmental Health Hazard Assessment (OEHHA), *CalEnviroScreen 4.0*, results for 6029003700, https://oehha.ca.gov/calenviroscreen/maps-data (last visited Feb. 26, 2024).
[136] Office of the Cal. Attorney General, *Environmental Justice at the Local and Regional Level* at 4.
[137] *Id.* at 4.
[138] Draft EIR, Vol. 1 at 4.3-14, 4.3-38 to 4.3-39.
[139] Draft EIR, Vol. 1 at 4.3-63 to 4.3-68.

Control District fugitive dust suppression regulations."[140] The Measure further specifies 14 specific "dust control measures [that] shall be implemented."[141]

The prescribed specific measures set forth in MM 4.3-2 are inadequate and do not represent all feasible mitigation for fugitive dust at the Project site. Inexplicably, MM 4.3-2 does not include all feasible measures identified by the San Joaquin Valley Air Pollution Control District in its most recent Guidance for Assessing and Mitigating Air Quality Impacts.[142] Nor does MM 4.3-2 institute all measures contemplated by the Air District's Regulation VIII.[143] Indeed, some of the measures set forth in MM 4.3-2 contradict stricter requirements set forth in Regulation VIII.

Consistent with CEQA's requirement to adopt all feasible mitigation, MM 4.3-2 should be revised to reflect stronger and/or additional mitigation to control fugitive dust. MM 4.3-2 must be strengthened not only to comply with CEQA, but to abide by the legislative directive that projects like CTV I "include . . . [s]trategies to minimize, to the maximum extent technologically feasible, copollutant emissions from facilities where CCUS or CDR technology is deployed to ensure that the use of carbon dioxide removal technologies and carbon capture and storage technologies does not have an adverse impact on local air quality and public health, particularly in low-income and disadvantaged communities."[144] Consequently, MM 4.3-2 should be revised to include the following:

- Work should be phased to reduce the amount of disturbed surface area at any one time.[145] The Owner/operator should be required to describe how it intends to phase work in the required Fugitive Dust Control Plan.

- At all times, for all activities (i.e., *not* just excavated soil piles, construction activities on unpaved surfaces, and grading), visible dust emissions should be limited to 20% opacity.[146]

- Wind barriers should be constructed and maintained to limit visible dust emissions to 20% opacity.[147] The Owner/operator should be required to describe where and how it will construct and maintain wind barriers in the required Fugitive Dust Control Plan.

[140] Draft EIR, Vol. 1 at 4.3-58.
[141] Draft EIR, Vol. 1 at 4.3-58.
[142] See San Joaquin Valley Air Pollution Control District (SJVAPCD), *Guidance for Assessing and Mitigating Air Quality Impacts* (Mar. 19, 2015) at 77–78, https://www.valleyair.org/transportation/GAMAQI.pdf.
[143] The Air District's Regulation VIII and its constituent rules are described in the Draft EIR in Volume 1 at 4.3-38 to 4.3-39. Further, it is available on the Air District's website at https://ww2.valleyair.org/rules-and-planning/current-district-rules-and-regulations/regulation-viii-fugitive-pm10-prohibitions/.
[144] Health & Safety Code, § 39741.1(a)(3)(A).
[145] Rule 8021, section 5.2 and table 8021-1.
[146] Rule 8021, sections 5.0, 5.2, 5.4.1, and table 8021-1; Rule 8051, section 5.0.
[147] Rule 8021, section 5.2 and Table 8021-1.

- Traffic speeds on unpaved roads should be limited to 15 miles per hour (*not* 25), with speed limit signs posted.[148]

- Construction activities should be discontinued whenever visible dust emissions exceed 20% opacity, even if ambient wind speeds do not exceed 25 miles per hour.[149]

- Track out should be prevented by one of the following: a grizzly with rails, pipes or grates to dislodge debris off exiting vehicles; a layer of washed gravel at one inch or larger in diameter, three inches deep; extension of paved road at least 100 feet from publicly maintained road; or installation of a wheel washer.[150]

- All visible carryout and trackout on paved public roads or the paved shoulders of a paved public road should be removed at the end of each workday;[151] it is not sufficient to isolate carryout or trackout behind a locked gate.

- For empty haul trucks, the interior of the cargo compartment must be cleaned or covered before the empty truck leaves the site.[152]

Additionally, MM 4.3-2 must specify that no construction or grading permits shall be issued, and no activities expected to cause fugitive dust emissions may otherwise commence, unless and until the Air District approves a Fugitive Dust Control Plan for the CTV I Project. The County must specify such a limitation because "mitigation measures must be in place" when a "project reaches the point where activity will have a significant adverse effect on the environment."[153]

8. The Draft EIR does not provide adequate mitigation to protect sensitive receptors.

a. MM 4.3-5 is inadequate and does not constitute all feasible mitigation.

To protect sensitive receptors, MM 4.3-5 states: "No Class VI or Class II well shall be located within 4000 feet of any sensitive receptor."[154] According to the Draft EIR, this measure

[148] Rule 8021, section 5.3.
[149] Rule 8021, section 5.4.1.
[150] See Rule 8041, sections 5.8 and 5.9; see also Kern County Planning & Natural Resources Dept., *Recirculated Draft Environmental Impact Report for 99 Houghton Industrial Park Project* (Oct. 2019) (hereinafter "99 Houghton Recirculated Draft EIR") at 4.3-43, https://psbweb.kerncounty.com/UtilityPages/Planning/EIRS/99_Houghton/DEIR/_99_Houghton_RDEIR_Vol%201.pdf.
[151] Rule 8041, section 5.1.
[152] Rule 8031, table 8031-1.
[153] *King & Gardiner Farms, supra,* 45 Cal.App.5th at 860, quoting *POET, supra,* 218 Cal.App.4th at 738.
[154] Draft EIR, Vol. 1 at 1-30, 4.3-74.

is intended to mitigate an "escape" of CO_2 "into the atmosphere," which "could result in health impacts to humans and wildlife."[155]

While MM 4.3-5 appropriately establishes a sizeable setback from the CTV I Project's injection wells, it is unclear if the setback distance provides adequate mitigation because the Draft EIR does not explain how the distance of 4,000 feet was selected. The Draft EIR must be updated to substantiate that MM 4.3-5's setback distance is adequate to protect sensitive receptors, reflecting an assessment of site-specific factors.

Notably, as described in the "Failure Investigation Report" for the CO_2 pipeline rupture that occurred not far from Satartia, Mississippi, emissions from the rupture affected community members located "approximately one mile" away.[156] As a consequence of the rupture and the significant leak of CO_2, 45 people were taken to the hospital and all 200 residents of Satartia had to be evacuated.[157] The threat posed by CO_2 emissions from an injection well—particularly in the event of a blowout—would seem to be equal if not greater than the threat posed by a pipeline rupture.

Beyond the need to substantiate MM 4.3-5's setback distance for injection wells, the stated rationale for the measure makes plain the measure's inadequacy. As the Draft EIR aptly notes, the escape of CO_2 "via either well failure *or pipeline rupture* . . . could result in health impacts to humans and wildlife."[158] Indeed, the incident near Satartia demonstrates that it is not only injection wells that pose a threat to public health, but also pipelines and presumably any other equipment or structure that could leak significant quantities of CO_2. Consequently, MM 4.3-5 should be revised to require a protective setback from not only the injection wells, but also the Project's pipelines and any other structures or equipment containing or conveying CO_2.

b. MM 4.3-7 constitutes inadequate and unlawfully deferred mitigation.

As a further measure to address air quality impacts on sensitive receptors, MM 4.3-7 sets forth the following monitoring requirements:

> Prior to issuance of any construction or grading permits, the Owner/operator shall consult with the San Joaquin Valley Air Pollution Control District and develop a draft Air Monitoring program for fence line monitoring of all air constituents generated by the CCS project including but not limited to: criteria pollutants, CO_2, and H_2S. The plan shall be reviewed and approved by both the San Joaquin Valley Air District and the California Air Resources Board, with a draft copy to the EPA UIC Program and Kern County Planning and Natural Resources, and implemented before any construction on the CCS facilities can occur. The final

[155] Draft EIR, Vol. 1 at 4.3-73.
[156] Draft EIR, Vol. 2, Failure Investigation Report – Denbury Gulf Coast Pipelines LLC (May 26, 2022) at 3.
[157] Draft EIR, Vol. 2, Failure Investigation Report – Denbury Gulf Coast Pipelines LLC at 2.
[158] Draft EIR, Vol. 1 at 4.3-73 (italics added).

approved plan shall be provided to the EPA UIC Program and Kern County Planning and Natural Resources.[159]

Given the CTV I Project's potential to expose nearby community members to substantial concentrations of air pollution, both criteria air pollutants and toxic air contaminants, the County can and should insist on a robust monitoring plan to detect elevated pollution levels.

Unfortunately, MM 4.3-7 does nothing more than generically require development and approval of a future plan. The Measure fails to identify any performance standards to be used to develop the monitoring plan and, equally important, neglects to identify performance standards for the mitigation to be instituted when the monitoring identifies significant impacts. This open-ended and therefore potentially meaningless promise of a mitigation measure to be developed sometime in the future violates CEQA's requirements for deferred mitigation.

In *Gray v. County of Madera* (2008) 167 Cal.App.4th 1099, the court rejected—for lack of any performance standards—a mitigation measure that required monitoring private wells near a quarry and, if an impact was found, specified that the project must replace the lost water from existing wells on the proponent's property. Even though the respondent county in *Gray* had "committed itself to a specific mitigation goal—the replacement of water lost by neighboring landowners because of mine operations," the court concluded the goal was not a specific performance standard that complied with CEQA.[160]

MM 4.3-7 is even more deficient than the mitigation measure rejected in *Gray*, as the Draft EIR does not identify any performance standards for the monitoring plan to be established beyond the pollutants to be addressed, let alone any performance standards for the mitigation to be implemented upon the identification of impacts. To meet CEQA's requirements, MM 4.3-7 should identify:

- Specific monitoring parameters (e.g., spacing of monitors, equipment sensitivity, frequency of monitoring) and/or performance standards to be used to select monitoring parameters;

- Requirements for reporting monitoring results to the County and responsible agencies and/or performance standards to be used to develop such reporting requirements;

- Requirements for reporting monitoring results to affected communities, regional community-based organizations, and to the public online and/or performance standards to be used to develop such meaningful public disclosure;

- Threshold level(s) and requirements for notification of nearby residents, other affected communities, and schools when a threshold is exceeded and/or performance standards to be used to develop such public notification requirements;

[159] Draft EIR, Vol. 1 at 1-31, 4.3-74.
[160] *Gray, supra,* 167 Cal.App.4th at 1119.

- Threshold levels of air pollution that, if detected at the fenceline, will trigger mitigation and/or performance standards to be used to select appropriate thresholds for mitigation;

- Mitigation measures to be implemented if monitoring thresholds are exceeded and/or performance standards to be used to select effective mitigation measures.

To adequately protect community members, monitoring parameters for the plan to be developed pursuant to MM 4.3-7 should be developed with input from nearby residents and affected communities. Community input is particularly valuable and important for determining the locations of monitors (including, but not limited to, near sensitive receptors and along the project fenceline), the number of monitors, and the thresholds that will trigger community notification and response requirements.

9. The Draft EIR fails to adopt all feasible mitigation to address Valley Fever.

The Draft EIR institutes one mitigation measure, MM 4.3-6, to address Valley Fever.[161] MM 4.3-6 is inadequate and does not incorporate all feasible mitigation to address Valley Fever.

MM 4.3-6 should be revised to include the fuller protections that the County previously devised for the 99 Houghton Industrial Park Project, as set forth in MM 4.3-1 of the Recirculated Draft EIR for the project:[162]

- The Owner/operator should be directed to thoroughly clean equipment, vehicles, and other items of dust before they are moved offsite to other work locations.

- Grading and trenching work should be phased so that earthmoving equipment is working ahead or down-wind of workers on the ground. The Owner/operator should be required to describe how it intends to phase work in the required Fugitive Dust Control Plan.

- The area immediately behind grading or trenching equipment should be sprayed with water before ground workers move into the area.

- In the event that a water truck runs out of water before dust is sufficiently dampened, any ground workers that otherwise would be exposed to dust should be directed to leave the area until a full truck resumes water spraying.

- All heavy-duty earth-moving vehicles should be closed-cab and equipped with a HEPA-filtered air system.

- Evidence of required training on how to spot and report the symptoms of Valley Fever and how to properly use personal protective equipment should be provided by the Owner/operator to the Kern County Planning and Natural Resources Department within 24 hours of the training session.

[161] Draft EIR, Vol. 1 at 1-30 to 1-31, 4.3-74.
[162] See 99 Houghton Recirculated Draft EIR at 1-27, 4.3-48 to 4.3-49.

10. The Draft EIR fails to adopt all feasible mitigation for cumulatively significant net increases in nonattainment air pollutants, including $PM_{2.5}$.

The Draft EIR acknowledges that the CTV I Project will result in a cumulatively considerable net increase of criteria air pollutants for which the San Joaquin Valley has been designated a "nonattainment" area pursuant to applicable state and federal ambient air quality standards. In particular, the Draft EIR states that "[t]he project's total emissions would exceed the San Joaquin Valley Air Pollution Control District thresholds for nitrogen oxides (NOx), particulate matter with a diameter of 10 micrometers or less (PM_{10}), and particulate matter with a diameter of 2.5 micrometers or less ($PM_{2.5}$), for which the project region is nonattainment under an applicable federal or State ambient air quality standard."[163]

To address the CTV I Project's significant criteria air pollutant emissions, the Draft EIR includes MM 4.3-9, which "requires the execution of a Developer Mitigation Agreement (DMA)" with the Air District.[164] According to the Draft EIR: "[t]he implementation of a DMA (MM 4.3-9) to reduce criteria pollutants of NO_X, ROGs, and PM net incremental emissions generated by a project has been incorporated into development projects in the county since 2008."[165]

In several respects, MM 4.3-9 does not meet CEQA's requirement that the County adopt all feasible mitigation, nor does it comply with the requirement of Health and Safety Code section 39741.1(a)(3)(A) that CCS projects "minimize, to the maximum extent technologically feasible, copollutant emissions . . . to ensure that the use of carbon dioxide removal technologies and carbon capture and storage technologies does not have an adverse impact on local air quality and public health, particularly in low-income and disadvantaged communities."

a. The County must approve the DMA and institute other requirements to ensure MM 4.3-9 is enforceable and enforced.

While MM 4.3-9 appropriately requires the Owner/Operator enter into the DMA and pay associated fees due to the Air District prior to the approval of any grading or construction activity, the Measure fails to specify that the agreement must be approved by the County as well, subject to public review and comment. In litigation over Kern County's Oil and Gas Ordinance, courts have found that the specific terms of such an implementing agreement are consequential and must provide for "particular" and "enforceable" mitigation.[166] Further, in correspondence between the County and Air District concerning such agreements, the County has confirmed that it—as lead agency—is ultimately "responsible for the implementation of all mitigation

[163] Draft EIR, Vol. 1 at 1-11.
[164] Draft EIR, Vol. 1 at 4.3-68.
[165] Draft EIR, Vol. 1 at 4.3-68.
[166] *King & Gardiner Farms, LLC v. County of Kern* (Fifth District Court of Appeal Case No. F077656, Feb. 25, 2020), Slip Opinion at 67-74; *Vaquero Energy Inc., et al. v. County of Kern, et al.* (Kern County Superior Case No. BCV-15-101645-GP, June 7, 2022), Ruling on Petitions for (Third) Writ of Mandate at 21–23.

measures."[167] For these reasons, the County must itself review and approve the DMA, subject to the additional steps for community input and public review discussed below.

The County should withhold its approval of the DMA unless and until the California Air Resources Board confirms in writing that the DMA meets the requirements of section 39471.1 of the California Health and Safety Code. MM 4.3-9 currently specifies that the DMA "shall be reviewed by the California Air Resources Board for compliance with" section 39741.1 "before execution and adoption,"[168] but does not specify if or how compliance will be confirmed. MM 4.3-9 should be revised to specify that written confirmation of compliance is required.

To ensure that MM 4.3-9 and all the other mitigation measures set forth in the Draft EIR are implemented and fully enforceable, the County should specify in the CUPs required by the CTV I Project that compliance is required, with construction as well as subsequent operational activities conditioned upon initial and ongoing compliance.

Further, MM 4.3-9 should be revised to require: (a) reporting by the Owner/operator to verify that actual CTV I Project emissions are consistent with the Draft EIR's emissions estimates and the fee paid; (b) reporting by the Air District to confirm that funding by the Owner/operator is sufficient to fund local pollution-reducing projects that, in fact, offset the Project's actual emissions; and (c) a mechanism that requires the Owner/operator to pay a supplemental fee or fees if actual Project emissions exceed the Draft EIR's estimates and/or the initial fee proves to be insufficient.

b. MM 4.3-9 is ambiguous about exactly what mitigation is required.

The Draft EIR and MM 4.3-9 are not clear about precisely what mitigation will be required under the mitigation measure. MM 4.3-9 states:

> The Owner/operator shall pay fees to fully offset Project emissions of NOx (oxides of nitrogen), ROG (reactive organic gases), PM10 (particulate matter of 10 microns or less in diameter), and PM2.5 (particulate matter of 2.5 microns or less in diameter) (including as applicable mitigating for reactive organic gases by additive reductions of particulate matter of 10 microns or less in diameter) (collectively, "designated criteria emissions") to avoid any net increase in these pollutants.[169]

[167] Letter from Kern County Planning & Natural Resources Dept. to SJVAPCD (Sept. 15, 2020) at 2; accord Letter from SJVAPCD to County of Kern Planning and Natural Resources Department (Oct. 30, 2020) at 2 (stating the Air District "is not responsible for making whole any shortfalls for emission reductions that the District is not able to achieve with the mitigation funds it receives from the County" pursuant to an emissions reduction agreement because "as the lead agency under CEQA," it is the County's "obligation to ensure implementation of all mitigation measures included in the Environmental Impact Report").
[168] Draft EIR, Vol. 1 at 1-32. 4.3-71.
[169] Draft EIR, Vol. 1 at 1-31, 4.3-70.

MM 4.3-9's requirement to "fully offset Project emissions . . . to avoid any net increase in these pollutants" is ambiguous. It is unclear if the County is mandating that, for each air pollutant emitted by the CTV I Project, the DMA will require an equivalent, offsetting reduction in the same air pollutant. Conversely, the County may intend to treat all the criteria air pollutants collectively and interchangeably, with the DMA only required to ensure that the combined sum of all increased criteria air pollutant emissions will be offset by an equivalent reduction in criteria air pollutants—no matter the particular air pollutant reductions achieved. Either way, the Draft EIR should be revised to clarify what the terms in the mitigation measure mean. For example, if it is the County's intention to allow reductions in PM_{10} to be credited as mitigation for $PM_{2.5}$ under MM 4.3-9, the Draft EIR should say as much so that the public and decisionmakers fully understand how MM 4.3-9 will operate.

c. The County must require that increases in $PM_{2.5}$ emissions be offset with commensurate reduction in $PM_{2.5}$.

To the extent the County intends to treat all the criteria air pollutants interchangeably for purposes of mitigation, such an approach fails to ensure that significant increases in particular air pollutants will be reduced, as CEQA requires. In this regard, the conflation of $PM_{2.5}$ and PM_{10} is especially problematic.

In reviewing mitigation for the Kern County Oil and Gas Ordinance, the courts have twice found that treating $PM_{2.5}$ and PM_{10} interchangeably for purposes of mitigation is unlawful. In 2020, the Fifth District Court of Appeal agreed with petitioners that the County's 2015 EIR failed to adequately mitigate $PM_{2.5}$ pollution. Reviewing the issue as a matter of law, the court observed that $PM_{2.5}$ and PM_{10} "are not the same" and faulted the County's mitigation measure and a related emissions reduction agreement for "[l]umping them together."[170] According to the appellate court, absent a finding that it would be infeasible, the County was required to adopt "fully enforceable" mitigation in the form of a "particular requirement" for $PM_{2.5}$.[171]

More recently, in 2022, the Kern County Superior Court again agreed with petitioners that the County unlawfully failed to adopt all feasible mitigation for $PM_{2.5}$ and to make such mitigation enforceable. In its ruling, the court faulted the County for continuing to "conflat[e] … PM2.5 and PM10."[172]

Although MM 4.3-9 mentions both $PM_{2.5}$ and PM_{10} separately, that is insufficient. Instead, MM 4.3-9 should specify that the Project's $PM_{2.5}$ emissions will be mitigated by funding projects that result in an equivalent quantity of $PM_{2.5}$ reductions. Absent such an explicit requirement in MM 4.3-9, significant increases in $PM_{2.5}$ may, in fact, evade mitigation. In its 2020 opinion, the Fifth District explained how this could happen in a detailed hypothetical:

> Suppose that during a proposed project's first year of operation it was estimated to emit 16 tons of PM2.5 and to emit 17 tons of PM10 that was larger than PM2.5. If the project proponent were to enter into offset agreements that reduced PM10

[170] *King & Gardiner Farms* Slip Opinion at 70–72.
[171] *King & Gardiner Farms* Slip Opinion at 70–73; accord *King & Gardiner Farms*, 45 Cal.App.5th at 830.
[172] *Vaquero Energy*, Ruling on Petitions for (Third) Writ of Mandate at 22.

that was larger than PM2.5 by 30 tons in the first year, then the net particulate matter emissions for the first year would be three tons, which is below the standard of significance for both PM10 and PM2.5. However, the 16 tons of PM2.5 emissions would not have been offset and, under Air District's 15-ton per year threshold of significance for that air pollutant, one would conclude that the project would have a significant adverse effect on air quality despite the offsets of PM10.[173]

d. Additional changes are required to ensure that MM 4.3-9 will effectively reduce air quality impacts to the extent feasible.

MM 4.3-9 recognizes the importance of addressing air quality impacts where the CTV I Project's increased air pollution emissions will be experienced most acutely—i.e., in the communities nearest to the proposed Project. MM 4.3-9 therefore appropriately requires that monies collected pursuant to the DMA will be used to fund pollution-reducing mitigation projects within a 20-mile radius.[174]

MM 4.3-9 also responds to the need for outreach to local community members to ensure effective operation of the DMA, requiring the Owner/operator to pay an annual fee "for the creation of a county managed community liaison position to provide technical support to the Eligible CCS Air Funding Communities and coordination with the San Joaquin Valley Air Pollution Control District to expedite use of the funding for air mitigation projects."[175] This likewise is a welcome and appropriate requirement.

Nonetheless, further steps can and should be taken to ensure the DMA effectively reduces air quality impacts. Specifically:

- MM 4.3-9 should require the Owner/operator and the Air District to establish a community-led steering committee made up of affected residents that live within Eligible CCS Air Funding Communities. The purpose of this steering committee would be to provide input to the Owner/operator and the Air District as the terms of the DMA are developed, and to advise the Air District on its funding decisions once the DMA is executed.

- MM 4.3-9 should also specify that, with the support of the DMA-funded community liaison, the steering committee will hold periodic public meetings and/or workshops to hear residents' concerns and to provide information about the availability of DMA funds.

- In addition to requiring funding for the community liaison position, MM 4.3-9 should also require additional funding to ensure that the public liaison and steering committee can conduct outreach in English as well as Spanish—with an ability to provide written materials in both languages as well as interpretation at meetings and/or workshops.

[173] *King & Gardiner Farms* Slip Opinion at 71.
[174] Draft EIR, Vol. 1 at 4.3-71.
[175] Draft EIR, Vol. 1 at 4.3-71.

B. The Draft EIR's Analysis and Mitigation of Climate Impacts is Inadequate.

1. The Draft EIR's GHG analysis is inadequate under CEQA.

The Draft EIR's GHG emissions analysis is unsupported, self-contradicting, and violates CEQA's requirements for proper analysis.

The GHG analysis reveals a contradiction at the heart of the premise of this Project: the Draft EIR's analysis of GHG impacts concludes that even though permanent CO_2 sequestration and reductions in CO_2 emissions are CTV I Project's main objectives, the Project has a potentially significant impact from GHG emissions. Even worse, the Draft EIR reaches this conclusion in part based on the assertion that it cannot guarantee that the CO_2 it proposes to inject underground will actually be put underground and remain there permanently without release or leakage. And no meaningful analysis or evidence supports the Draft EIR's conclusions relating to any of these points. The GHG analysis fails, too, for the same reason the project description is inadequate: the analysis does not incorporate the full scope of Project facilities and activities or their GHG emissions—and relatedly, the Draft EIR does not grapple with whether and to what extent the Project may extend the life of existing fossil fuel facilities and associated GHG emissions. The analysis does not adequately assess consistency with plans and policies relating to GHGs. The Project improperly fails to have a plan for monitoring the CO_2 to guarantee it will remain sequestered. And finally, the mitigation is inadequate, including an improper reliance on offset credits as mitigation for its potentially significant GHG impacts.

a. The GHG analysis fails to disclose important information regarding the Project's emissions.

The Draft EIR's analysis of GHG emissions is informationally inadequate. It fails to disclose the full range of projected emissions from the overall scope of activities relating to the Project, or even from the full operations of capture and storage activities.

The GHG impact analysis discloses that the County plans to issue entitlements for the whole storage capacity of 49.25 MMT of CO_2, as well as CCS facilities capturing CO_2 from the existing plants (the gas plant and power plant) at the Elk Hills oil field. Future sources, according to the Draft EIR, "are required to be permitted with a separate CUP process and environmental review for compliance with CEQA."[176]

The analysis then provides an estimate of the construction and operational emissions. The analysis is provided only for the existing plants and the new capture facilities built for them. Under Table 4.8-4, "Estimated Operational Greenhouse Gas Emissions", the Draft EIR presents the expected emissions from the existing plant, the projected emissions from mobile sources of the capture facility, and the projected amounts of CO_2 captured and sequestered until the year

[176] Draft EIR, Vol. 1 at 4.8-19.

2045.[177] The Draft EIR concludes that over 20 years, the Project will result in net emissions reduction of 31,217,430 MT CO_2e.[178]

But the Draft EIR fails to disclose the operational emissions from the capture facility *stationary sources* and includes only its mobile emissions in Table 4.8-4. This is misleading and inadequate. The Sahu Report notes that the analysis is missing, and should include, GHG emissions associated with the maintenance of equipment, including "blowdown" or similarly necessary emissions in order to allow for proper preventive maintenance.[179] The analysis must include the projected GHG emissions from *all* Project operations.

b. The GHG analysis fails to properly analyze future sources of CO_2 injection.

As discussed above, the project description and scope are too narrow. This flaw also renders the GHG emissions analysis inadequate.

The Draft EIR reviews the total potential CO_2 storage of the Project, which is almost at 50 MMT, and the projected injection up until 2045.[180] Regarding the sources of this CO_2, the Draft EIR acknowledges that "[a]dditional sources will need to be identified and permitted by the applicant"[181] and claims that "[e]ach of those sources will have capture facilities with the same amine technology or better and a reasonable assumption can be made that it would produce the same GHG emissions per ton of capture as evaluated for this initial source."[182] The Draft EIR goes on to argue that:

> All known sources are shown in Section 3.9 of Chapter 3, Project Description, but as they have not been permitted or completed CEQA, information cannot be provided on the total amount of GHG emissions they produce, how much will be captured, how much stored, how much additional created or how much will still be released to the atmosphere.[183]

The Draft EIR fails to analyze GHG impacts from the full range of facilities and activities that constitute and relate to the Project, as explained more fully in this letter's discussion of project description and cumulative impacts. Moreover, the document presents an internally contradictory picture of reasonably foreseeable CO_2 sources for the storage facility. The Draft EIR argues that information about future sources of CO_2 is unknown, and at the same time argues that future sources will come from "essential but hard to decarbonize" industries.[184] If the information regarding future sources is still unknown, it is unclear how the Draft EIR can assume they will come from such industries. Nothing in the Draft EIR indicates that the County will

[177] Draft EIR, Vol. 1 at 4.8-24 ("Table 4.8-4 shows only the initial source permitted with this EIR (collection of pre-combustion oilfield gas from in-field CRC facilities) at the same rate").
[178] Draft EIR, Vol. 1 at 4.8-24.
[179] Sahu Report at 4.
[180] Draft EIR, Vol. 1 at 4.8-25.
[181] Draft EIR, Vol. 1 at 4.8-25.
[182] Draft EIR, Vol. 1 at 4.8-25.
[183] Draft EIR, Vol. 1 at 4.8-25.
[184] Draft EIR, Vol. 1 at 4.8-26.

condition future sources on falling within the "essential but hard to decarbonize" category, or defines which industries qualify for that category. This is especially concerning given the fact that the only fully-disclosed source in the Draft EIR is a fossil fuel plant that sends power to oil production activities.[185]

The Draft EIR also provides no support for the claim that future sources will use the same amine technology and create the same levels of operational emissions. Again, nothing in the Draft EIR mitigation measures conditions future sources on using that same technology or better. In fact, the Draft EIR admits the possibility of "additional, unmitigated GHG emissions be[ing] created from the capture facility operations"[186] but fails to disclose what the circumstances, likelihood, or magnitude of those "additional, unmitigated GHG emissions" are.

Not only is the Draft EIR analysis not supported by evidence, but it is also contradicted by the evidence. As discussed above, available information about future sources is available well beyond what the Draft EIR discloses and analyzes. The Draft EIR fails to account in any way for the emissions generated by the facilities that will send their CO_2 for sequestration, including through transportation, and fails to analyze the Project's GHG emissions throughout its projected life span. It must include that information and account for its impacts on GHG emissions.

c. The GHG analysis fails to analyze the whole Project's lifespan.

The Draft EIR also fails to explain why the analysis goes only to the year 2045 and up to 31 MMT of CO_2,[187] when the Draft EIR seeks to approve the whole storage capacity of almost 50 MMT, and the Project's lifespan is currently estimated to be 30 years (or roughly to 2054),[188] and potentially longer. EPA's docket for the CTV I Project Class VI permit indicates that CTV would be required to implement an EPA-approved Post-Injection Site Care and Site Closure Plan, and that it will include post-injection monitoring for at least 50 years and until it demonstrates non-endangerment of underground sources of drinking water (USDW) based on monitoring and other site data.[189]

The analysis should account for the whole storage capacity the Draft EIR is seeking to approve, and for the whole projected life of the related CCS facilities and sources.

d. The GHG analysis fails to account for potential life extension of fossil fuel facilities.

The first proposed source for CO_2 sequestration in the CTV I Project is the pre-combustion Elk Hills oil field gas, which is processed at the natural gas plant (CGP-1) facility

[185] Draft EIR, Vol. 1 at 3-3.
[186] Draft EIR, Vol. 1 at 4.8-26
[187] Draft EIR, Vol. 1 at 4.8-26
[188] Draft EIR, Vol. 1 at 4.2-14.
[189] EPA, *Public Comments Sought on Class VI UIC Injection Well Carbon Storage Draft Permits* at 4–5.

and used at the Elk Hills power plant.[190] The GHG analysis assumes continuous operations of the power plant, which is already over 20 years old, at least into the year 2045.[191]

The GHG analysis fails to provide any information about the expected life of the power plant independently of its role as a CO_2 source for the Project, despite acknowledging that California aims to reduce its dependency on fossil fuels.[192] In some places, the Draft EIR even assumes continued operations for the 30-year duration of the proposed Project. [193]

As the Sahu Report notes, the proposed Project would require the power plant to operate for over 50 years, while "[w]ithout significant additional investments to extend the life of the power plant, it is likely that the Elk Hills power plant would have shut down but for the proposed project."[194]

The Draft EIR fails to address the critical question of whether the CTV I Project may facilitate extending the life of the Elk Hills power plant or of any other fossil fuel source, and the resulting GHG emissions implications.

e. The GHG analysis does not disclose potential offset credit generation.

The DEIR does not discuss or disclose whether Project proponents believe its operations will—or should—receive credit as offsets in the cap-and-trade market. A recent report by the Independent Emissions Market Advisory Committee noted that "there are conflicting views on whether carbon dioxide removals should be given credit as offsets in the cap-and-trade market and resolving this will be an important issue for CARB and the legislature."[195] CRC's presentation regarding the CTV I Project from November 2023 states that "[t]he capture project is targeting 45Q credit generation as well as the potential for LCFS qualification and Cap & Trade (C&T) avoidance."[196]

The question of whether the CTV I Project can generate offset credits is crucial for a full analysis of the Project's impacts. If the Project is allowed to generate credits, it means its overall GHG impacts will be materially different than those claimed under the GHG analysis, as its operation may allow for continued emissions elsewhere. The analysis must disclose and analyze the issue of offset credits generation by the Project.

f. The GHG analysis is not supported by the evidence.

The Draft EIR's analysis for Impact 4.8-1, "Generate Greenhouse Gas Emissions, Either Directly or Indirectly, that may have a Significant Impact on the Environment," is unsupported

[190] Draft EIR, Vol. 1 at 3-1.
[191] California Energy Commission (CEC), *Elk Hills Power Project* (last accessed Feb. 28, 2024), https://www.energy.ca.gov/powerplant/combined-cycle/elk-hills-power-project.
[192] Draft EIR, Vol. 1 at 4.8-24.
[193] Sahu Report at 3
[194] Sahu Report, at 3–4.
[195] Independent Emissions Market Advisory Committee, *2023 Annual Report* (Feb. 2024) at p. 27.
[196] CRC and CTV, *Third Quarter 2023 Results* (Nov. 01, 2023).

by substantial evidence and internally contradictory. This analysis assumes that unless "any of the injected CO2 leak at injection," or "additional, unmitigated GHG emissions be created from the capture facility operations," the injected CO_2 will remain in the reservoirs, resulting in reduction of CO_2 emitted by the CO_2 source industries.[197] The Draft EIR also, however, acknowledges briefly that leaks might happen "at injection." And even more confusingly, the Draft EIR makes a significance finding based on the acknowledged (and vaguely-stated) risk of a GHG "release due to unforeseen circumstances or equipment failure."[198] Moreover, as the expert report of Dr. Dominic DiGiulio (attached as Attachment B, hereafter "DiGiulio Report") shows, to the extent the Draft EIR relies on the assumption that stored CO_2 will actually both reach and remain in the reservoirs as required for the Project to meet its objectives, that assumption is not supported by the evidence.

In his report, Dr. DiGiulio concludes that "[i]nformation presented in the DEIR and Class VI permit applications does not support a finding that the project will retain 99% of stored CO_2 in excess of 100 years at cessation of injection, as required by the California Air Resources Board."[199] Dr. DiGiulio explains that the retention is not credible due to the large number of wellbore penetrations in the area, the high pressure of storage, the fact the storage will primarily consist of supercritical fluid, and the elevated risk of seismic activity in the vicinity of the Project area.[200]

Dr. DiGiulio explains that leakage of CO_2 from wellbores is widely considered to be one of the most significant leakage pathways for geologic storage of CO_2.[201] Given the large number of well penetrations in the area, a robust evaluation of wellbore integrity of both plugged and unplugged wells prior to injection is required to assess the CO_2 retention.[202] However, as the DiGiulio Report shows, the Draft EIR fails to support its conclusions regarding CO_2 retention with evidence.

The full extent of the failure to support the Draft EIR's analysis and conclusions is detailed in the DiGiulio Report. A few examples of that failure are provided below.

The Draft EIR identified 204 wellbores in the 26R reservoir that penetrate the Reef Ridge Shale - the primary confining layer in both storage areas. For the 26R reservoir area, the Draft EIR states that "*Appendix 1*" lists the wells individually and provides information including well name, API-12, well type, status, spud date, surface coordinates, and pre-operational requirements. However, Appendix 1 is missing from the Draft EIR.[203] A document that might be a part of that missing appendix was submitted to the EPA. However, that does not absolve the Draft EIR from the duty to "adequately inform the public and decision makers, who may not be previously familiar with the details of the project."[204] Moreover, there is no mention of

[197] Draft EIR, Vol. 1 at 4.8-26
[198] Draft EIR, Vol. 1 at 4.8-26.
[199] DiGiulio Report at 8.
[200] DiGiulio Report at 8.
[201] DiGiulio Report at 3.
[202] DiGiulio Report at 8.
[203] DiGiulio Report at 11.
[204] *Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal. 4th 412, 443, as modified (Apr. 18, 2007).

preparation of the same type of Appendix for the A1 – A2 Reservoir area. Appendix 1 must be included in a recirculated version. The Draft EIR must be revised to include a detailed wellbore-by-wellbore evaluation in order to assess leakage potential and minimize it.[205]

Class VI permit applications require "A tabulation of all wells within the area of review which penetrate the injection or confining zone(s)." That information was provided late, to the EPA only, and is not included in the Draft EIR.[206] Moreover, the document that was provided to the EPA is still missing critical information and riddled with vague and indefinite terms. The DiGiulio Report explains that records of plugging and/or completion should at least include wellbore schematics including actual details of plugging and completion. The Draft EIR must be recirculated with the necessary information. This should include all information associated with wellbores relevant to wellbore integrity, including, for example, internal and external mechanical integrity tests, drilling and cementing records, cement bond/variable density logs, and cement squeeze operations.[207]

The DiGiulio Report notes that the Draft EIR assumes a 0.0% wellbore barrier failure rate for 354 wellbores, which is not only at odds with the published rates of wellbore failure, ranging from 2-75% in the literature, but also unsupported by any data that can be independently reviewed.[208] Dr. DiGiulio notes that it does not appear the EPA conducted an independent evaluation of wellbore integrity of well penetration, and that there is no supporting evidence to accept the statement of no wellbore barrier failure.[209] The Draft EIR must be revised to include all relevant information, including but not limited to wellbore diagrams, cement evaluation logs, and internal and external mechanical integrity tests, to support its conclusions with evidence.

Finally, Dr DiGiulio highlights the fact that there are inconsistencies between the Draft EIR and the documents filed with the EPA for the Project's Class VI permit applications: most notably, there are discrepancies in the number of wellbores requiring plugging.[210] These discrepancies must be addressed and the Draft EIR must be revised accordingly.

In sum, the analysis takes credit for the potential CO_2 storage of the Project, but fails to support the conclusion that CO_2 will be retained in the ground with evidence.

2. The Draft EIR's halfhearted and contradictory finding of potentially significant GHG impacts violates CEQA.

The Draft EIR finds that "[a]ccounting for the GHG emissions reductions from CCS, the Project's impacts related to GHG emissions would be less than significant."[211] But then it goes on to make a significance finding, saying:

[205] DiGiulio Report at 11.
[206] DiGiulio Report at 11.
[207] DiGiulio Report at 10–11.
[208] DiGiulio Report at 12.
[209] DiGiulio Report at 12.
[210] DiGiulio Report at 10–11.
[211] Draft EIR, Vol. 1 at 4.8-26.

> However, the estimated reductions are contingent upon injected CO_2 remaining in the identified geographically confined reservoirs for storage in perpetuity without leakage from injection and capture activities. Should any of the injected CO_2 leak at injection or additional, unmitigated GHG emissions be created from the capture facility operations, then GHG emissions from the project would be potentially significant.[212]

With this brief statement, the Draft EIR concludes that despite implementation of several mitigation measures, "the possibility of a release due to unforeseen circumstances or equipment failure remains" and the CTV I Project's impacts from GHG emissions "remain significant and unavoidable."[213] This specific acknowledgment of significant impact from the risk of unintended releases of GHGs is articulated in the Draft EIR's GHG impacts section as one of the rationales for the GHG significance finding, but is not included in the summary of impacts in Table 1.1.[214] Moreover, as discussed more fully above and in the DiGiulio Report, the Draft EIR's impact analysis ignores this risk completely.

First, if this conclusion is correct—if the Project may have a significant (negative) impact on GHG emissions because of the risk of release from failure at any stage in Project operations—then the County should not approve the CTV I Project, as it does not fulfill its fundamental objective: to capture and permanently store CO_2 emissions underground.

Second, the Draft EIR's handling of this issue violates CEQA. The Draft EIR attempts to avoid accounting for the Project's impacts by acknowledging the possibility of leakage and finding that risk to be a significant and unavoidable impact, and at the same time failing to include any analysis of the nature, extent, or magnitude of this risk—and elsewhere the Draft EIR appears to deny the risk even exists. The Draft EIR thus does not comply with CEQA's requirement that an EIR will "be prepared with a sufficient degree of analysis to provide decisionmakers with information which enables them to make a decision which intelligently takes account of environmental consequences."[215] And the conclusions are thus not supported by substantial evidence.

The courts are clear that "[A]n EIR's designation of a particular adverse environmental effect as 'significant' does not excuse the EIR's failure to reasonably describe the nature and magnitude of the adverse effect."[216] Yet the Draft EIR does exactly that. The GHG discussion makes no reasonable effort "to explain the nature and magnitude of the impact" from GHG leakage, as CEQA requires.[217] It includes no information regarding the probability of CO_2 leakage, the circumstances under which it might happen, the potential magnitude of such leakage, or its impacts on GHG emissions. It simply classifies the impact as significant and unavoidable without any meaningful discussion. By doing so, it also violates the rule set by the courts that an EIR must set forth the bases for its findings; a bare conclusion regarding an

[212] Draft EIR, Vol. 1 at 4.8-26.
[213] Draft EIR, Vol. 1 at 4.8-26.
[214] Draft EIR, Vol. 1 at 1-13.
[215] *Sierra Club, supra*, 6 Cal.5th 502 at 514.
[216] *Cleveland Nat'l Forest Found. v. San Diego Assn. of Governments* (2017) 3 Cal.5th 497, 514.
[217] *Sierra Club, supra*, 6 Cal.5th 502 at 519.

environmental impact without an explanation of its factual and analytical basis is not sufficient.[218]

As stated in the DiGiulio Report, CO_2 leakage from geologic storage is bound to occur, and "the important question is not whether there will be leakage, but whether the extent of leakage is acceptable […] and how leakage will be monitored and quantitated."[219] The Draft EIR fails to do just that.

There are several leakage risks that a proper analysis must account for and analyze. First, the risk of leakage from well penetration: the DiGulio Report notes the presence of 354 well penetrations in the storage area, leading to a well penetration density of 16.4 wells/km^2. As explained in the report, research shows that more than 8 wells/km^2 concentrations are of concern regarding CO_2 retention in the ground.[220] The Draft EIR must be revised to include a robust evaluation of wellbore integrity of both plugged and unplugged wells, to properly reflect the risk of leakage from these wells.

Leakage from wellbores can also be manifested in the form of a CO_2 well blowout.[221] Despite the fact that release of CO_2 from an injection well or failed plugged or unplugged wellbores could be catastrophic depending on surface topography and meteorologic conditions, the Draft EIR fails to discuss the probability of such an event when discussing GHG emissions impacts.[222]

The Draft EIR also fails to analyze the issue of lateral confinement to storage areas. As the DiGiulio Report shows, there is no evidence to support the assumption that CO_2 stored in reservoirs will in fact be confined and will not migrate beyond them.[223] The Draft EIR must be revised to support these assumptions and assess the risk of leakage from lateral migration.

The DiGiulio Report also shows that the Draft EIR's analysis of seismic risk is highly deficient and not supported by the evidence, as it fails to properly account for all factors of seismic risk.[224] The flaws in the Draft EIR's seismic analysis are discussed in detail below. However, as explained in the DiGiulio Report, the effects of natural or induced seismicity are of particular concern at the CTV I Project, due to its effect on wellbores, which can occur even after a well is permanently plugged and abandoned. The Draft EIR must be revised to properly account for the seismicity risks, and once this is done, to properly account for the risk of CO_2 leakage resulting from seismic activity.

The Draft EIR's GHG analysis must be revised to include an accurate, meaningful discussion of GHG impacts that is supported by the evidence, and this evidence-supported

[218] *Laurel Heights*, *supra*, 47 Cal. 3d at 404.
[219] DiGiulio Report at 7.
[220] DiGiulio Report at 7.
[221] DiGiulio Report at 4.
[222] DiGiulio Report at 5.
[223] DiGiulio Report at 6–7.
[224] DiGiulio Report at 20.

analysis must reflect a consistent conclusion as to the nature, magnitude, and significance of the impact.

3. The Draft EIR's GHG consistency analysis is inadequate under CEQA.

Under Impact 4.8-2, the Draft EIR purports to analyze whether the Project will conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gas.[225] Under this impact area, the Draft EIR first analyzes the CTV I Project's consistency with CARB's 2022 Scoping Plan.[226] The Scoping Plan analysis is inadequate under CEQA. Not only it is short, generic, and superficial, but it also fails to address important ways in which the Project is not consistent with the Scoping Plan.

The Draft EIR's consistency analysis is made up of a few paragraphs generally describing the Scoping Plan discussion of carbon capture, removal and sequestration, followed by a bullet point list of the Scoping Plan's "Strategies for Success" in the sector, and ending with a single paragraph stating flatly that the Project "would support the Strategies for Success identified in the CARB 2022 Scoping Plan," "would comply with any new regulations developed as a result of implementation of the identified Strategies" and "is reasonably expected to reduce region wide and Statewide GHG emissions." The paragraph concludes with no further discussion to show the Project would be consistent with the CARB 2022 Scoping Plan.[227]

First, the analysis is generic. It fails to provide the reader with "sufficient information to foster informed public participation and to enable the decision makers to consider the environmental factors necessary to make a reasoned decision,"[228] as required under CEQA. The analysis also fails to provide substantial evidence to support its conclusions. Except for flatly declaring consistency, the analysis does not address any of the Scoping Plan Strategies beyond simply listing them. It fails to make a connection between the Strategies and the Project, and explain how the Project is consistent with them, or how they are even relevant to the Project. Just as an example, the identified Strategies that call for the state to "Evaluate and streamline permitting barriers to project implementation while protecting public health and the environment" and to "update the CARB Carbon Capture and Sequestration Protocol with the best available science and implementation experience" have nothing to do with the Project.

Second, the analysis fails to address the crucial issue of the Project's CO_2 sources' consistency with the Scoping Plan. The Scoping Plan states that CCS is included in the Scoping Plan "to address emissions from limited sectors, including electricity generation, cement production facilities, and refineries."[229] The Scoping Plan also discusses implementation in the electricity sector in or before 2045 as well as the potential to support hydrogen production.[230] As

[225] Draft EIR, Vol. 1 at 4.8-28.
[226] Draft EIR, Vol. 1 at 4.8-28.
[227] Draft EIR, Vol. 1 at 4.8-30.
[228] *Berkeley Keep Jets Over the Bay Comm. v. Bd. of Port Comm'rs*, 91 Cal.App.4th 1344, 1356, 111 Cal. Rptr. 2d 598, 606 (2001), as modified on denial of reh'g (Sept. 26, 2001).
[229] CARB, *2022 Scoping Plan for Achieving Carbon Neutrality* at 86.
[230] *Id.*

discussed above, the Draft EIR fails to provide information regarding its future CO_2 sources and therefore cannot conclude the Project is consistent with the Scoping Plan. Moreover, the only disclosed CO_2 source in the Draft EIR is the pre-combustion Elk Hills oil field gas which provides about one third of its power for oil field operations—not even a sector the Scoping Plan lists for CCS implementation. The Draft EIR's conclusion that the CTV 1 Project is consistent with the Scoping Plan is therefore not only unsupported by the evidence, but is also contradicted by it.

Finally, the Draft EIR fails to address the fact that the CTV 1 Project's proposed mitigation measures are inconsistent with the Scoping Plan. As discussed below, a primary mitigation measure proposed in the Draft EIR, in addition to monitoring plans and compliance with regulations, is buying credits to offset GHG emissions.[231] However, the Scoping Plan makes clear that GHG mitigation measures come in a hierarchical order: first, the lead agency must "exhaust[] all the on-site GHG" mitigation. Then, "CARB recommends prioritizing local, off-site GHG mitigation measures" and only then use "non-local off-site mitigation, and voluntary offsets issued by a recognized and reputable voluntary carbon registry."[232] As discussed below, the Draft EIR fails to comply with the requirement that offsets will be issued by a recognized and reputable registry, and it also fails to exhaust, or even discuss, all onsite GHG mitigation and other local measures. Finally, it fails to acknowledge and discuss the fact that by improperly relying on offsets, it is inconsistent with the Scoping Plan.

4. The Draft EIR fails to analyze and mitigate cumulatively considerable GHG emissions impacts.

The Draft EIR's analysis of the CTV I Project's cumulative GHG emissions impacts suffers from many of the same flaws pointed out above regarding its project-level analysis, and from several other serious flaws. The Draft EIR must be revised to correct these flaws before any decision can be made regarding the Project.

First, there are basic misstatements and inconsistencies that call the analysis into question. As one example, the analysis claims that "Table 4.8-3 shows total GHG reductions of 3,967,977 MT CO_2e over 20 years from implementation of the project".[233] In fact, Table 4.8-3 shows the estimated construction GHG Emissions, not total reductions,[234] and those projected reductions of the Project, according to the other tables in the GHG analysis, are 31,217,430 MT CO_2e over 20 years, not 3,967,977 as stated in the cumulative analysis.[235]

Moreover, the Draft EIR frames its cumulative GHG analysis in fundamentally misleading ways. For example, the document includes the following statement: "Since the project individually results in a net reduction in GHG emissions, the project would also contribute to reductions in cumulative GHG emissions."[236] First, this statement directly

[231] Draft EIR, Vol. 1 at 4.8-27 to 4.8-28.
[232] CARB, *2022 Scoping Plan for Achieving Carbon Neutrality* at 270–71.
[233] Draft EIR, Vol. 1 at 4.8-32.
[234] Draft EIR, Vol. 1 at 4.8-22.
[235] Draft EIR, Vol. 1 at 4.8-24.
[236] Draft EIR, Vol. 1 at 4.8-32.

contradicts the Draft EIR's cumulative GHG significance finding, which concludes that the Project will contribute to cumulatively considerable significant GHG emissions.[237] And second, this statement completely misses the point of cumulative impact analysis: that "environmental damage often occurs incrementally from a variety of small sources [that] appear insignificant when considered individually, but assume threatening dimensions when considered collectively with other sources with which they interact."[238] In other words, if a CEQA analysis could infer a project's cumulative impacts directly from its individual impact, there would be no need for a cumulative impact analysis at all.

Another major flaw is that the cumulative impact analysis fails to analyze the CTV I Project's cumulative *projects*. Under CEQA, cumulative impact analysis requires consideration of "other projects causing related impacts,"[239] including "probable future projects."[240] The Draft EIR provides a list of cumulative projects under its project description section. But it fails to analyze their impacts in the GHG analysis, claiming that "information cannot be provided" regarding their potential GHG impacts.[241] This claim is not supported by the evidence and is in fact contradicted by it, as discussed above. The cumulative impacts analysis must analyze the projects in its cumulative projects list, as well as any probable future project that plans on sending CO_2 for sequestration at the CTV I Project (as discussed in detail, above in the discussion of project description and below in this letter's final section on cumulative impacts analysis).

Instead of discussing the cumulative projects the Draft EIR discloses, as well as other related cumulative projects the Draft EIR fails to disclose, the Draft EIR focuses on the CTV I Project's cumulative impacts together with the impacts of "past, present and reasonably foreseeable future oil and gas development including wells and abandonment activity," explaining this focus is "[d]ue to the proposed project's location within an existing oil and gas field."[242] This is underinclusive. While geographic proximity can be a factor in identifying cumulative projects, it is not the only determinative factor.[243]

The Draft EIR fails to explain why it focuses on the cumulative impacts of the CTV I Project with only the oil and gas development. It is riddled with vague statements like "impacts from oil and gas development in Kern County on cumulative GHG emissions were determined to remain significant and unavoidable despite implementation of mitigation measures"[244] that lack any explanation as to their relevance to the CTV I Project's cumulative analysis. Potentially, there is a connection between the oil field operations and CTV I because of the Project's usage of depleted oil and gas reservoirs, but that cannot explain the analysis, since the depleted reservoirs are already identified. It is unclear whether this connection stems from plans to

[237] See, e.g., Draft EIR, Vol. 1 at 1-13 ("The project's cumulative contribution to GHG emissions after implementation of the recommended mitigation measures would remain cumulatively significant and unavoidable").
[238] *Communities for a Better Env't v. Cal. Resources Agency* (2002) 103 Cal.App.4th 98, 114, 126.
[239] CEQA Guidelines, § 15130(a)(1).
[240] CEQA Guidelines, § 15130(b)(1)(A).
[241] Draft EIR, Vol. 1 at 4.8-25.
[242] Draft EIR, Vol. 1 at 4.8-31.
[243] CEQA Guidelines, § 15130(b)(1)(A).
[244] Draft EIR, Vol. 1 at 4.8-32.

sequester more CO_2 sourced from oil and gas production. The Draft EIR must be revised to clarify this point, as well as the rest of the connection between the Project and future oil and gas development.

The Draft EIR's cumulative GHG impact analysis is legally inadequate, not supported by substantial evidence, and must be revised to address all the inaccuracies, inconsistencies, and unsupported assumptions, include all relevant cumulative projects, and explain its analysis.

5. The Draft EIR does not provide adequate mitigation for GHG impacts.

The GHG mitigation measures identified in the Draft EIR fail to meet CEQA's standards for effective, enforceable mitigation. The proposed measures are ineffective, unenforceable, and vague, and there is no evidence to support their efficacy. To the extent that some of the vagueness will be clarified in the future, the DEIR also illegally defers that mitigation.

Under CEQA, proposed mitigation measures must be "fully enforceable" through permit conditions, agreements, or other legally binding instruments.[245] Any proposed mitigation must also provide assurance that such implementation will in fact occur.[246] The proposed measures fail on all counts.

a. MM 4.8-1 constitutes inadequate and unlawfully deferred mitigation.

To mitigate what the Draft EIR finds to be a potentially significant impact from GHG emissions, it proposes a monitoring plan under MM 4.8-1. This mitigation measure requires that prior to injection, the owner/operator will submit "a monitoring plan that complies with all requirements of the EPA UIC permit" for the Project, to demonstrate the retention of the CO_2 in the reservoir. The Measure states that that the plan shall be submitted to the County, concurrent with submittal to the EPA for review, and that "[a] copy of the final approved plan from the EPA shall be provided to the Kern County Planning and Natural Resources Department."[247]

Given how crucial it is to guarantee that CO_2 stored in the reservoir will remain there, both for mitigating a potentially significant impact and for achieving the Project's stated goal of CO_2 storage, it would be expected the Draft EIR will develop a robust monitoring plan. However, the proposed Mitigation Measure is anything but robust.

In fact, all this Mitigation Measure does is reiterate an already existing rule – that CCS projects that receive a UIC permit from the EPA must prepare a monitoring, reporting, and verification (MRV) plan and submit it for the EPA's approval.[248] This Measure adds nothing to this rule except requiring that a copy of the approved plan will be provided to the County.

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[245] Pub. Resources Code, § 21081.6(b); CEQA Guidelines, §15126.4(a)(2).
[246] *Anderson First Coalition v. City of Anderson* (2005) 130 Cal.App.4th 1173, 1186–87.
[247] Draft EIR, Vol. 1 at 4.8-27.
[248] 40 C.F.R § 98.448.

Relying solely on the future EPA MRV plan is inadequate under CEQA and constitutes an impermissible deferral of mitigation. The EPA UIC permit is issued under the Safe Drinking Water Act. As a result, it does not, and cannot, cover all relevant aspects of monitoring for CO_2 leakage. This is evident simply from the fact that there are no storage effectiveness criteria in the Class VI federal regulations.[249] Specifically, Dr. DiGiulio notes that the monitoring plan submitted for the Project in the Class VI permit applications does not directly consider leakage from well penetrations – although this is the most likely source of loss of CO_2.[250]

A major flaw in relying on EPA's MRV plan is the fact that these plans lack clear performance standards. CEQA allows for details to be developed in future time, as long as the agency adopts specific performance standards the mitigation will achieve.[251] MRV plans that were developed under the EPA permit program have been heavily criticized for failing to include specific monitoring strategies, for containing ambiguous language, and for being difficult to verify and enforce.[252] By relying on EPA's future MRV plan for the CTV 1 Project, the Draft EIR impermissibly defers its mitigation.

The DiGiulio Report makes clear why reliance on the EPA MRV plan fails to comply with CEQA's requirement for effective mitigation. For example, Dr. DiGiulio notes that continuous monitoring in the Etchegoin Formation is important to detect leakage, but further notes that under the EPA permit application, there will be only one such well in the 26R Reservoir. A proper monitoring plan should analyze and support the number of required monitoring wells above confining zones to guarantee effective detection of leakage.[253]

The DiGiulio Report also explains that in the Corrective Action Plan filed with the EPA, CTV states that all wellbores within the Area of Review will be pressure tested prior to abandonment and will be reviewed to demonstrate adequate confinement "if necessary" and "if conditions allow". As Dr. DiGiulio notes, these statements are far too vague to be of any use,[254] and thus reliance on the plan cannot serve as enforceable and effective mitigation.

Finally, the requirement to submit a monitoring plan "[p]rior to any injection of CO2"[255] is vague and unenforceable. CO_2 injection will be ongoing in the Project. The Measure must be revised to clarify at what point exactly a monitoring plan should be submitted, clarify that the approval of such a monitoring plan will be a condition on each new injection from each source, and clarify and guarantee the means of enforcing the plan.

In particular, MM 4.8-1 must be revised to include a monitoring plan that will effectively address the potentially significant impact of CO_2 leakage or other release from the CTV 1

[249] DiGiulio Report at 7.
[250] DiGiulio Report at 8.
[251] CEQA Guidelines, § 15126.4(a)(1)(B).
[252] Environmental Integrity Project, *Flaws in EPA's Monitoring and Verification of Carbon Capture Projects* (Dec. 2023), https://environmentalintegrity.org/news/epas-rules-for-verifying-carbon-capture-projects-are-riddled-with-holes/.
[253] DiGiulio Report at 13.
[254] DiGiulio Report at 12.
[255] Draft EIR, Vol. 1 at 4.8-27.

Project. As explained in the DiGiulio Report, such monitoring program should be specific to evaluating leakage from plugged well penetrations as general air monitoring may not be sufficiently sensitive to determine leakage.[256] To the extent the revised measure is lacking any specific elements or details, it must at a minimum identify performance standards to be used in developing it, as required under CEQA.[257] Given the potential impacts of the GHG emissions from the Project, it is also crucial that the monitoring plan will be open for public comments and will require the approval of CARB in addition to the County.

Finally, and crucially, a monitoring plan alone will not fully mitigate the risk of leakage or release to the extent feasible. GHG mitigation measures must also include an action plan that addresses what will happen to address any release, mitigate fully the emissions from any release, and ensure the integrity of the reservoir and overall storage mechanism.

b. MM 4.8-6 is an ineffective, unenforceable, and impermissibly deferred mitigation measure.

The first part of MM 4.8-6 states as follows:

> The project shall offset all greenhouse gas emissions associated with the capture facility, and construction equipment not covered by the Cap and-Trade program or other mandatory greenhouse gas emission reduction measures through owner/operator reductions of greenhouse gas emissions as verified by the San Joaquin Valley Air Pollution Control District, through acquisition of offset credits from the California Air Pollution Control Officers Association Exchange Register or other third party greenhouse gas reductions as verified by the San Joaquin Valley Air Pollution Control District, or through inclusion in an Emission Reduction Agreement, to offset Project-related greenhouse gas emissions that are not included in the Cap-and-Trade program to assure that no net increase in greenhouse gas emissions from the Project construction or operation occur. [258]

In essence, this Measure purports to offset any GHG operational emissions "associated with" the Project's capture facility (as well as some construction emissions) using the tool of emission credits, and claims to thus achieve a "no net increase" in GHG emissions from the Project construction or operations. This Measure is not only inappropriate and unlawful as mitigation, but also reveals a fundamental failure in the Project's ability to meet its objectives.

i. MM 4.8-6 goes against the Project's fundamental premises and objectives.

The CTV I Project is a carbon sequestration project. Its main goals are to permanently store CO_2 in the ground and support California's climate goals.[259] But MM 4.8-6 proposes to allow the Project to allow "acquisition of offset credits from the California Air Pollution Control

[256] DiGiulio Report at 13.
[257] CEQA Guidelines, § 15126.4(a)(1)(B)
[258] Draft EIR, Vol. 1 at 4.8-27 to 4.8-28.
[259] Draft EIR, Vol. 1 at 1-5.

Officers Association Exchange Register or other third party greenhouse gas reductions as verified by the San Joaquin Valley Air Pollution Control District", to offset any "emissions associated with the capture facility" and "to offset Project-related greenhouse gas emissions that are not included in the Cap-and-Trade program to assure that no net increase in greenhouse gas emissions from the Project construction or operation occur."[260] This Measure thus contemplates that the Project and associated facilities may emit substantial amounts of GHG emissions—potentially without limit—into the atmosphere, as long as they purportedly offset these emissions with emissions credits.

The notion of a carbon sequestration project that may use carbon credits to offset its own emissions is absurd, and undercuts the rationale behind carbon sequestration. An effective carbon sequestration project should be the place where CO_2 is being put in the ground physically and permanently, not a link in a chain of offsets that creates profits for its owners and harm to the public and the environment.

If a CO_2 sequestration project is allowed to offset its emissions through acquisition of offset credits, then the following scenario is possible: A GHG emitting facility that is looking to mitigate its GHG emissions can go and buy offset credits from certain registries. Alternatively, and higher in the hierarchy of preferred mitigation, that facility can send its CO_2 for sequestration at the CTV I Project and achieve the same GHG mitigation goals. The facility chooses sequestration, theoretically putting the CO_2 in the ground permanently. But the CO_2 the facility sends to CTV I may not stay in the ground; instead, CTV I may purchase the same offset credits the emitting facility could have bought in the first place, to offset the emissions from its sequestration project. The futility of this scenario is clear even before going into the many problems with relying on carbon offsets and before considering the added emissions from CO_2 transportation and the operations of the CTV I Project.

ii. MM 4.8-6's reliance on offset credits is not supported by the evidence.

Under CEQA, an agency must have specific evidentiary support for a conclusion that mitigation will be effective.[261] The Draft EIR lacks evidentiary support, however, that offset credits can achieve emission reductions.

Offset programs, in general, are a contentious tool for curbing GHG emissions, and there is mounting criticism in the scientific and environmental communities against using credits in the effort to stop climate change.[262] Research shows that nature-based solutions cannot effectively offset fossil fuel combustion due to the different nature of CO_2 emissions in the two

[260] Draft EIR, Vol. 1 at 4.8-27 to 4.8-28.
[261] See, e.g., *Sierra Club v. County of San Diego* (2014) 231 Cal.App.4th 1152, 1168.
[262] Amazon Watch, *Statement: Offsets Don't Stop Climate Change* (Oct. 6, 2021), https://amazonwatch.org/news/2021/1006-statement-offsets-dont-stop-climate-change.

categories,[263] and offsets are likely to increase GHG emissions rather than decrease them.[264] Environmental justice advocates have pointed out that offsets perpetuate environmental injustice by increasing the relative burden of pollution on already overburdened communities, including low-income communities of color, while GHG reduction is happening, if at all, elsewhere. [265]

There is also a consensus that, to be effective, offsets credits must be real, permanent, additional, verifiable, and enforceable.[266] Additionality is especially hard to ascertain: "additional" emission reductions are reductions not otherwise required by law or likely to occur anyway. Assembly Bill (AB) 32, California's landmark GHG reduction statute, clarifies that "additional" means "in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur."[267] To be "additional," therefore, an offset credit must not result from actions otherwise legally required, *and* it must be in addition to any reduction that would otherwise occur. MM 4.8-6 fails to include any requirement for additionality of credits, nor for any of the other requirements listed above, and thus there is no support for the effectiveness of the mitigation measure.

The Draft EIR also lacks evidence that there exist any offset programs capable of ensuring that offsets are "additional." This is a particular concern given that MM 4.8-6 does not include any requirements regarding the offsets' origin, allowing for international offsets, which are especially challenging to verify.[268] There is also no support for the assumption there are enough GHG offset credits available to satisfy the mitigation measures' requirements. This problem is exacerbated by the fact that the Draft EIR fails to quantity the volume of emissions that will need to be mitigated using offsets.

iii. MM 4.8-6 is ineffective, unenforceable, and impermissibly deferred.

Even if offset credits could be, under certain conditions and limitations, a proper mitigation measure for GHG emissions, and even if they could be acceptable mitigation for a carbon sequestration project, MM 4.8-6 is inadequate under CEQA's mitigation requirements.

First, as mentioned before, there are no performance standards for offsets, and no requirement they will be real, permanent, additional, verifiable, and enforceable. Instead, the measure relies on offsets issues by different parties, including unidentified "third parties," to

[263] Carton, W. at el, *Undoing Equivalence: Rethinking Carbon Accounting for Just Carbon Removal*, Frontiers in Climate (Apr. 16, 2021), https://www.frontiersin.org/articles/10.3389/fclim.2021.664130/full.
[264] Anderegg, W., *Gambling With the Climate: How Risky of a Bet Are Natural Climate Solutions?,* AGU Advances (July, 22 2021), https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2021AV000490.
[265] Amazon Watch, *Statement: Offsets Don't Stop Climate Change*.
[266] *Golden Door Properties, LLC v. County of San Diego* (2020) 50 Cal. App. 5th 467, 511.
[267] Health & Safety Code, § 38562(d)(2).
[268] *Golden Door Properties, LLC*, *supra*, 50 Cal.App.5th 467 at 513.

issue the credits. As courts have recognized, protocols adopted by voluntary market registries may not meet standards necessary to ensure that credits in fact reduce emissions.[269]

The only check on any offsets' effectiveness in mitigating GHG impact is the requirement that they will be "verified" by the San Joaquin Valley Air Pollution Control District (SJVAPCD) or through inclusion in an Emission Reduction Agreement. MM 4.8-6 thus impermissibly defers mitigation.[270] By leaving the decision on verification of the credits solely to the judgment of the SJVAPCD, without setting any performance standards and process for the verification and only generally requiring "no net increase," the Measure violates CEQA. "Simply stating a generalized goal for mitigating an impact does not allow the measure to qualify for the exception to the general rule against the deferred formulation of mitigation measures."[271]

The option given in the Mitigation Measure to offset emissions through inclusion in an Emission Reduction Agreement is also invalid under CEQA, for the same reasons. Emission Reduction Agreements are not defined anywhere in the Draft EIR in the context of GHG emissions and are used by the Air District for reduction of certain other air pollutants, not GHGs. CARB's review of SJVAPCD Emission Reduction Credit System states with respect to GHG that:

> Ultimately, the impact of these GHG ERCs is not clear, as there is no currently authorized use in an NSR context consistent with District rules or in the context of GHG Cap and Trade programs. To CARB's knowledge, none of these GHG ERCs have been used.[272]

Finally, MM 4.8-6 is unenforceable. Mitigation measures must be "fully enforceable through permit conditions, agreements, or other legally binding instruments."[273] Here, the Measure fails to specify in any detail how the Air District will quantify the emissions reductions it needs to achieve, or does achieve, through this measure, the process by which the offsets will be purchased, and proof of their purchase filed, or any enforcement mechanism to ensure that this Measure is actually implemented.

In fact, aside from vaguely stating that the Project "shall offset," the Mitigation Measure fails to state at what point any offset "shall" happen, or whether the Air District or the County will require offsets as a condition of approval of any permit.

The last part of MM 4.8-6 deals with future sources that will be sending CO_2 for injection in one sentence. It summarily states: "All sources providing CO_2 for injection must certify that

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[269] *Golden Door Properties, LLC*, *supra*, 50 Cal. App. 5th 467 at 511–12.
[270] *King & Gardiner Farms*, *supra*, 45 Cal.App.5th at 856.
[271] *Id.* See also *Sierra Watch v. County of Placer* (2021) 69 Cal.App.5th 86, 110; *Golden Door Properties, LLC*, *supra*, 50 Cal.App.5th 467 at 517.
[272] CARB Enforcement Division, *Review of the San Joaquin Valley Air Pollution Control District Emission Reduction Credit System* (June 2020) at 30, https://ww2.arb.ca.gov/sites/default/files/2020-06/SJV_ERC_FINAL_20200604.pdf
[273] CEQA Guidelines, § 15126.4(a)(1)(B), (a)(2).

any additional CO_2 generated from the source capture facility has been mitigated to "no net increase" before injection at Carbon Terra Vault 1".[274]

This part of the Mitigation Measure aimed at future sources suffers from the same severe flaws as described above, only exacerbated. It is entirely ineffective and unenforceable, as it only requires vaguely that future CO_2 sources will "certify" that any "additional" CO_2 has been "mitigated to 'no net increase'". It fails to explain what type of certification can be used and under what conditions, or even to name the agency to whom such "certification" will be submitted and how it will be verified. It also fails to explain what "additional" means in the context of this Measure.

Moreover, the Measure fails to address in any way the carbon generated by *trucks* that will bring CO_2 for injection. As stated before, the Draft EIR, though it fails to provide any analysis on the issue, anticipates that some sources will ship their CO_2 using trucks. Such GHG emission sources must be addressed under the Draft EIR's GHG mitigation measures.

c. MM 4.8-2 through MM 4.8-5 unlawfully rely on reporting requirements or existing or future regulations or plans, without demonstrating these measures meaningfully mitigate Project impacts.

The remaining GHG mitigation measures do not, individually or together, succeed in mitigating GHG impacts.

MM 4.8-2 requires quarterly reporting on the amount of CO_2 injected into the CCS project, and the source of the CO_2.[275] While such reporting is essential, it is not enough, taken together with the other mitigation measures, to mitigate impacts to the extent feasible.

MM 4.8-3 merely requires permitted stationary sources to comply with the Cap-and-Trade regulation and implement Best Performance Standards (BPS) applicable to greenhouse gas reduction for Components at Light Crude Oil and Natural Gas Production, Natural Gas Processing Facilities.[276] But these BPS only apply to certain types of facilities, and if these facilities are not subject to Cap-and-Trade, this mitigation measure will not apply to them at all. Moreover, the Final Staff Report prepared for the SJVAPCD Climate Action Plan states explicitly that "[u]se of performance based standards is not a method of mitigating emissions."[277]

Similarly, MM 4.8-4 and MM 4.8-5 merely require compliance with SJVAPCD regulations (Rule 4401 and 4409) and regulations adopted or amended for methane.[278]

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[274] Draft EIR, Vol. 1 at 4.8-28.
[275] Draft EIR, Vol. 1 at 4.8-27.
[276] Draft EIR, Vol. 1 at 4.8-27.
[277] SJVAPCD, *Final Staff Report - Climate Change Action Plan: Addressing GHG Emissions Impacts under CEQA* (2009) at 59.
[278] Draft EIR, Vol. 1 at 4.8-27.

MM 4.8-3, MM 4.8-4, and MM 4.8-5 rely on existing or future regulations, without adding any standards or measures to mitigate potential impacts from GHG emissions. CEQA allows the use of compliance with regulatory standards as mitigation, but only where the regulatory standards ensure actual mitigation of project impacts to the extent feasible. CEQA therefore requires that a determination that compliance will be sufficient to prevent significant impacts be based on a project-specific analysis of potential impacts and the effect of regulatory compliance.[279]

C. The Draft EIR's Analysis and Mitigation of Energy Use Impacts is Inadequate.

The Draft EIR fails to adequately disclose, analyze, and mitigate the CTV I Project's impacts to energy resources. CEQA Guidelines, Appendix F lays out the following directives for proper discussion of a proposed project's energy impacts in an EIR:

> The goal of conserving energy implies the wise and efficient use of energy. The means of achieving this goal include:
>
> (1) decreasing overall per capita energy consumption,
>
> (2) decreasing reliance on fossil fuels such as coal, natural gas and oil, and
>
> (3) increasing reliance on renewable energy sources.[280]

The analysis required under CEQA thus provides the opportunity for project proponents to evaluate the energy consequences of their decisions.

The Draft EIR applies, as a threshold of significance, whether the Project will "result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation."[281] The Draft EIR concludes that:

> [C]onstruction activities associated with the proposed project would result in the consumption of petroleum-based fuels. However, there are no unusual project characteristics that would necessitate the use of construction equipment or vehicles that would be less energy efficient than at comparable construction sites in other parts of the state. Therefore, it is expected that construction fuel consumption associated with the proposed project would not be any more inefficient, wasteful, or unnecessary than at other construction sites in the region.[282]

In this conclusion, the Draft EIR applies, as a threshold, whether the Project would be "*more* inefficient, wasteful, or unnecessary than at other construction sites in the region." But

[279] *Californians for Alternatives to Toxics v. Dept. of Food & Agric.* (2005) 136 Cal.App.4th 1.
[280] CEQA Guidelines, Appendix F, § 2.
[281] Draft EIR, Vol. 1 at 4.6-12.
[282] Draft EIR, Vol. 1 at 4.6-14.

CEQA instead requires an evaluation of whether this project is energy-efficient, not average; CEQA requires mitigation of impacts to energy consumption, where feasible. The claim that the Project has no significant impact on energy resources is thus not supported by substantial evidence. The EIR should require, for example, use of electricity-powered construction equipment and vehicles in all feasible applications.

Moreover, the Draft EIR does not provide sufficient information or analysis to evaluate the Project's overall relationship to energy consumption, and does not even address this question. CO_2 storage projects will often tend to substitute for, rather than facilitate, decreasing reliance on fossil fuels such as coal, natural gas, and oil. The Project's energy conservation analysis fails for many of the same reasons its project description, GHG impact analysis, and cumulative impact analysis are inadequate. In particular, an analysis that includes information about the relationship between Project CO_2 storage operations and Project CO_2 sources is necessary, to fully disclose and analyze whether and to what extent CTV I will facilitate development and use of fossil fuel infrastructure or extend the life of existing fossil fuel CO_2-emitting industries. The Draft EIR's failure to include any meaningful discussion of the Project's CO_2 sources renders the discussion inadequate to evaluate how the Project will decrease reliance on fossil fuels or increase reliance on renewable energy.

D. The Draft EIR's Analysis and Mitigation of Geologic Risks is Inadequate.

The Draft EIR fails to adequately disclose, analyze, and mitigate the significant geologic impacts of the CTV I Project in this region. These failures are unacceptable given the setting in which the Project may occur and render the Draft EIR defective as an informational document.

The expert report of Dr. Dominic DiGiulio addresses the numerous deficiencies in the County's analysis and why it underestimates the severity of the Project's geologic impacts in further detail. Dr. DiGiulio's analysis highlights the serious risk of CO_2 leaks from the storage reservoirs as well as seismic hazards on wellbores in the Elk Hills oil field, and concludes:

> Given the large number of well penetrations, high pressure during storage, storage primarily as a supercritical fluid, and natural seismicity, leakage through well penetrations is a major concern. . . .
>
> In the absence of a robust investigation of wellbore integrity at the Carbon TerraVault I project, neither the [Draft EIR] nor the Class VI permit applications should be approved.[283]

1. The Draft EIR must fully account for the significant risk of leaks due to existing wellbores at the Elk Hills oil field.

The Draft EIR fails to properly consider any of these issues because it fails at the outset to fully account for the geologic setting at the Elk Hills oil field. When analyzing a project's adverse environmental impacts under CEQA, "[t]he significance of an activity depends on the setting."[284] It is imperative that an EIR accurately and fully describe a project's environmental

[283] DiGiulio Report at 31–32.
[284] *Kings County Farm Bureau*, 221 Cal.App.3d at 718; see also CEQA Guidelines, § 15125.

setting because this description forms the baseline for evaluating its environmental impacts.[285] Indeed, the Draft EIR here must demonstrate not only that the CTV I Project's geologic impacts were adequately investigated but that these impacts were "considered *in the full environmental context.*"[286] It is impossible for the Draft EIR to fulfill its informational purpose if it is not adequately describing and considering the existing environment and geologic setting that may be impacted by the Project.

The Elk Hills oil field and its surrounding region have been deeply shaped by oil and gas drilling activity for many decades. Elk Hills is one of the oldest and largest oil fields in the U.S., discovered over 100 years ago, and is characterized by "the presence of a large number of well penetrations."[287] As discussed in the DiGiulio Report, "[l]eakage of CO_2 from wellbores is widely considered to be one of the most significant leakage pathways for geologic storage of CO_2" and the large number of wellbores at Elk Hills therefore "increases the possibility of leakage" which could be "catastrophic."[288]

These risks are exacerbated where, as here, wellbores have not been permanently plugged back to surface, and the Draft EIR contains discrepancies in the number of wellbores that require plugging.[289] Some recent estimates indicate that Elk Hills contains nearly 1,400 idle, unplugged wells that have not produced oil or gas for an average 14 years.[290]

Even if properly plugged, Dr. DiGiulio notes that wellbore integrity failure and leaks from plugged wells "is not uncommon," with research finding failure rates from 2-75%.[291] Yet the Draft EIR found an implausible 0% failure rate in both storage reservoirs, with no wellbores deemed deficient or requiring corrective action.[292]

The Draft EIR fails to acknowledge these issues or disclose the inherent and heightened risks of CO_2 storage in a depleted oil field like this one, which renders it lacking in substantial evidence to support its subsequent conclusions about impacts and mitigation.

2. The Draft EIR must be recirculated with the missing "Appendix 1."

In fact, many of the Draft EIR's conclusions about geologic impacts are "impossible to verify" due to missing details.[293] Dr. DiGiulio notes that the Draft EIR excludes critical information needed to assess wellbore integrity at the Elk Hills oil field and the likelihood of leaks from the storage reservoirs. Specifically, the Draft EIR repeatedly references an "Appendix

[285] See CEQA Guidelines, § 15125(a).
[286] CEQA Guidelines, § 15125(c) (emphasis added).
[287] Olalde & Menezes, *The Toxic Legal of Old Oil Wells: California's Multibillion-Dollar Problem*, LA Times (Feb. 6, 2020), https://www.latimes.com/projects/california-oil-well-drilling-idle-cleanup/; DiGiulio Report at 3–4.
[288] DiGiulio Report at 3–4, 5; see also Environmental Integrity Project, *Flaws in EPA's Monitoring and Verification of Carbon Capture Projects* at 5–6.
[289] DiGiulio Report at 10–11.
[290] Olalde & Menezes, *The Toxic Legal of Old Oil Wells: California's Multibillion-Dollar Problem*.
[291] DiGiulio Report at 9, 12.
[292] *Id.* at 12.
[293] *Ibid.*

1" that "lists the wells [in the field] individually and provides information including well name, API-12, well type, status, spud date, surface coordinates, and pre-operational requirements" but does not provide it in the document.[294] This "wellbore-by-wellbore evaluation" with these details and others like "each well's type, construction, date drilled, location, depth, and record of plugging and/or completion" is needed "to assess wellbore integrity issues prior to plugging to plug wells in a manner to minimize leakage to the extent possible."[295]

The Draft EIR thus violates CEQA's mandate for an EIR to "include detail sufficient to enable those who did not participate in its preparation to understand and to consider meaningfully the issues raised by the proposed project."[296] Even if pieces of this information are included in EPA's Class VI permit materials or elsewhere, the County is required to include the full Appendix with the Draft EIR for public review and comment, and to use it to inform its own analysis of impacts and appropriate mitigation for the CTV 1 Project. The failure of the Draft EIR to include the Appendix means the County must recirculate it with the missing information discussed in the DiGiulio Report included, and provide an adequate public comment period on the recirculated draft.

3. The Draft EIR must address how seismic hazards will exacerbate potential geologic impacts.

The Draft EIR also does not accurately describe and consider the full environmental context related to seismic activity in the region. Although the Draft EIR notes that the County is in the highest seismic hazard zone and discusses the basic seismic history of the region,[297] it inappropriately narrows its analysis of impacts to the bounds of the Elk Hills oil field, which fails to capture potentially significant adverse geologic and safety impacts in the broader region. The analysis otherwise waves away further review of the potential impacts of natural or induced seismicity due to the project because "there are no known major faults within the project area."[298]

By contrast, Dr. DiGiulio classifies the impacts of seismicity on the Project area as "high risk" (vs. the Draft EIR's classification of "low to medium" risk) and recommends the County conduct a detailed seismicity evaluation in order to properly determine that seismicity will not impact containment of injected CO_2.[299] The report defines the appropriate "region of concern" as encompassing all seismic events within 200 kilometers from the storage reservoirs, discusses key seismic events in the region's history, and points out that the Draft EIR's discussion of seismic events within a smaller 100-kilometer range of the oil field is insufficient for ensuring the Project avoids catastrophic loss of containment.[300] Critically, the Draft EIR's seismic risk analysis fails entirely to consider legacy wells or the significant consequences of leaks through these wells.[301]

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[294] See, e.g., Draft EIR, Vol. 2, App'x E.2: EPA Class VI UIC Permit Application Narratives for the Elk Hills 26R Storage Project and the A1A2 Storage Project at 2019.
[295] DiGiulio Report at 11.
[296] *Laurel Heights*, *supra*, 47 Cal.3d at 405.
[297] Draft EIR, Vol. 1 at 4.7-13, 4.7-3.
[298] Draft EIR, Vol. 1 at 4.7-18.
[299] DiGiulio Report at 15–25.
[300] DiGiulio Report at 15–18.
[301] DiGiulio Report at 20.

The Draft EIR's omission of this requisite level of analysis renders the geologic impacts section lacking in substantial evidence to support its conclusions.

In addition, the County's dismissal of the risks of seismicity induced from injection of CO_2 at Elk Hills as "unlikely" is inconsistent with the scientific literature linking fluid injection into deep underground wells with earthquakes.[302] The DiGiulio Report notes "[e]ven in areas of low to moderate natural seismic activity, fluid injection may induce earthquakes in excess of [magnitude] 4."[303] The report discusses numerous real-world examples of injection-induced seismicity that the Draft EIR fails to disclose or address when considering the impacts of the CTV I Project, including in particular incidents of CO_2 injection inducing seismic events.[304]

Dr. DiGiulio further explains that "[f]or induced seismicity, the primary concern here is pressure transmission below the Monterey Formation, not above it. In the Class VI regulations, the primary concern is leakage through faults in the confining layer, not transmission of pressure and induced seismicity below the storage formation. Hence, neither EPA regulations nor the [Draft EIR] adequately consider induced seismicity."[305] Thus, the County cannot outsource its obligations to properly analyze and mitigate the potential impacts of induced seismicity by ceding those obligations to EPA, a tactic it deploys throughout the geologic impacts section.[306]

Given the risks of natural and induced seismicity and the fact that Kern County and the region surrounding the Elk Hills oil field is already one of the most seismically active in the state—the Central Valley is considered a "hot spot" where oil and gas wells and earthquakes are clustered in space[307]—the Draft EIR cannot dismiss potential impacts. Indeed, Dr. DiGiulio notes "[s]eismicity may be induced tens of kilometers away from large-scale injection" which further expands the impact area the County should consider for the Project well beyond the Elk Hills oil field.[308]

Potential impacts here could include damage to project infrastructure like pipelines, compressors, injection wells, or other wells in the oil field, damage to other structures in the

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[302] Draft EIR, Vol. 1 at 4.7-18; see, e.g., Goebel, T.H.W. et al., *Wastewater Disposal and Earthquake Swarm Activity at the Southern End of the Central Valley, California*, Geophys. Res. Lett., 43 (2016), 1092–99 (hydrogeological modeling reveals wastewater disposal likely contributed to seismicity via localized pressure increase along a seismically active fault, with results suggesting induced seismicity may remain undetected in California without detailed analysis of local geologic setting, seismicity, and fluid diffusion, and proximity of high-rate injectors and large active faults can cause noticeable earthquakes under certain geologic conditions).

[303] DiGiulio Report at 26.

[304] DiGiulio Report at 26–27.

[305] DiGiulio Report at 28.

[306] See Environmental Integrity Project, *Flaws in EPA's Monitoring and Verification of Carbon Capture Projects*.

[307] Kang, M. et al., *Potential Increase in Oil and Gas Well Leakage Due to Earthquakes*, Environ. Res. Commun. (2019), 1: 121004 at 3, https://doi.org/10.1088/2515-7620/ab576e.

[308] DiGiulio Report at 26–27; see also Kuchment, *Drilling for Earthquakes*, Scientific American (2016), 315, 1, 46–53, https://www.scientificamerican.com/article/drilling-for-earthquakes/ ("Evidence suggests that earthquake risks can spread for miles beyond the original disposal sites and can persist for a decade or more after drilling stops.").

region like roads and buildings, and dangerous CO_2 leaks to air and groundwater that harm the environment and health of nearby communities.[309] Even ground shaking from small- to moderate-sized earthquakes is consequential for a CO_2 repository and capable of creating leakage pathways to the surface.[310] The omission of this information violates CEQA's mandate that the data in an EIR "must be presented in a manner calculated to adequately inform the public and decision makers, who may not be previously familiar with the details of the project," and to give the readers "a better road map to the information it intends to convey."[311]

Overall, the County fails to provide substantial evidence to support the assumptions and conclusions in the geologic impacts section.

4. The Draft EIR fails to adequately address cumulative geologic impacts.

The Draft EIR's failures described above taint its cumulative impact analysis and render it inadequate under CEQA. While it acknowledges the impacts of cumulative induced seismic activity from the CTV I Project are significant and unavoidable, it otherwise waves away all other geologic impacts and fails to conduct further analysis on the nature and magnitude of the significant risks "due to the uncertainty of the implementation of multiple [CCS] projects and the ability to simultaneously cease injection during a[] [seismic] event."[312] The Draft EIR's bare conclusion violates CEQA.[313]

As discussed throughout these comments, the Draft EIR must also address "probable future projects."[314] This includes the numerous other CO_2 sources being prepared for CTV I as well as further industrial development that is expected in the region in connection with the Project.

5. The Draft EIR fails to adopt all feasible mitigation to address geologic risks.

The Draft EIR sets forth mitigation measures to address the geologic impacts of the CTV I Project that are wholly inadequate under CEQA. The DiGiulio Report details numerous deficiencies in the County's mitigation measures and why they must be addressed.

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[309] See, e.g., Millman, *California Earthquakes Caused $200 Million in Damage, Report Says*, Wall Street Journal (July 24, 2019), https://www.wsj.com/articles/california-earthquakes-caused-200-million-in-damage-report-says-11564006544 (pair of recent 6.4 and 7.1 magnitude earthquakes in Kern County caused about $200 million in property damage alone, not including damage to infrastructure such as roads or to a nearby naval base); Natural Resources Defense Council (NRDC), *Drilling in California: Who's at Risk?* (2014) at 9, https://www.nrdc.org/sites/default/files/california-fracking-risks-report.pdf.
[310] Zoback, M. & Gorelick, S., *Earthquake Triggering and Large-Scale Geologic Storage of Carbon Dioxide*, 109 PNAS 10164 (2012) at 10165–66, https://doi.org/10.1073/pnas.1202473109.
[311] *Vineyard Area Citizens*, *supra*, 40 Cal. 4th at 443.
[312] Draft EIR, Vol. 1 at 4.7-24 to 4.7-25.
[313] *Sierra Club*, *supra*, 6 Cal.5th at 519.
[314] Pub. Resources Code, § 21083(b)(2).

The Draft EIR acknowledges that earthquakes may disturb surface and subsurface facilities like wellbores at the Project site and could result in loss, injury, or death.[315] It also acknowledges that the site may be subject to strong ground shaking that could cause structural damage and other Project components that could injure people.[316] Thus, the County must adopt all feasible mitigation.

MM 4.7-1 requires CRC to prepare a comprehensive seismic activity monitoring plan that includes connection to the Statewide seismic monitoring program of the California Seismic Network and compliance with state requirements, including "[a]ppropriate subsurface monitoring to ensure geologic sequestration of injected carbon dioxide; [i]dentification of hazards and conditions that may require the suspension of carbon dioxide injections; notification protocols for all applicable agencies and emergency procedures."[317]

The elements of MM 4.7-1 are inadequate and do not represent all feasible mitigation for the impacts of earthquakes and ground shaking. The DiGiulio Report points out that, while a seismic monitoring plan would be able to detect an earthquake, it does not reduce damage to surface and subsurface facilities, and thus the impacts should be considered significant and unavoidable, rather than less than significant as the Draft EIR concludes.[318]

The DiGiulio Report provides numerous recommendations for seismic monitoring network design that are missing and should be included in MM 4.7-1 to comply with CEQA's requirement to adopt all feasible mitigation.[319] As the report notes, "monitoring of natural seismicity is not mitigation."[320]

In addition, MM 4.7-1 is riddled with vague and indefinite terms. Under CEQA, a mitigation measure must include criteria or performance standards against which the mitigation's actual implementation can be measured.[321] MM 4.7-1, however, is a laundry list of vague actions such as "appropriate" subsurface monitoring, "[i]dentification of hazards and conditions," and "notification protocols for all applicable agencies and emergency procedures."[322] The Draft EIR must be revised to include measurable and enforceable mitigation measures to address the Project's impacts. Open-ended and therefore potentially meaningless terms in a mitigation measure that will be developed at an unspecified time in the future also violate CEQA's requirements for deferred mitigation.

MM 4.7-1 is also effectively unenforceable because the Draft EIR does not contain permit conditions, agreements, or other legally binding instruments that ensure the seismic monitoring plan will be prepared and implemented, and who will enforce it.[323] The Measure must specify that no construction or grading permits shall be issued, and no activities expected to

[315] Draft EIR, Vol. 1 at 4.7-17.
[316] Draft EIR, Vol. 1 at 4.7-18.
[317] Draft EIR, Vol. 1 at 4.7-17.
[318] DiGiulio Report at 23–24.
[319] DiGiulio Report at 28–30.
[320] DiGiulio Report at 23.
[321] *San Joaquin Raptor Rescue Ctr.*, *supra*, 149 Cal.App.4th at 670.
[322] Draft EIR, Vol. 1 at 4.7-17.
[323] Pub. Resources Code, § 21081.6(b); CEQA Guidelines, § 15126.4(a)(2).

cause earthquakes or ground shaking may otherwise commence, unless and until the County, EPA Region 9, CARB, and California Seismic Network all approve the seismic monitoring plan for the CTV I Project. The County must specify such a limitation because "mitigation measures must be in place" when a "project reaches the point where activity will have a significant adverse effect on the environment."[324]

The DiGiulio Report points out that the Draft EIR's claim that mitigation of strong ground shaking "is typically provided by designing structures in accordance with the latest edition of the California Building Code" is flawed.[325] Because the Building Code does not address wellbore integrity, compliance would not mitigate potential impacts for this Project, thus the impacts should be considered significant and unavoidable, not less than significant.[326]

It is important to note that merely requiring compliance with agency regulations or other existing requirements like the California Building Code does not conclusively indicate that the Project would not have a significant and adverse impact. Those legal requirements may not be strong enough to protect against environmental impacts. In *Kings County Farm Bureau v. City of Hanford*, for example, the court found that the fact that EPA and the local air pollution control district had issued the necessary air emission permits for the construction of a coal fired cogeneration plan did not nullify the CEQA requirement that the lead agency analyze the significant air quality impacts of the entire project.[327] Similarly here, the Draft EIR cannot rely on the Building Code to conclude that impacts would not be significant based on those requirements, without at least describing what those requirements are and how they would reduce the Project's geologic impacts to less than significant.

MM 4.7-3 is also inadequate and does not represent all feasible mitigation for the impacts of unstable soil or land that could result in landslides, subsidence, liquefaction, or collapse. The Measure states that CRC "shall implement all requirements of a site-specific geotechnical report" with no further detail or direction.[328] This language is vague and indefinite, and defers development of the geotechnical report until an unspecified time in the future. The Draft EIR must be revised to include measurable and enforceable terms for the report to address the Project's impacts. Moreover, without any permit conditions or other legally binding instruments to ensure the report will be prepared and implemented, this measure is entirely unenforceable. The Draft EIR must specify that no permits shall be issued and no activities expected to cause landslides, subsidence, liquefaction, or collapse may begin until the County and other relevant agencies approve the report.

The flaws in the Draft EIR's analysis of geologic risks also impacts its development of mitigation measures to address cumulative impacts. After acknowledging significant and unavoidable cumulative impacts, the Draft EIR makes no attempt to adopt feasible mitigation, claiming "there are no other feasible and reasonable mitigations available" other than the

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[324] *King and Gardiner Farms, supra,* 45 Cal.App.5th at 860, quoting *POET, supra,* 218 Cal.App.4th at 738.
[325] Draft EIR, Vol. 1 at 4.7-18.
[326] DiGiulio Report at 24.
[327] *Kings County Farm Bureau*, *supra*, 221 Cal.App.3d at 716.
[328] Draft EIR, Vol. 1 at 4.7-21.

deficient measures discussed above.[329] This failure violates CEQA, particularly given the analysis and recommendations in the DiGiulio Report.

In addition to addressing the deficiencies in the Draft EIR's current mitigation measures for geologic impacts and strengthening its seismic monitoring and mitigation plan measures, the DiGiulio Report recommends numerous additional feasible mitigation measures that the County should adopt to address the CTV I Project's serious impacts. One example that would protect nearby communities—and reflect measures already considered for other impacts in the Draft EIR—is to "determine safe distance(s) for injection wells, wellbores, and pipelines from human receptors and adopt setback(s) that prohibit development at unsafe distance(s)."[330]

E. The Draft EIR's Analysis and Mitigation of CO_2 Pipeline Safety Hazards is Inadequate.

The Draft EIR fails to adequately disclose, analyze, and mitigate the serious carbon dioxide pipeline safety hazards of the CTV I Project. The expert report of Richard Kuprewicz (attached as Attachment C, hereafter "Kuprewicz Report") addresses the numerous deficiencies in the County's analysis in further detail and why they obscure the severity of the Project's pipeline safety impacts. The issues raised in the report highlight why the Draft EIR is defective as an informational document.

1. The Draft EIR fails to provide critically important pipeline information.

As the Kuprewicz Report concludes, "[i]mportant pipeline information is missing in the [Draft EIR] that will not permit decisionmakers to make an informed decision about this Project."[331] The report offers a list of key examples of the Draft EIR's "major shortcomings" and failure to disclose critical details about the Project.[332]

The missing details about the nature of the CTV I Project's pipeline construction and operations prevent understanding of the applicable regulations and safety jurisdiction of relevant agencies, and thus a complete analysis and appropriate mitigation. The Draft EIR also contains inaccurate and misleading details that obscure a full understanding of potential pipeline safety impacts. For example, the Kuprewicz Report discusses the Draft EIR's attempts to minimize the extent of impacts from the Satartia, MS pipeline rupture.[333] Relatedly, the Draft EIR also completely fails to address the possibility of a CO_2 injection well blowout, which "can release many thousands of tons from essentially an infinite supple of CO_2 in the reservoir, easily surpassing pipeline rupture releases."[334]

[329] Draft EIR, Vol. 1 at 4.7-25.
[330] DiGiulio Report at 5.
[331] Kuprewicz Report at 2.
[332] *Id.* at 2–5.
[333] *Id.* at 6.
[334] *Id.* at 6–7.

The deficiencies in the Draft EIR are particularly consequential given the history of explosions and disasters that have harmed people in pipeline-related incidents,[335] and the ongoing harms faced by communities in the Elk Hills region due to oil and gas activity. In fact, as recently as February 2024, a pipeline burst in Bakersfield, releasing barrels of oil on a public street next to Buena Vista Elementary School.[336] Between January 1, 2010, and January 19, 2023, a total of 8,140 pipeline incidents were reported to the Pipeline and Hazardous Materials Safety Administration (PHMSA), an average of 1.7 incidents per day. Hazardous liquid pipelines (which encompass CO_2 pipelines) accounted for more than half of these incidents.[337] The DiGiulio Report also discusses at length examples of large-scale CO_2 releases and their impacts on neighboring communities.[338]

Notably, an earlier similar carbon capture proposal in the Elk Hills oil field that would have compressed CO_2 from a hydrogen plant and transported it to the field via pipeline to 25 injection wells for enhanced oil recovery found serious safety risks.[339] Specifically, the project risk assessment for its approximately 3 mile pipeline—about a quarter of the length of the CTV I Project's planned pipelines—determined that a large amount of CO_2 could be released into the atmosphere if it failed.[340] Studies find that exposure to large amounts of CO_2 could lead to harmful impacts like irritation, chronic or irreversible tissue damage, or narcosis, and to irreversible health effects, impairing, or even death for close exposure to the release.[341] None of these issues are addressed in the Draft EIR, rendering it lacking in substantial evidence to support its conclusions.

The Draft EIR's failures are particularly stark given the evidence that most CCS pipelines fall largely within environmental justice communities, like those surrounding Elk Hills, that live in close proximity to industrial pollution.[342]

Given its serious deficiencies, the Draft EIR's dismissal of all pipeline-related impacts, including cumulative impacts, as less than significant is not supported by substantial evidence.

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[335] See, e.g., Zegart, Dan, *The Gassing of Satartia*.
[336] LaVigne, *Pipe Burst Spills Oil in Front of Buena Vista Elementary School*, KERO-TV (Feb. 8, 2024), https://www.turnto23.com/news/in-your-neighborhood/bakersfield/pipe-burst-spills-oil-in-front-of-buena-vista-elementary-school.
[337] FracTracker Alliance, *2022 Pipeline Incidents Update: Is Pipeline Safety Achievable?* (Feb. 1, 2023), https://www.fractracker.org/2023/02/2022-pipeline-incidents-update-is-pipeline-safety-achievable/.
[338] DiGiulio Report at 4–5.
[339] Submitted by Occidental of Elk Hills, Inc. to Cal. Dept. of Conservation, *Proposed Enhanced Oil Recovery Project (Phase 1), Underground Injection of Carbon Dioxide Gas, Stevens Reservoirs – T30, 31S, R23, 24E, Sections 33S, 34S, 35S, 2G, 3G, & 4G, Engineering Study, Geologic Study, and Injection Plan* (Oct. 2, 20212) at 1, 6.
[340] Stantec, *Hydrogen Energy Center Application for Certification Amendment –Attachment D: Hazards Assessment of CO_2 Supply Line* (Apr. 12, 2011) at 7.
[341] *Id.* at 6–7.
[342] Rota, M., *Carbon Dioxide Waste Capture and Injection: A False Solution for Louisiana and the World* (2023), https://healthygulf.org/carbon-waste-injection-false-solution-for-louisiana/.

2. The Draft EIR fails to adopt all feasible mitigation to address pipeline safety hazards.

Because of the missing and inaccurate information regarding CO_2 pipeline safety issues, it is impossible for the Draft EIR to satisfy CEQA's requirement to adopt all feasible mitigation measures for these impacts. The proposed measures are also ineffective, unenforceable, and vague, and illegally defer mitigation.

For example, MM 4.9-4 requires a construction permit site plan for all CO_2 pipelines, which will be reviewed and approved by the County and California State Fire Marshall (OSFM), noting that PHMSA has delegated CO_2 pipeline oversight to OSFM.[343] In addition to this Measure being vague and improperly deferring the plan to an unspecified future date, it is unclear whether OSFM actually has proper jurisdiction over the CTV I Project's CO_2 pipelines. As discussed in the Kuprewicz Report, the Draft EIR's failure to provide CO_2 purity information and clearly distinguish between facility and injection pipelines impacts whether either agency has jurisdiction and responsibility for the Project.[344] The report also highlights that federal pipeline safety regulations are seriously inadequate, thus the County cannot rely on compliance alone to avoid fulfilling its own separate obligations under CEQA to properly assess and mitigate impacts.[345]

As another example of the Draft EIR's deficient mitigation measures, MM 4.9-10 only requires compliance with EPA's Class VI permit before injection can begin.[346] As discussed throughout these comments, merely requiring compliance with existing regulations or other requirements like the Class VI requirements does not conclusively indicate that the Project would not have significant and adverse impacts.

These highlighted examples are just a sample and illustrate the overall failures of the Draft EIR to analyze and adopt all feasible CO_2 pipline safety mitigations for the CTV I Project. The Kuprewicz Report recommends additional feasible mitigation measures that the County should adopt to address CO_2 pipeline impacts, including, as noted elsewhere, that the County should adopt setbacks from the pipelines.[347]

F. The Draft EIR's Analysis and Mitigation of Water Supply Impacts is Inadequate.

An accurate analysis of the CTV I Project's impact on the local water supply is crucial because water is scarce in Kern County and groundwater pumping has occurred at unsustainable levels for decades, resulting in overdraft conditions region-wide, county-wide, and within the

[343] Draft EIR, Vol. 1 at 4.9-57 to 4.9-58.
[344] Kuprewicz Report at 2–3.
[345] *Id.* at 5.
[346] Draft EIR, Vol. 1 at 4.9-60.
[347] Kuprewicz Report at 4–5; DiGiulio Report at 5; see also Hillebrand, M. et al., *Toxicological Risk Assessment in CO_2 Capture and Storage Technology*, International Journal of Greenhouse Gas Control 55 (2016) 118–43 (concentrations of CO_2 releases from pipelines are function of distance, thus safety distances have to be calculated wherein no hazardous concentrations are reached, varying between <1 m and 7.2 kilometers).

Project Area. Unfortunately, the Draft EIR fails to adequately disclose and analyze water supply impacts and correspondingly fails to adopt all feasible mitigation.

As an initial matter, it is worth noting that the Draft EIR is confusing because the header for the section on Utilities and Service Systems—one of the several sections that address water supply issues—is mislabeled as "4.17 Utilities and Service Systems." The section on Utilities and Service Systems is actually section 4.19. The erroneous header should be corrected because it is confusing to the reader and complicates navigation of the document.

1. The Draft EIR's description of the environmental and regulatory setting for water supply is inadequate.

The Draft EIR is misleading and fails as an informational document because, remarkably, it fails to acknowledge the most basic fact about water supply in Kern County: there is "no surplus water available" in the County to meet domestic and/or irrigation demands, meaning that any use of municipal and industrial ("M&I") quality water by the proposed CTV I Project necessarily "reduces potential supplies for other purposes and users."[348] The Draft EIR should disclose this reality upfront to the public and decisionmakers.

The details that the Draft EIR does provide downplay the Project's water supply impacts and are inadequate. For example, in describing the relevant "Environmental Setting" for the CTV I Project's impact on water supply, the Draft EIR merely notes that "[t]he project site is located within the Tulare Lake Basin," which "is ranked as 'high priority' in a statewide ranking of groundwater importance."[349] The Draft EIR also notes "[t]he Kern County Subbasin ('Subbasin') is the specific groundwater subbasin in which the project resides."[350]

To meaningfully inform readers, the Draft EIR must explain the significance of the Tulare Lake Basin's designation of "high priority" and offer more details on conditions in the Tulare Lake Basin generally and the Kern County Subbasin specifically.

The Tulare Basin is designated as "high priority" both because the region is heavily reliant on groundwater and because groundwater supplies are in a condition of "critical overdraft."[351] Similarly, the Kern County Subbasin has been identified as "high priority," reflecting that the area is "critically overdrafted" and suffers from related problems including

[348] Kern County Planning & Natural Resources Dept., *Draft Supplemental Recirculated Environmental Impact Report for Revisions to Title 19-Kern County Zoning Ordinance, Supplemental Water Supply Baseline Technical Report* (July 2020) at 4, 58.
[349] Draft EIR, Vol. 1 at 4.10-1.
[350] Draft EIR, Vol. 1 at 4.10-2.
[351] Draft EIR, Vol 2., Water Supply Assessment for the Carbon Terravault 1 Project at 2–3.

"land subsidence and groundwater quality degradation."[352] Persistent overdraft of groundwater also "dries up wells."[353]

Although the Draft EIR acknowledges that the Kern County Subbasin, "as a whole, has an overdraft of 324,326 acre-feet per year over the baseline conditions,"[354] nowhere is the significance of this fact explained.

The Draft EIR is similarly misleading and incomplete in its description of the regulatory setting for water supply. The Draft EIR includes a general discussion of the Sustainable Groundwater Management Act (SGMA) and how it is being implement in the Project Area.[355] As part of this discussion, the Draft EIR notes the status of six groundwater sustainability plans (GSPs) that have been prepared for the San Joaquin Valley Kern County Subbasin.[356] However, nowhere does the Draft EIR explain that SGMA applies to Kern County and the Project Area because the Act was designed to address chronic groundwater overdraft and its negative consequences.

Further, the Draft EIR neglects to address whether or how the six GSPs will affect the available water supplies in the Kern County Subbasin generally or for the Project specifically. Although the Draft EIR indicates that state authorities have determined that the six GSPs are deficient in some respects, the Draft EIR also confirms that, under SGMA, local Groundwater Sustainability Authorities are still "required to begin implementation of the plans . . . while working to amend the plans and address the deficiencies."[357] The Draft EIR should address the expected consequences of the GSPs—if any—on the proposed CTV I Project and its planned operations and water use.

2. The Draft EIR's analysis of the Project's impact on water supply is contradictory, inaccurate, and misleading.

The Draft EIR fails as an informational document because it does not clearly explain the source or amount of water that will be used by the Project.

First, the Draft EIR makes conflicting statements about the source of water to be used by the CTV I Project. In section 4.10, the Draft EIR states: "[t]he proposed project would use water during construction and for operation of the project. Water for the project would be supplied by

[352] Draft, EIR, Vol. 2, West Kern Water District, Urban Water Management Plan 2020 Update (June 2021) at 34
[353] Rachel Becker, *San Joaquin Valley growers may face probation for failing to protect groundwater*, Cal Matters (Oct. 12, 2023), https://calmatters.org/environment/2023/10/san-joaquin-valley-groundwater/.
[354] Draft EIR, Vol. 1 at 4.10-35, 4.19-2, 4.19-21 to 4.19-22.
[355] Draft EIR, Vol. 1 at 4.10-15 to 4.10-17, 4.19-7 to 4.19-8.
[356] Draft EIR, Vol. 1 at 4.10-16 to 4.10-17, 4.19-8; see also id. at 4.19-13 to 4.19-14.
[357] Draft EIR, Vol. 1 at 4.10-17, 4.19-8, 4.19-14.

the WKWD from existing water allocations for Elk Hills and CRC."[358] Further, according to section 4.10, "all water would be trucked to the site from the WKWD." [359]

The foregoing description of the source of the Project's water supply is contradicted by text in section 4.19 which states that—for Project operations—"[w]ater to operate the carbon capture and storage (CCS) facilities is proposed to be sourced from produced water from existing oil and gas operations within Elk Hills."[360]

Second, no matter the source, the Draft EIR inaccurately and misleadingly describes the Project's water supply demand. Table 4.19-2 describes the Project's water demand as follows:

Table 4.19-2: Water Supply Availability

	Allotment (acre-feet per year)	Project Demand	Usage of Water Allotment
Elk Hills	3,000		
CRC	2,200		
Construction (18 months)		75 acre-feet	1.4%
Operation (per year)		19.49 acre-feet	0.37%
Total	**5,200**	**94.49 acre-feet**	**1.77%**

Key:
CRC = California Resources Corporation

This table is clearly wrong. The table incorrectly combines a one-time water demand for construction (75 acre-feet) with an annual operational demand (19.49 per year) and concludes that the "Total" Project demand is 94.49 acre-feet. But this is not an accurate total. Just the first phase of the Project is expected to last 26 years,[361] meaning that operational water demand will amount to at least 506.74 acre-feet (19.49 acre-feet annually x 26 years). The Draft EIR must be revised to eliminate Table 4.19-2, which is inaccurate and misleading. Further, the Draft EIR must disclose how much water the Project will use over its full operational lifetime.

3. The Draft EIR's finding that the Project will not substantially reduce groundwater supplies is not supported by substantial evidence.

The Draft EIR offers several reasons to support its conclusion that the CTV I Project will not substantially decrease groundwater supplies, all of which are erroneous.

First, the Draft EIR states: "Project operation would not rely on locally sourced groundwater wells, as all water would be trucked to the site from the WKWD [West Kern Water District]." [362] But WKWD supplies the water it provides from "groundwater within the Kern

[358] Draft EIR, Vol. 1, at 4.10-34.
[359] Draft EIR, Vol. 1 at 4.10-35.
[360] Draft EIR, Vol. 1 at 4.19-19.
[361] Draft EIR, Vol. 1 at 1-6, 2-1, 3-2, 3-12.
[362] Draft EIR, Vol. 1 at 4.10-35.

County subbasin,"[363] meaning the Project's water use will still impose a burden on local groundwater supplies.

Second, the Draft EIR asserts that, even accounting for pre-Project water use at the Project site, water use is expected to remain below the WKWD's future water budget for CRC and Elk Hills, which affords 5,200 acre-feet per year.[364] As an initial matter, it is unclear if the future water budget adopted for the Project site by WKWD in 2020 remains valid, given that the Kern Groundwater Authority (KGA) is currently responsible for an annual overdraft of 239,346 acre-feet per year,[365] and state authorities have disapproved KGA's proposed Groundwater Sustainability Plan for the area.[366]

In any event, the fact that the WKWD may have budgeted for operations at the site does not mean that the Project's expected water use will not have a significant impact. As noted above, there is no surplus water in Kern County, groundwater in the Kern Subbasin is suffering from critical overdraft, and the water to be used by the Project will all be sourced from groundwater. Whether water use at the site was anticipated or not, the Project will still be using substantial quantities of groundwater.

Third, the Draft EIR avers that, "[s]hould the project require water supplies in excess of the allotment from the District, impacts to water supplies would be considered potentially significant. In order to address this, MM 4.19-1 would be implemented, ensuring that any groundwater or reclaimed water used is accounted for and regulated."[367]

The Draft EIR's adoption of MM 4.19-1 does not support a finding that the Project's groundwater use will be mitigated to a level of insignificance. That is because MM 4.19-1 in no way limits or mitigates the Project's water use. Rather, the Measure just specifies that the Project Owner/operator shall "provide information on any groundwater . . . that will be used," and County officials, in turn, "shall compile the water use information in a report" to be posted online annually.[368] This measure does not reduce or limit water use; it merely requires that "that any groundwater . . . used is accounted for."[369]

4. The Draft EIR fails to adopt all feasible mitigation for the Project's cumulative impacts on water supply.

Putting aside the Draft EIR's unsupported finding that the Project will not have a significant direct impact on groundwater supplies, the Draft EIR does acknowledge that "the cumulative impacts of any use of groundwater in the area are considered significant."[370] Consequently, the County must adopt all feasible mitigation to address this cumulative impact.

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[363] Draft EIR, Vol. 1 at 3-34; accord 4.19-2 (stating "WKWD primarily pumps groundwater").
[364] Draft EIR, Vol. 1 at 4.19-20 to 4.19-21.
[365] See, e.g., Draft EIR, Vol. 1 at 4.19-21
[366] See, e.g., Draft EIR, Vol. 1 at 4.19-13 to 4.19-14.
[367] Draft EIR, Vol. 1 at 4.10-35.
[368] Draft EIR, Vol. 1 at 1-65, 4.19-21 to 4.19-22.
[369] Draft EIR, Vol. 1 at 4.19-27.
[370] Draft EIR, Vol. 1 at 4-10-43.

The Draft EIR identifies several mitigation measures that will purportedly address this significant cumulative impact on water supply: MMs 4.9-1, 4.10-1, 4.10-2, 4.10-3, 4.10-4, 4.10-5, and 4.19-1.[371] But none of these measures will actually reduce the Project's impact on groundwater supplies:

- MM 4.9-1 provides worker training on the handling of hazardous substance,[372] but the Project site is not a source of groundwater for municipal and industrial (M&I) uses, which is supplied from elsewhere by WKWD.[373]

- MMs 4.10-1 through 4.10-5 all address onsite operations (i.e., stormwater measures and management of drilling muds, drilling fluids, and produced water)[374] but, again, the Project site is not a source of groundwater for M&I uses, which is supplied from elsewhere by WKWD.

- MM 4.19-1, as discussed above, merely requires reporting on groundwater use, and does not limit its use in any way.

Consistent with CEQA's requirement to adopt all feasible mitigation, the County should require the following feasible measures to mitigate the Project's impacts on local groundwater supplies:

- The County should identify specific purposes for which the Project may use M&I quality water—limited to those purposes for which such high-quality, freshwater is truly necessary—and direct that all other water uses in the Project area shall be met by recycling oil field-produced water. The Draft EIR indicates that such recycling and reuse of oil filed-produced water already occurs at the site.[375] The County should make this voluntary practice mandatory.

- The County should set a cap on the CTV I Project's water use. According to the Draft EIR, if construction activities (75 acre-feet) and operational activities (19.49 acre-feet) were to occur in the same year, the Project's water demand would total 94.49 acre-feet annually.[376] The Project should be held accountable for its estimated water needs and limited to an annual cap of 95 acre-feet per year or less for its CCS operations. In setting the cap, the County should subtract any use(s) included in the Project's estimated water demand that could be met by recycling oil field-produced water.

[371] Draft EIR, Vol. 1 at 4.10-44.
[372] Draft EIR, Vol. 1 at 1-45, 4.9-55.
[373] Draft EIR, Vol. 1 at 4.10-7 to 4.10-8 (noting "there is no appreciable quantity of groundwater in the project area" and "any groundwater encountered in this area is generally unusable"); 4.19-2 (stating WKWD's "[w]ater supply is obtained within the District from wells located in the northeast corner of the District in the underflow area of the Kern River Basin and from an area north and adjacent to the State of California's Tule Elk Reserve.").
[374] Draft EIR, Vol. 1 at 1-52 to 1-55, 4.10-29 to 4.10-33.
[375] Draft EIR, Vol. 1 at 4.10-8.
[376] Draft EIR, Vol. 1 at 4.19-21.

- The County should levy and collect an annual "fair-share" fee from the Owner/operator to be paid to the KGA to account for the Project's contribution to cumulative impacts on local groundwater supplies that KGA must mitigate pursuant to SGMA.

5. The Draft EIR inadequately analyzes and mitigates disposal of oil field-produced water.

The Draft EIR notes that "[a] significant percentage of the oil field-produced water in the project area is either recycled into the same geologic zones from which it was produced or is sequestered in deeper zones that are isolated from sources of drinking water."[377] Water that is not recycled or sequestered underground requires disposal. According to the Draft EIR, produced water "may also be transported, via truck or pipeline to existing wastewater treatment facilities permitted to receive production water for disposal" or "stored in surface impoundments where it percolates into groundwater and/or evaporates."[378]

The Draft EIR is inadequate as an informational document because it does not specify what percentage of the oil field-produced water is currently (in the oil field) or will be (for the Project) recycled and reinjected onsite as opposed to disposed of in some other way. Instead, the Draft EIR merely surmises that "very little water is disposed of . . . because purchasing fresh water is more expensive than recycling water."[379] The Draft EIR can and should be more specific to inform the public and decisionmakers; it should detail current water disposal volume(s) and practice(s) at the Project site and how these are expected to change, if at all, with the construction and operations of the proposed CCS facility.

It is important that the Draft EIR accurately address the fate of oil field-produced water because it has consequences for the CTV I Project's impacts:

- As the Draft EIR suggests, a high rate of recycling would lessen the degree to which the Project will compete with other users for scarce municipal and industrial-quality water.[380]

- Conversely, if transportation of the oil field-produced water by truck or pipeline is required for disposal, related environmental impacts must be evaluated and mitigated. For example, the Draft EIR notes that truck traffic impacts air quality.[381]

- Surface disposal of oil field-produced water in ponds also threatens impacts that should be disclosed if the practice will occur. "Because it was commingled with hydrocarbons in the formation," produced water "typically contains chemicals associated with the formations, such as salts, oils and greases, inorganic and organic chemicals, and naturally occurring radioactive material, that exceed state and federal standards for drinking

[377] Draft EIR, Vol. 1 at 4.10-8.
[378] Draft EIR, Vol. 1 at 4.9-7.
[379] Draft EIR, Vol. 1 at 4.10-8.
[380] Draft EIR, Vol. 1 at 4.10-8.
[381] See, e.g., Draft EIR, Vol. 1 at 4.3-63, 4.3-66, 4.3-72.

water."[382] Disposal in surface impoundments can therefore increase air pollution as well as contaminate the soil and harm biological resources.

Although the Draft EIR does not analyze the impact, the Draft EIR seems to contemplate that surface impoundments will, in fact, be used for disposal of oil field-produced water. More specifically, MM 4.10-5 states: "[t]he Owner/operator shall not discharge produced water into any surface disposal facility unless the facility has received the Waste Discharge Requirements from the Central Valley Regional Water Quality Control Board, or the need for Water Discharge Requirements has been waived by the Central Valley Regional Water Quality Control Board."[383] Likewise, MM 4.1-2 states: "[s]umps and ponds shall be permitted only to the extent authorized by the Central Valley Regional Water Quality Control Board . . . and shall comply with all applicable legal requirements and mitigation measures for . . . percolation or evaporation ponds for produced water."[384]

If the CTV I Project proposes to use such surface impoundments at the Project site, the extent to which they may be used and the impacts of such use must be disclosed. An adequate impact analysis is necessary to inform the development of all feasible mitigation measures and to include meaningful public input on the impacts and proposed mitigation.

G. The Draft EIR's Analysis and Mitigation of Biological Resources Impacts is Inadequate.

1. The Draft EIR must account for the threatened, endangered, and sensitive animal and plant species in the Central Valley and Elk Hills oil field.

The Elk Hills oil field and surrounding area is known to support high densities of species protected by state and federal law. The California Department of Fish and Wildlife (CDFW) has specifically called out several species known to be supported in the area through prior biological surveys, including the blunt-nosed leopard lizard, giant kangaroo rat, San Joaquin kit fox, Swainson's hawk, San Joaquin antelope squirrel, American badger, short-nosed kangaroo rat, burrowing owl, California glossy snake, and California jewelflower.[385] CDFW recommended additional surveys for special status plant species and also noted the potential for San Joaquin pocket mouse.[386] In addition, CDFW shared with the California Geologic Energy Management Division (CalGEM) in 2022 that "there is potentially suitable habitat [in the Elk Hills oil field] within the well pad footprints and/or adjacent to the wells that can serve as refugia, denning, breeding, foraging, and dispersal habitat" for additional species "likely to occur within th[e] oil field," including the Tipton kangaroo rat, tricolored blackbird, Temblor legless lizard, Kern mallow, San Joaquin woolly threads, Buena Vista Lake shrew, LeConte's thrasher, loggerhead shrike, Tulare grasshopper, San Joaquin coachwhip, California glossy snake, coast horned lizard,

[382] Draft EIR, Vol. 1 at 4.9-7.
[383] Draft EIR, Vol. 1 at 4.10-33.
[384] Draft EIR, Vol. 1 at 4.1-23.
[385] Letter from Bob Stafford, California Department of Fish and Wildlife, to Cindi Hoover, Kern County Planning & Natural Resources Dept. (April 6, 2022), Draft EIR, Vol. 2, App'x A.2: Comment Letters at 148.
[386] *Id.* at 159, 162.

western pond turtle, western spadefoot, prairie falcon, California horned lark, and Crotch bumble bee.[387] That 2022 letter also notes that several special-status plant species may occur in the oil field, including California Rare Plant Rank species Horn's milk-vetch, heartscale, Lost Hills crownscale, slough thistle, recurved larkspur, Temblor buckwheat, Tejon poppy, alkali-sink goldfields, pale-yellow layia, showy golden madia, California alkali grass, and oil neststraw.[388]

Table 1. *Threatened, Endangered and Sensitive Animals, Plants, and Plant Communities of the Elk Hills Area (threatened and endangered species are bolded)*

Common Name	***Scientific Name***	***Federal/State Status***	***CDFW Letter[389]***
Plants			
California jewelflower	***Caulanthus californicus***	***FE/CE, 1B.1***	**1, 2**
San Joaquin woollythreads	***Monolopia congdonii***	***FE/1B.2***	**2**
Kern mallow	***Eremalche parryi ssp. kernensis***	***FE/1B.2***	**2**
Horn's milk-vetch	*Astragalus hornii var. hornii*	*S/1B.1*	2
heartscale	*Atriplex cordulata var. cordulata*	*S/1B.2*	2
Lost Hills crownscale	*Atriplex coronata var. vallicola*	*S/1B.2*	2
Slough thistle	*Cirsium crassicaule*	*S/1B.1*	2
recurved larkspur	*Delphinium recurvatum*	*S/1B.2*	2
Temblor buckwheat	*Eriogonum temblorense*	*S/1B.2*	2
Tejon poppy	*Eschscholzia lemmonii ssp. kernensis*	*S/1B.1*	2
alkali-sink goldfields	*Lasthenia chrysantha*	*--/1B.1*	2
pale-yellow layia	*Layia heterotricha*	*S/1B.1*	2
showy golden madia	*Madia radiata*	*S/1B.1*	2
California alkali grass	*Puccinellia simplex*	*S/1B.2*	2
oil neststraw	*Stylocline citroleum*	*S/1B.1*	2
Insects			
Crotch bumble bee	*Bombus crotchii*	*--/WL*	2
Amphibians			
western spadefoot	*Spea hammondii*	*S/SSC*	2
Reptiles			
Temblor legless lizard	*Anniella alexanderae*	*Under Review / Candidate*	2
western pond turtle	*Actinemys marmorata*	*/SSC*	2
California glossy snake	*Arizona elegans occidentalis*	*--/SSC*	1, 2
blunt-nosed leopard lizard	***Gambelia sila***	***FE/CE, FP***	**1, 2**
San Joaquin coachwhip	*Masticophis flagellum ruddocki*	*--/SSC*	2

[387] Letter from CDFW to CalGEM, Elk Hills Oil Field, Kern County, Special-Status Species Information from CDFW (revised Aug. 12, 2022) at 1.
[388] *Id.* at 6.
[389] CDFW Letter 1: Letter from Bob Stafford, Cal. Department of Fish & Wildlife, to Cindi Hoover, Kern County Planning & Natural Resources Dept. (April 6, 2022), Draft EIR, Vol. 2, App'x A.2: Comment Letters at 148; Letter, 2: Letter from CDFW to CalGEM, Elk Hills Oil Field, Kern County, Special-Status Species Information from CDFW (revised Aug. 12, 2022).

coast horned lizard	*Phyrnosoma blaimvillii*	*/SSC*	2
Birds			
burrowing owl	*Athene cunicularia*	*S/SSC*	1, 2
tricolored blackbird	***Agelais tricolor***	***CT***	**2**
loggerhead shrike	*Lanius ludovicianus*	*/SSC*	2
California horned lark	*Erempohila alpestris actia*	*/WL*	2
prairie falcon	*Falco mexicanus*	*/WL*	2
Le Conte's thrasher	*Toxostoma lecontei*	*S/SSC*	2
Swainson's hawk	***Buteo swainsoni***	***CT***	**1, 2**
Mammals			
Nelson's (San Joaquin) antelope squirrel	***Ammospermophilus nelsoni***	***S/CT***	**1, 2**
giant kangaroo rat	***Dipodomys ingens***	***FE/CE***	**1, 2**
short-nosed kangaroo rat	*Dipodomys nitratoides brevinasus*	*S/SSC*	1, 2
Tipton kangaroo rat	***Dipodomys nitratoides nitratoides***	***FE/SE***	**1, 2**
Buena Vista Lake shrew	Sorex *ornatus relictus*	*FE/SSC*	2
Tulare grasshopper mouse	*Onychomys torridus tularensis*	*S/SSC*	2
San Joaquin pocket mouse	*Perognathus inornatus*	*--/SSC*	1
American badger	*Taxidea taxus*	*--/SSC*	1, 2
San Joaquin kit fox	***Vulpes macrotis mutica***	***FE/CT***	**1, 2**

Federal Designation

FE—Federally listed as endangered
FT—Federally listed as threatened.
S—BLM Sensitive Species.

State Designation

CE—State listed as endangered.
CT—State listed as threatened. Species that although not presently threatened in California with extinction are likely to become endangered in the foreseeable future.
SSC—California Department of Fish and Wildlife's "Species of Special Concern." Species with declining populations in California.
WL—Watch List
1B.1—Plant rare, threatened or endangered in Cal. and elsewhere, and very threatened in Cal.
1B.2—Plant rare, threatened or endangered in Cal. and elsewhere, and fairly threatened in Cal.

Many of these same species were listed in the letter the Center for Biological Diversity, Central Valley Air Quality Coalition, and Central California Environmental Justice Network submitted in response to the Notice of Preparation for the Project, based on species found in the U.S. Geologic Survey quadrangles surrounding the Project site.

2. The Draft EIR must address construction and operation impacts to species.

Though the Draft EIR claims there are no significant and unavoidable Project impacts to biological resources, this misses the mark and reflects a failure to account for the evidence

showing that operating CCS projects can be severely detrimental, or even deadly, to wildlife, plants, and habitats.

The Project poses risks to biological resources from leakage and uncontrolled blowouts of compressed CO_2 from pipelines and injection wells.[390] Compressed CO_2 forms a low dense cloud that can spread long distances from the release site and sicken and asphyxiate living things, including plants and animals.[391] CO_2 injection in oil fields and CO_2 pipeline transport have resulted in leakage and blowouts in several states that have caused wildlife deaths and significant habitat degradation. For example, a CO_2 injection well blowout in the Tinsley field, Mississippi, took 37 days to bring under control and killed deer, birds, fish, and other animals.[392] The blowout ejected CO_2 along with mud and drilling fluids, requiring the removal of 27,000 tons of drilling mud and contaminated soil and 32,000 barrels of liquids, and causing extensive habitat damage.[393] Other examples of CO_2 harms to wildlife and plants, and research on this topic, include:

- In 1986, a sudden, catastrophic release of CO_2 from Lake Nyos in Cameroon killed 1,700 people and 3,000 cattle. The CO_2 spread 10 km from the lake. Bird, insect, and small mammal populations in the area were not seen for at least 48 hours after the event.[394]

- Experiments with controlled injections of CO_2 into soil showed adverse effects on plants in response to CO_2 exposure. Biomass changes were seen in all plants studied; for example, clover plants decreased by 79% while grass decreased by 42%. The researchers' overarching conclusion was that elevated concentrations of soil CO_2 damages both soil microbiology and growing vegetation.[395]

- Other research on CO_2 and plants showed reduced plant growth and extensive mortality where CO_2 concentrations were greatest in the soil. For the plants that survived, root and shoot growth was significantly lower than in controls. Reproductive variables such as

[390] The Project's Biological Study Area (BSA), for example, includes "everything within the limits of the project footprint (the carbon capture and storage [CCS] Surface Land Area) and a 250-foot survey buffer, where feasible." Draft EIR, Vol. 1 at 4.4-3. Accordingly, the impacts to species from CO_2 leaks and blowouts must be considered within the scope of the BSA.
[391] See Pipeline Safety Trust and AccuFacts, *CO_2 Pipelines: Dangerous and Under-Regulated* (March 2022), https://pstrust.org/wp-content/uploads/2022/03/3-23-22-Final-Accufacts-CO2-Pipeline-Report2.pdf.
[392] Zegart, *The Gassing of Satartia*.
[393] Amy, *Oil spills in Mississippi, Alabama lead to $3.5 million in penalties for the company,* Clarion Ledger (Apr. 30, 2019), https://www.clarionledger.com/story/news/2019/04/30/oil-spills-penalties-mississippi/3625587002/.
[394] Kling, G.W. et al., *The 1986 Lake Nyos Gas Disaster in Cameroon, West Africa*, 236 Science 169 (1987).
[395] Smith, K.L. et al., *Environmental Impacts of CO2 Leakage: Recent Results from the ASGARD Facility, UK*, 37 Energy Procedia 791 (2013).

number of seeds per plant and seed dry weight per plant were also reduced compared to controls.[396]

The Draft EIR's analysis must also consider the impacts posed to burrowing species in the Project site, including the area in which the CO_2 plume is expected to spread. (The Draft EIR acknowledges that construction could cause loss of burrows and dens during construction at p. 4.4-40, but not during Project operation.) Burrowing animals are particularly vulnerable to death from CO_2 suffocation in the event of CO_2 pipeline or injection well blowout, since released CO_2 could fill nearby burrows where animals are resting or retreating. Federally listed burrowing species in the Project area include the San Joaquin kit fox, San Joaquin antelope squirrel, giant kangaroo rat, and blunt-nosed leopard lizard.

3. The Draft EIR must comply with CEQA's biological resources review requirements.

Protecting biological resources is a fundamental tenet of CEQA. Under Public Resources Code section 21001(c), it is the policy of the state to "[p]revent the elimination of fish or wildlife species due to man's activities, insure that fish and wildlife populations do not drop below self-perpetuating levels, and preserve for future generations representations of all plant and animal communities." EIRs must provide an in-depth analysis of whether a project will: Reduce substantially the habitat of a fish or wildlife species; Cause a fish or wildlife population to drop below self-sustaining levels; Threaten to eliminate a plant or animal community; or Reduce substantially the number or restrict the range of an endangered, rare, or threatened species.[397]

In addition to review under CEQA, when a project has the potential to significantly impact a species listed under the federal or California Endangered Species Act, consultation with wildlife agencies and an Incidental Take Permit are required.[398]

4. The Draft EIR's reconnaissance surveys are deficient.

There are deficiencies in the reconnaissance surveys that the Draft EIR relies upon to identify potentially impacted species. In evaluating whether a project will affect endangered, rare, or threatened species, lead agencies can use reconnaissance-level surveys, rather than protocol-level surveys or other methods, only where the choice of methodology is supported by substantial evidence.[399]

Of the 39 species CDFW identified as potentially occurring in the Project area (see Table 1 in section VI.G.1), the Draft EIR identifies just 27 that may be potentially affected by the Project following literature, database analysis, and reconnaissance surveys in September – December 2022. But the initial database review and reconnaissance surveys were insufficient to identify all sensitive species that may potentially occur in the Project area. In particular, despite the poor timing of the reconnaissance surveys to detect many species, the Draft EIR relies on the

[396] Al-Traboulsi et al., *Potential Impact of CO2 Leakage from Carbon Capture and Storage (CCS) Systems on Growth and Yield in Spring Field Bean*, 80 Environ. Exper. Botany 43 (2012).
[397] CEQA Guidelines, § 15065(c)(1).
[398] Cal. Fish and Game Code, § 2081; Endangered Species Act, § 10.
[399] *Gray*, *supra*, 167 Cal.App.4th at 1124.

database review and reconnaissance surveys to exclude the Tipton kangaroo rat and several plant species that CDFW has noted occur or have the potential to occur near the Project site.

a. Tipton Kangaroo Rat

CDFW wrote in comments on the scoping phase of the Project that Tipton kangaroo rat "have been documented to occur near the Project site" and that suitable habitat is present for the species to "occupy or colonize the Project."[400] CDFW went on to recommend a trapping plan to determine the presence of Tipton kangaroo rat, to be reviewed and approved by CDFW prior to execution, and that "these surveys be conducted between April 1 and October 31, when kangaroo rats are most active and well in advance of ground- and/or vegetation-disturbing activities in order to determine if impacts . . . could occur."[401] Contrary to CDFW's recommendation, the Biological Analysis Report did not include a plan submitted to and approved by CDFW and did not take place between April 1 and October 1. As expected, no Tipton kangaroo rat were observed during winter reconnaissance surveys. Rather than include this species for further evaluation in protocol-level surveys, it was removed from consideration with the following rationale: "The BSA is outside of the known geographic range (east of the California aqueduct) of the species."[402] This statement is not supported by substantial evidence and is contradicted by multiple letters from CDFW. The species should have been included in the Draft EIR as potentially occurring in the Project area to ensure it was included in future surveys and covered by mitigation measures.

b. Special Status Plants

CDFW identified multiple plant species that may be located in the Project area. The agency recommended in comments on the Notice of Preparation for the Project that Project sites should be surveyed "by a qualified botanist following the 'Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities' . . . . This protocol, which is intended to maximize detectability, includes the identification of reference populations to facilitate the likelihood of field investigations occurring during the appropriate floristic period."[403] The protocol is "meant to help people meet California Environmental Quality Act (CEQA) requirements for adequate disclosure of potential impacts to plants" and further recommends that field surveys be conducted multiple times during flowering or fruiting, when plants will be evident and identifiable.[404] The Draft EIR's methodology and recommendations are at odds with this protocol.

Surveys are particularly important because information in databases is voluntarily submitted and is "obtained opportunistically and is often focused on protected lands or on lands where development has been proposed."[405] CDFW identified with aerial imagery that many plant species could be impacted by the development in the Elk Hills oil field, including Horn's milk

[400] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154.
[401] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 155.
[402] Draft EIR, Vol. 2, App'x C.1: Biological Analysis Report at 1701.
[403] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 159.
[404] CDFW, *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (Mar. 2018) at 1.
[405] Draft EIR, Vol. 2, App'x C.1: Biological Analysis Report at 1618.

vetch, slough thistle, alkali-sink goldfields, pale-yellow layia, and California alkali grass.[406] CDFW further stated that:

> [i]n order to adequately assess any potential impacts to biological resources, focused biological surveys are advised to be conducted by a qualified wildlife biologist during the appropriate survey period(s) in order to determine whether or not any special status species may be present within the well development areas and prior to any ground-disturbing activities. Survey results can then be used to inform the level of environmental review and identify any mitigation, minimization, and avoidance measures necessary to reduce potential impacts to special status biological resources to less than significant.[407]

The Biological Analysis Report also appears to recognize the importance of surveys to supplement information in databases. It says that "the absence of recorded occurrence in these databases at any specific location does not preclude the possibility that a special-status resource may be present, which is why site-specific surveys were undertaken." However, it is not clear if the determination of whether species had the potential to occur was made prior to or after reconnaissance surveys.[408] And, if made after reconnaissance surveys, the "site-specific surveys" conducted for the Biological Analysis Report are not the same as the surveys recommended by CDFW to determine the species in the Project area and develop mitigation. For example, they were conducted between September and December, outside bloom times. There is also no evidence that the surveyors possess specific plant knowledge or have experience "conducting floristic botanical field surveys" or that the surveys followed other requirements in CDFW's 2018 protocols for surveying document.[409] CDFW's protocol specifically states that it is inappropriate to conduct "'[f]ocused surveys' that are limited to habitats known to support special status plants or ***that are restricted to lists of likely potential special status plants***" because they "are not adequate to identify all plants in a project area to the level necessary to determine if they are special status plants,"[410] but this is exactly what the Draft EIR proposes.[411]

5. The Draft EIR's proposed mitigation measures are unsupported and/or insufficient.

A large number of species-specific mitigation measures lack support, ignore scientific evidence, and/or expert agency recommendations submitted during the scoping period, fail to

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[406] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 151.
[407] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 146–47.
[408] Draft EIR, Vol. 2, App'x C.1: Biological Analysis Report at 1618 ("The results of the database inquiries were reviewed to develop a comprehensive list of sensitive biological resources that may be present on or in the vicinity of the Project site (see Table A-1 in App'x A). This list was then evaluated against existing site conditions observed during the biological field surveys of the BSA to determine which special-status resources have the potential to occur and then the potential for impacts to those resources as a result of the implementation of the Project.").
[409] CDFW, *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* at 11.
[410] CDFW, *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* at 4.
[411] Draft EIR, Vol. 1 at 4.4-57.

adhere to legal requirements, and ultimately must be substantially revised. Further, the Draft EIR lacks entirely mitigations for specific species or offers vague and/or yet-to-be-determined mitigation plans that must be specified and recirculated for comment from the public and experts.

a. Blunt-nosed Leopard Lizard

The blunt-nosed leopard lizard (BNLL) is a Fully Protected species in California and the proposed Project is located in "what is known as the highest quality BNLL habitat" within the oil field.[412] The Draft EIR fails to provide sufficient mitigation measures to detect the species and avoid take, just as it fails to adequately respond to concerns, evidence, and suggestions offered by the CDFW during the Project scoping period. And as a minor initial matter, the Draft EIR mischaracterizes the BNLL as a snake.[413] It is instead a rather large lizard that is part of the iguana family. This error should be corrected.

Surveys

First, the Draft EIR ignores the CDFW's concerns about survey protocols. The proposed mitigation measures provide that "[n]o more than one year prior to ground disturbing activities, focused surveys . . . shall be conducted in all potential" habitat" (MM 4.4-9(b)); as well as "[w]ithin 30 days before any ground-disturbing activities in special-status species habitat, the qualified biologist shall conduct a pre-disturbance survey" (MM 4.4-1(C)). But as the CDFW pointed out in their scoping comment: "Protocol-level surveys for BNLL are not synonymous with 30-day 'preconstruction surveys' often recommended for other wildlife species. In addition, the BNLL protocol specifies different survey effort requirements based on whether the disturbance results from maintenance activities or if the disturbance results in habitat removal (CDFW 2019)."[414] The Draft EIR does not address the difference between protocol-compliant surveys and 30-day preconstruction surveys, or the difference in survey type based on Project activity and impact. The BNLL mitigation measures for surveys must provide more specifics on how the proposed surveys will comply with the nuances in the protocols.

Second, the mitigation measures must be clearer on the timing of the one-year survey and provide more explanation for how the timing will fit with the BNLL's complex lifecycle and the fact that the species can remain below ground for years at a time. MM 4.4-9 says only that "focused surveys . . . shall be conducted" within a year of construction. The BNLL breeds from May to June, and eggs hatch in July and August.[415] The species is then active during the day in the spring, summer, and fall months, though adult activity decreases during the hot summer months of July and August, just as the hatchlings emerge from the burrows.[416] At that point, adults generally retreat into their burrows for the winter. Hatchlings stay out until October or

[412] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 150.
[413] Draft EIR, Vol. 1 at 4.4-45.
[414] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 150.
[415] California Herps, *Blunt-Nosed Leopard Lizard - Gambelia sila*, https://californiaherps.com/lizards/pages/g.sila.html (last accessed Mar. 1, 2024).
[416] U.S. Fish and Wildlife Service (FWS), *Blunt-Nosed Leopard Lizard*, https://www.fws.gov/species/blunt-nosed-leopard-lizard-gambelia-silus (last accessed Mar. 1, 2024).

November, before going into burrows.[417] Adults are capable of remaining below ground for two winters when poor environmental conditions, such as drought, are present.[418] The Mitigation Measure for longer-term surveys must therefore account for detecting both adult and juvenile lizards, as well as the fact that adults may remain underground for two years in a row.

Deferred Mitigation

MM 4.4-9(c) says that if BNLL are found during surveys, an "avoidance plan shall be prepared." The Mitigation Measure then recommends certain minimum actions to be included in the plan, such as a Worker Awareness Program and a speed limit.[419]

But the County cannot defer creation of a mitigation measure until a problem is detected. Under the CEQA rule against improper deferred mitigation, an EIR may not outline a mitigation measure in overly general terms, leaving the details to be decided at a later time, without setting performance standards or showing how the impact can be mitigated as described in the EIR.[420] Formulation of a measure's specific requirements for biological impacts may be permissible if the measure refers to the options that will be considered and the measure identifies specific performance standards.[421] All of these required safeguards and specifics are lacking in MM 4.4-9(c).

Cumulative Analysis

The CDFW recommended in the scoping period that the County perform a "robust cumulative impact analysis" of the BNLL because of the "significant loss of habitat for the species," the fact that the Project area and surrounding lands "contain some of the highest quality remaining habitat" for the BNLL, and that any "ground disturbing activities . . . may have the potential to significantly impact" populations.[422] The Draft EIR entirely ignores this recommendation and it is not reflected either in the analysis or the mitigation measures. There is no explanation for why CDFW's recommendation was ignored. The County must take up this recommendation and adjust its analysis and mitigation measures accordingly.

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[417] *Id.*
[418] *Id.*
[419] *Id;* see also MM 4.4-9(c)(3) (if BNLL are detected during construction, "construction shall cease within a 250-foot radius" until additional measures are determined).
[420] CEQA Guidelines, §15126.4(a)(1)(B); *Preserve Wild Santee v. City of Santee* (2012) 210 CA4th 260, 280 (rejected measure calling for management of species without specifying performance standards or other guidelines for that management); *San Joaquin Raptor Rescue Ctr.*, *supra*, 149 CA4th at 669 (measure specifying that future surveys for special status species be completed and undefined habitat management plan be developed in response to surveys found legally inadequate).
[421] *Clover Valley Found. v. City of Rocklin* (2011) 197 CA4th 200, 237 (requirement that permits be obtained from Department of Fish and Wildlife and Corps of Engineers served as performance standards supporting agency's determination that impact to listed species and its habitat would be mitigated); see also *Rialto Citizens for Responsible Growth v. City of Rialto* (2012) 208 CA4th 899, 945; *Cal. Native Plant Society*, *supra*, 172 CA4th at 621; *Endangered Habitats League, Inc. v. County of Orange* (2005) 131 CA4th 777, 794; *Defend the Bay v. City of Irvine* (2004) 119 CA4th 1261, 1275.
[422] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 150.

Buffer Zones

The mitigation measures for BNLL buffer areas fail to match the analysis and evidence CDFW provided in the scoping period. CDFW sought to determine the appropriately sized buffer to create a "reasonable chance of preventing take."[423] The agency reviewed the best available scientific information on the area which individual BNLL use and the distances that individuals are known to move between points.[424] They summarized relevant findings and concluded that the buffer area would need to be 164 acres *at a minimum* to avoid take.[425]

Rather than grapple with this informed and reasoned recommendation, the mitigation measures for the BNLL are vastly under-protective. MM 4.4-9(a) provides only a 50-foot buffer where ground-disturbing activities could impact suitable burrows. MM 4.4-9(b) prescribes a 250-foot buffer if the species is detected. (Even here, it is unclear what "detected" means—the same Mitigation Measure states that no buffer is needed if no BNLL "is observed," but "observation" may not be the same as detecting signs of the lizard.)[426]

The Draft EIR's prescribed 50-foot buffer is 2% of the CDFW recommendation, and the 250-foot buffer only 10% of the CDFW recommendation. Moreover, the evidence the CDFW analyzed showed the *minimum* home range for the BNLL to be 1.1 acres (with other findings extending up to nearly 22 acres). One acre is 660 feet long—meaning the buffers in the mitigation measures are not even half of the bare minimum space needed to protect the species. These buffers simply fall far short of what is needed to meet the County's legal obligations and avoid take of the species. The Draft EIR offers no explanation for running counter to the best available scientific evidence of what might be reasonable to avoid take.

b. San Joaquin Kit Fox

There is both high likelihood of San Joaquin Kit Fox (SJKF) presence and occupation of the Project site and a need for strong mitigation measures. Per the CDFW, SJKF "may be attracted to the Project area due to the type and level of ground-disturbing activities and the loose, friable soils resulting from intensive ground disturbance."[427] Mitigations must eliminate or substantially limit the likelihood of den collapse, inadvertent entrapment, reduced reproductive success, reduction in health and vigor of young, and direct mortality of individuals.[428]

The current SJKF mitigation measures are deficient and fail to align with scientific evidence and/or legal requirements in several ways. First, the CDFW was clear in its scoping comment that avoiding Project impacts to SJKF "is likely infeasible," and this Project warrants

[423] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 151.
[424] Draft EIR. Vol. 2, App'x A.2: Comment Letters at 151.
[425] Draft EIR. Vol. 2, App'x A.2: Comment Letters at 152–53 (going on to explain that there is "a reasonable plan for avoidance is to assume that the lizard might utilize up to 98.8 acres in any direction from where it was observed," and assuming a circular home range, the diameter would be 2340.8 feet, or a 395-acre circle as a buffer).
[426] See also MM 4.4-9(c)(3) (if BNLL are detected during construction, "construction shall cease within a 250-foot radius until additional measures are determined).
[427] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 153.
[428] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 153.

consultation with CDFW and acquisition of a SJKF-specific ITP prior to ground-disturbing activities.[429] This is because the "existing ITP issued to OXY/CRC does not include the proposed Project as a Covered Activity."[430]

Second, while MM 4.4-6 provides for buffers around potential and confirmed dens, it also directs that any dens that "cannot be avoided" will be removed. Calling for den removal fails to align with evidence provided during the scoping period that kit fox relocation is complex and likely to fail.[431] The Mitigation Measure further fails to propose how exactly den "excavation" will occur, if/where relocation will happen, and how relocation will take into account critical factors such as expense, available habitat, impact on existing populations, and documentation.[432] Den removal also implicates species take which, as noted below, requires a separate ITP than what the County currently claims covers Project activities.[433] The Mitigation Measure also fails to acknowledge the USFWS's guideline that occupied natal or pupping dens will not be destroyed until the foxes have vacated, thus requiring postponement of Project activities.[434] Details such as these must be included in the mitigation measures so that all parties (including the Project developer, workers, and local regulators) are aware of their obligations and limitations.

Third, other measures to project the SJKF do not align with CDFW and USFWS recommendations. (Of note, MM 4.4-6 directs the reader to other measures "including capping pipes, covering trenches, adding exit ramps to excavated areas" at MM 4.4-15. But MM 4.4-15 concerns wetlands and waters, whereas 4.4-13 concerns additional measures to avoid adverse impacts to species, such as speed limits and covering open trenches. This drafting error should be corrected.) For example, the CDFW recommends all perimeter fencing be raised 5 to 7 inches above ground level to allow SJKF movement through the Project site and to minimize impacts to SJKF habitat connectivity.[435] MM 4.4-13(h) prescribes perimeter fencing to be 4 inches off the ground—meaning, this fencing would be too short for the SJKF to pass. The USFWS also recommends that new sightings of kit fox shall be reported to the California Natural Diversity Database.[436] The County should amend its mitigation measures to take into account these expert agency recommendations.

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[429] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154.
[430] Draft EIR. Vol. 2, App'x A.2: Comment Letters at 154.
[431] Bremner-Harrison, S. et al., *Feasibility and Strategies for Translocating San Joaquin Kit Foxes to Vacant or Restored Habitats* (2007), https://esrp.csustan.edu/publications/pdf/esrp_2007_kitfoxreloction_w.pdf.
[432] See *id.* at 3-7.
[433] See, e.g., FWS, *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance* at 4 (2011), https://www.fws.gov/sites/default/files/documents/survey-protocols-for-the-san-joaquin-kit-fox.pdf (emphasizing that "Destruction of any known or natal/pupping kit fox den requires take authorization/permit from the Service" and that if "at any point during excavation, a kit fox is discovered inside the den, the excavation activity shall cease immediately and monitoring of the den as described [therein] should be resumed").
[434] *Id.* at 4 (2011).
[435] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154.
[436] FWS, *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance* at 6.

c. Giant Kangaroo Rat, Tipton Kangaroo Rat, Short-Nosed Kangaroo Rat, and San Joaquin Antelope Squirrel

As an initial matter, the Draft EIR must correct its omission of the Tipton Kangaroo Rat from the Draft EIR. According to CDFW, the Giant Kangaroo Rat (GKR), Tipton Kangaroo Rat (TKR), and Short-Nosed Kangaroo Rat (SNKR) "have been documented to occur near the Project site (CDFW 2022), and the Project Area supports some of the best GKR habitat present in the Elk Hills oil field."[437] It is unclear why the Draft EIR's list of Special Status Animal Species that could occur onsite fails entirely to include the TKR.[438] This omission must be corrected, not just in the table but in the surveys of species at the site, analysis of impacts, and biological resources mitigation measures.

Regarding surveys, the CDFW recommended trapping surveys for the GKR, TKR, and SNKR, to be conducted according to trapping plans developed in consultation with CDFW.[439] CDFW further recommended that these surveys be conducted between April 1 and October 31, when kangaroo rats are most active and well in advance of ground- and/or vegetation-disturbing activities.[440] Once completed, they requested that all survey results be sent to CDFW.[441] Without explanation or evidence to explain why it would not have to conduct such surveys (including for the TKR), the Draft EIR does not take up any of these recommendations. Relatedly, the CDFW recommended seeking ITPs upon detection of any of the protected rat species; it does not appear the Project has done this.[442]

While the Draft EIR's 50-food den buffer aligns with the CDFW recommendation,[443] the mitigation measures ignore the CDFW's caution that buffers may not be sufficient to ensure that the species can "freely disperse to and from burrows."[444] Inhibiting the movement of these protected species could be considered "capture" and/or result in prohibited species take.[445] To address this, the CDFW recommended that no burrow be surrounded more than 180 degrees around by development activities.[446] The Draft EIR ignores this recommendation without explanation or evidence. The mitigation measures should adopt this 180-degree protection in addition to buffers around rodent dens.

The issues above are similar with the San Joaquin antelope squirrel (SJAS), which is known to occur throughout the Elk Hills oil field.[447] Like the rat species, the CDFW

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[437] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154; *see also* Draft EIR, Vol. 1 at 4.4-38 (noting that the USFWS published a recovery plan for species in the San Joaquin Valley, including the TKR, identifying it as a "keystone" species).
[438] Draft EIR, Vol. 1 at Table 4.4-4.
[439] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154.
[440] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154.
[441] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154.
[442] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154–55 (stating that "the existing ITP issued to OXY/CRC does not include the proposed Project as a Covered Activity").
[443] Draft EIR, Vol. 1 at Table 4.4-6.
[444] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154.
[445] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154.
[446] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154.
[447] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 156.

recommended that no SJAS burrow be surrounded more than 180 degrees around by development activities.[448] The Draft EIR fails to adopt this measure and fails to offer explanation or evidence that omitting this protection would somehow avoid capture and/or take. The CDFW also informed the County of the need for a separate ITP permit for SJAS take.[449]

d. Swainson's Hawk

Swainson's hawks have been documented to occur in the areas bordering the Elk Hills oil field, and the habitat type present provides suitable foraging and nesting habitat.[450] Despite this, the Draft EIR lacks any mitigation measures specific to the species.

The CDFW recommended specifically for the Swainson's hawk that, upon discovery of an active nest, a minimum half-mile buffer be delineated and that such a buffer be maintained until the breeding season ends or a qualified biologist determines the birds have fledged.[451] Instead, MM 4.4-8 (which broadly covers all bird nests) provides that if a nest is detected, it will be continuously surveyed for 24 hours to establish behavior baseline prior to construction; then continuously monitored to detect any behavioral changes. Monitoring of a nest falls short of an immediate buffer and the Draft EIR does not provide evidence that simple monitoring will be sufficient to reduce adverse impacts to the species. Further, the Measure does not clarify who will do the 24-hour monitoring or the continuous behavioral monitoring; at the very least this must be a qualified biologist selected by the County.

The Draft EIR also entirely fails to address the loss of Swainson's hawk foraging habitat and tree removal, two concerns CDFW raised during the scoping period.[452] The CDFW provided reasoned and supported recommended mitigations to address these concerns that must be incorporated into the Draft EIR.

e. Burrowing Owl

Burrowing owls have been documented in the Project vicinity, per CDFW.[453] The Project has the "potential to significantly impact local [] populations" and, and as described in CDFW's "Staff Report on Burrowing Owl Mitigation" (CDFG 2012), "excluding and/or evicting [burrowing owls] from their burrows is considered a potentially significant impact under CEQA."[454]

The CDFW's Staff Report is clear that Project-specific CEQA mitigation is important for burrowing owls and unless otherwise provided in a state, local, or regional conservation strategy, mitigation measures must incorporate the following four principles: 1) use of the precautionary principle; 2) use of mitigation effectiveness monitoring and reporting, as well as adaptive management; 3) protect and conserve owls in wild, semi-natural, and agricultural habitats; and 4)

[448] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 156.
[449] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 157.
[450] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 157.
[451] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 158.
[452] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 158.
[453] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 160.
[454] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 160.

protect and conserve natural nest burrows or surrogates.[455] The Staff Report then lists best practices for mitigation measures grounded in scientific literature.[456] These include, broadly, avoidance, pre-construction surveys, site surveillance, and buffer zones.[457]

The Draft EIR does not take the CDFW's scoping comment or Staff Report fully into account, leaving its burrowing owl mitigations insufficient to reduce adverse impacts and unsupported by any evidence.

First, accurate surveys to detect burrowing owl presence is key, and CDFW suggested during the scoping period that the Project conduct "three or more surveillance surveys" with each visit occurring at least three weeks apart during peak breeding season (April 15 to July 15).[458] Mitigation Measure 4.4-1 provides only that "any required focused/protocol surveys shall be conducted . . . with protocol survey timelines." The Draft EIR does not address the guideline for three or more surveillance surveys for owls, nor does it contain evidence or an explanation for why this approach would not be taken.

Second, MM 4.4-4 provides that burrowing owls present in the Project area or within 500 feet outside the breeding season "may be moved away . . . using passive relocation techniques." While this measure pledges to follow CDFW guidelines, the Draft EIR fails to acknowledge that according to the CDFW, "excluding birds from burrows is not a take avoidance, minimization, or mitigation method and is instead considered a potentially significant impact under CEQA."[459] The Draft EIR must therefore acknowledge that displacing owls is an impact and analyze it as such. Should MM 4.4-4 maintain the approach of displacing owls, it must also incorporate the CDFW's guideline that burrow exclusion be conducted only by qualified biologists and only during the non-breeding season, and that occupied burrows be replaced with artificial ones at a ratio of 1:1.[460]

Finally, there is no logical connection between the full suite of impacts to burrowing owls named in the Draft EIR and the mitigation measures named. The Draft EIR acknowledges that "[n]oise, vibration, and increased human activity" from construction "could alter the daily behaviors of individual owls and affect foraging success, displace owls from their burrows, or lead to nest failure."[461] The Draft EIR then claims MMs 4.4-1, -3, -4, -11, and -13 "would reduce impacts,"[462] but these Measures on their face do not fully address the impacts. MM 4.4-1 concerns surveys, MMs 4.4-3 and -4 address buffers and owl nest exclusion, MM 4.4-11 describes worker education, and MM 4.4-13 lists additional measures such as trash and dust control. The Measures listed are a start, but the Draft EIR does not fully connect how they will

[455] CDFW, *Staff Report on Burrowing Owl Mitigation, State of California* (March 7, 2012) at 3–4, https://www.sandiegocounty.gov/content/dam/sdc/pds/ceqa/JVR/AdminRecord/IBR/RTCReferences/3a%20CDFG%202012_Staff%20Reports%20on%20Burrowing%20Owl%20Mitigation.pdf.
[456] *Id.* at 8.
[457] *Id.* at 8–10.
[458] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 160.
[459] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 161 (citing the CDFW Staff Report).
[460] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 161.
[461] Draft EIR, Vol. 1 at 4.4-46.
[462] Draft EIR, Vol. 1 at 4.4-46.

address noise, vibration, and other impacts that could alter the daily behaviors of owls; the impacts are therefore left unmitigated.

f. Nocturnal Species

There are six protected nocturnal species in the Project area,[463] but the mitigation measures fail to adequately reduce impacts to these species (and other species) from the array of nighttime Project activities expected to occur.

As an initial matter, the Biological Resources section acknowledges that construction could occur at night and therefore require lighting that may affect diurnal and nocturnal wildlife.[464] But elsewhere in the document, the Draft EIR states that nighttime Project activities could include "drilling activities, vehicle and equipment activities supporting drilling, and safety and security lighting for areas, such as construction yards, work areas, vehicle and equipment parking areas, and staging and laydown areas,"[465] and that Class VI well drilling "typically run[s] continuously, 24 hours a day" for "up to 60 days."[466] The full range of nighttime activities mentioned in other parts of the Draft EIR must be incorporated, analyzed, and mitigated in the Biological Resources section.

Perhaps because of this disconnect, the only nighttime-related mitigation measure for species merely directs use of "directing lighting" and compliance "with applicable lighting mitigation measures."[467] Nighttime lighting is harmful to nocturnal species, but lighting is far from the only impact of nighttime construction and other activities that needs to be mitigated. (Moreover, the lighting mitigation is far too vague to be evaluated or measured and must be revised to include specifics and information about enforcement.) For example, the San Joaquin kit foxes "are known to sometimes rest and play near the den entrance in the afternoon, but most above-ground activities begin near sunset and continue sporadically throughout the night."[468] Accordingly, for that species, the U.S. Fish and Wildlife Service recommends that "[n]ight-time construction should be minimized" and if it does occur, "then the speed limit should be reduced to 10-mph" and "[o]ff-road traffic outside of designated project areas should be prohibited."[469]

The County must therefore develop mitigation measures to address the full array of impacts to nocturnal species from activities such as traffic, noise, vibrations, and continuous

[463] The species are the California glossy snake, Draft EIR, Vol. 1 at 4.4-44, 4.4-18; the giant kangaroo rat, *id.* at 4.4-22 (noting that "suitable burrows with diagnostic signs of kangaroo rat were observed" during surveys); the short-nosed kangaroo rat, *id.* at 4.4-22; the San Joaquin pocket mouse, *id.* at 4.4-22; the American badger, *id.* at 4.4-23 (noting that "dens displaying signs consistent with the use of a badger were observed" in the Project area); and the San Joaquin kit fox, *id.* at 4.4-23.
[464] Draft EIR, Vol. 1 at 4.4-40.
[465] Draft EIR, Vol. 1 at 4.1-24.
[466] Draft EIR, Vol. 1 at 4.1-25.
[467] Draft EIR, Vol. 1 at 4.4-13.
[468] FWS, *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance* at 3.
[469] *Id.* at 5.

drilling. The County must also develop measures to address impacts to daytime species whose rest and other behaviors might be disrupted by nighttime disturbances and continuous drilling.

g. Worker Environmental Awareness Program

Mitigation Measure 4.4-11 to create a Worker Environmental Awareness Program is a good start but, as written, falls short of the County's legal requirements and could benefit from adopting recommendations by other agencies.

For one, the Draft EIR defers development of the program, stating only in MM 4.4-11 that it "shall be developed." As noted earlier in this comment section, the County cannot defer development of a mitigation measure and instead must provide specifics prior to finalizing the Draft EIR. A worker educational program is not the type of mitigation that requires further data or inputs from operations to prescribe measures, nor is it impractical or infeasible to devise the specifics of such a program now.[470]

One template the County could consider comes from the USFWS regarding the SJKF. They recommend an employee education program that does the following:

> The program should consist of a brief presentation by persons knowledgeable in kit fox biology and legislative protection to explain endangered species concerns to contractors, their employees, and military and/or agency personnel involved in the project. The program should include the following: A description of the San Joaquin kit fox and its habitat needs; a report of the occurrence of kit fox in the project area; an explanation of the status of the species and its protection under the Endangered Species Act; and a list of measures being taken to reduce impacts to the species during project construction and implementation. A fact sheet conveying this information should be prepared for distribution to the previously referenced people and anyone else who may enter the project site.[471]

This type of thorough education is appropriate for all protected species that are or could occur at the Project site. These materials must be developed and shared with the public and decisionmakers prior to finalizing and certifying the Draft EIR.

Similarly, MM 4.4-12 provides that "wildlife found that might have been affected by exposure to CO_2 shall immediately cause a shutdown of all injection operations." This measure is important and should therefore be incorporated into the Worker Environmental Awareness Program, along with other information about exactly *how* to identify wildlife suffering symptoms of CO_2 exposure.

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[470] See, e.g., *Defend the Bay v. City of Irvine* (2004) 119 Cal.App.4th 1261, 1275; *Preserve Wild Santee*, *supra,* 210 Cal.App.4th at 281; CEQA Guidelines, § 15126.4(a)(1)(B).

[471] FWS, *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance* at 6.

h. Cumulative Impacts and Mitigations

The Draft EIR concludes that "the cumulative impacts of the project when combined with other known and unknown projects, would be significant and unavoidable" for biological resources.[472] The Draft EIR then offers no additional mitigation measures beyond the ones proposed to address direct impacts.[473]

The Draft EIR opts not to independently consider and evaluate potential cumulative impacts to biological resources because of the *Final Environmental Impact Report - Revisions to the Kern County Zoning Ordinance - 2015(C) Focused on Oil and Gas Local Permitting*, referred to in the EIR as the Oil and Gas EIR.[474] The relationship to this Draft EIR is somewhat opaque. The County uses the Oil and Gas EIR "as a source of information regarding cumulative impacts," but supposedly "does not rely" on it "for purposes of tiered review under CEQA."[475] By way of further explanation, the Oil and Gas EIR's information "provide [sic] evidence for the record of the analysis of cumulative impacts" for activities included in the Project, meaning it offers "facts and evidence for the record" on the oil field's biological resources.[476]

We agree that CEQA Guidelines section 15152 guides whether the County can tier to a previous analysis, but the County's supposed use but non-reliance on the Oil and Gas EIR is unconvincing. Per the Guidelines, "tiering" is defined as "using the analysis of general matters contained in a broader EIR" with later EIRs, incorporating by reference the general discussions from the broader EIR, and concentrating the later EIR solely on the issues specific to the later project.[477] This definition of tiering describes how the County is using the Oil and Gas EIR for this Project—meaning, the County is tiering to the challenged EIR, even if it claims not to be.

The County should not be tiering to the Oil and Gas EIR given its status in litigation. The Oil and Gas EIR "is subject to a pending court challenge."[478] This alone should prohibit the County from using the challenged EIR as a source of information. The Draft EIR, however, attempts to carve out the cumulative impacts section of the Oil and Gas EIR to use here because that section is not directly challenged in the lawsuit.[479] Such a tightrope walk is unsupported. In the court challenge, the direct impacts (such as to air, water, and biological resources) are at issue; if the court orders a remedy on those direct impacts, the cumulative impacts analysis would also have to change.[480] This casts the entire analysis of impacts (direct and cumulative) of the EIR into doubt, and the current Draft EIR should instead conduct its own cumulative impacts analysis rather than attempt to rely on a disputed and stale one.

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[472] Draft EIR, Vol. 1 at 4.4-66.
[473] Draft EIR, Vol. 1 at 4.4-66.
[474] Draft EIR, Vol. 1 at 4.4-65.
[475] Draft EIR, Vol. 1 at 4.4-65 (citing CEQA Guidelines, § 15152).
[476] Draft EIR, Vol. 1 at 4.4-65
[477] CEQA Guidelines, § 15152(a).
[478] Draft EIR, Vol. 1 at 4.4.-64.
[479] Draft EIR, Vol. 1 at 4.4.-64.
[480] CEQA Guidelines, § 15130(a)(1) (defining cumulative impact as "the combination of the project evaluated in the EIR together with other projects causing related impacts").

6. The Draft EIR's reliance on a prior conservation easement deed for Endangered Species Act coverage is improper.

It is unclear to what extent Kern County proposes to rely on previously issued plans for Endangered Species Act coverage for the Project, but reliance on existing coverage through take permits is improper. As the Draft EIR recognizes, unauthorized take of species is unlawful, and the County must have an ITP to cover any species take.[481] Yet the Draft EIR claims that California Resources Corporation has an ITP from 2012, pointing to Appendix C.2. The Draft EIR also references an "Elk Hills Habitat Conservation Plan" but does not provide the plan anywhere in the appendices.[482]

The Draft EIR's discussion of ITP coverage is problematic for several reasons. First, the document provided in Appendix C.2 is not an ITP or Habitat Conservation Plan—it is a conservation easement deed for conservation areas that largely do not overlap with the Project site.[483] The document mentions only a small number of the potentially impacted protected species.[484] And the document mentions "certain impacts of oil and gas production facilities and activities at the Elk Hills oil field," which would not encompass the CO_2 capture, compression, transportation and injection activities of this Project.[485] Although the Center for Biological Diversity is aware that a previous oil field operator prepared a Habitat Conservation Plan in 2009 as part of an ITP application necessary to extend a prior permit beyond 2014 and authorize incidental take of species associated with continued oil and gas production activities,[486] there is no publicly available information indicating that plan was finalized.[487]

The Center for Biological Diversity requested from Kern County an ITP noted in other Elk Hills oil field drilling approval documents.[488] The Center received a document in response, ITP number 2081-2014-019-04, issued to California Resources Corporation Elk Hills, LLC. We are including it with our comment submission since this permit must be part of the administrative record.

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[481] Draft EIR, Vol. 1 at 4.4-23 (take requires an ITP issued under section 2081 or a finding that an ITP issued under the federal Endangered Species Act is consistent with state requirements); *id.* at 4.4-25 (section 10 of the federal Endangered Species Act allows a permit applicant to obtain an ITP through submission of a habitat conservation plan); see also MM 4.4-2 (stating that there may be no incidental take of any protected species without a permit or approved conservation plan).

[482] Draft EIR, Vol. 1 at 4.4-36.

[483] Draft EIR, Vol. 2, App'x C.2: Conservation Easement Deed – Elk Hills Conservation Area at 1721 *et seq.*; Draft EIR, Vol. 2, App'x C.3: Conservation Easement Deed – Elk Hills Conservation Area Map at 1741 *et seq.*

[484] Draft EIR, Vol. 2, App'x C.2: Conservation Easement Deed – Elk Hills Conservation Area; Draft EIR, Vol. 1 at 4.4-36.

[485] Draft EIR, Vol. 2, App'x C.2: Conservation Easement Deed – Elk Hills Conservation Area.

[486] 71 Fed. Reg. 6883.

[487] See 78 Fed. Reg. 39836.

[488] Letter from Center for Biological Diversity to Kern County Planning & Natural Resources Department, *Elk Hills Oilfield Incidental Take Permit* (Jan. 16, 2024); CalGEM, *Notice of Determination, NOD-OG California Resources 072022-201-1* (Aug. 25, 2022).

Second, the ITP does not sufficiently include the CTV I Project as a Covered Activity. The ITP explains that the activities covered involve "continued oil and gas related activities and the exploration and development of new wells necessary to enhance recovery and processing of oil and gas reserves."[489] The CTV I Project, in contrast, proposes to capture CO_2 from existing oil field operations, but also "is dependent on the sources permitted for injection into the storage, the ability of the project year by year to obtain CO_2 and inject at the maximum 2,210,000 million tons per year."[490] As noted earlier in this comment letter, additional sources of CO_2 could include DAC, hydrogen, and waste to energy facilities. Moreover, CO_2 compressors, pipelines, injection wells, and other infrastructure are fundamentally different from oil and gas counterparts.

Third, and relatedly, the existing ITP covers only four species—the San Joaquin kit fox, San Joaquin antelope squirrel, giant kangaroo rat, and Tipton kangaroo rat—not the full range of species that could suffer take from the CTV I Project.[491] Even the CDFW—the state's authoritative agency on this issue—reiterated throughout its comment during the Scoping Phase that the existing ITP is insufficient to cover the Project's impacts on protected species.[492] The CDFW issued its opinion based not only on species that the ITP fails to cover, but the deficiency of the existing ITP to address impacts to the four covered species.[493]

It should also be noted that while the current ITP covers incidental take of the Tipton Kangaroo Rat resulting from oil and gas production, the Draft EIR arbitrarily excludes this species from surveys and consideration of mitigation measures.[494] CRC must therefore obtain a new ITP to cover *all* activities that could result in take of protected species flagged as occurring or potentially occurring in the Project Area. Obtaining ITP(s) covering CTV I Project activities and other species must occur before any construction begins to avoid unlawful take. The County must therefore revise MM 4.4-2, which provides only that if CRC "elects in the future to pursue any disturbance . . . that requires additional take authorization," the Project would obtain a new ITP. [495] The Draft EIR must then be revised to analyze and account for the new ITP.

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[489] CDFW, ITP No. 2081-2014-019-04, Elk Hills Oil and Gas Field at 2–3 (hereinafter, "ITP Permit 2081"); see also *id.* at 6–10 (listing covered activities and not including CCS).
[490] Draft EIR, Vol. 1 at 4.8-24.
[491] ITP Permit 2081 at 11 ("These species and only these species are the 'Covered Species' for the purposes of this ITP.").
[492] Draft EIR, Vol. 2, App'x A.2: Comment Letters at 146–65; see also section VI.G, *supra* (noting instances in which the ITP does not cover protected species for the activities proposed).
[493] See, e.g., Draft EIR, Vol. 2, App'x A.2: Comment Letters at 154 (noting that the Project warrants consultation with CDFW and acquisition of a SJKF-specific ITP prior to ground-disturbing activities and for this species, the "existing ITP issued to OXY/CRC does not include the proposed Project as a Covered Activity").
[494] See Draft EIR, Vol. 2, App'x C.1: Biological Analysis Report at 1701; see also section VI.G, *supra* (discussing exclusion of the Tipton kangaroo rat in the Draft EIR).
[495] Draft EIR, Vol. 1 at 4.4-64 (emphasis added).

H. The Draft EIR Fails to Analyze and Mitigate Cumulatively Considerable Impacts.

Under CEQA, an EIR must discuss significant "cumulative impacts."[496] Cumulative impacts are defined as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts."[497] A legally adequate cumulative impacts analysis views a particular project over time and in conjunction with other related past, present, and reasonably foreseeable future projects with impacts that might compound or interrelate with those of the project at hand.[498] Such analysis is necessary because "environmental damage often occurs incrementally from a variety of small sources [that] appear insignificant when considered individually, but assume threatening dimensions when considered collectively with other sources with which they interact."[499] As is the case for all impact categories, a lead agency's threshold findings of significance with regard to cumulative impacts must "be supported by substantial evidence"; and, where found, cumulatively considerable impacts must be adequately mitigated.[500]

"[M]ere awareness of proposed expansion plans or other proposed development does not necessarily require the inclusion of those proposed projects in the EIR. Rather, these proposed projects must become 'probable future projects.' (CEQA Guidelines, § 15130(b)(1)(A).)"[501] "'[P]robable future projects' can be interpreted as reasonably probable future projects . . . [P]rojects that are undergoing environmental review are reasonably probable future projects. [Citation.] We conclude that any future project where the applicant has devoted significant time and financial resources to prepare for any regulatory review should be considered as probable future projects for the purposes of cumulative impact."[502]

An adequate cumulative impacts analysis and discussion requires a thorough assessment of the incremental significance of the CTV I Project's impacts over time, and in consideration of "other projects causing related impacts."[503] The Draft EIR concludes that the CTV I Project will cause potentially significant impacts for a number of impact areas, including, but not limited to, air quality, biological resources, energy, geology and soils, and GHG. For some impact areas, including air quality, biological resources, and GHG, the Draft EIR concludes the impact will be significant and unavoidable.[504] However, the Draft EIR fails to conduct an appropriate cumulative impacts analysis and support its conclusion with evidence, because it fails to consider the full range of projects that are required in a cumulative impact analysis.

The most crucial aspect of cumulative impact analysis of a carbon sequestration project is the project's sources of CO_2. An analysis of these sources is necessary not only to understand the impact of their operation together with the CTV I Project, but also in order to give the public a

[496] CEQA Guidelines, § 15130(a).
[497] CEQA Guidelines, § 15355(b).
[498] Pub. Resources Code, § 21083(b)(2); CEQA Guidelines, § 15065(a)(3).
[499] *Communities for a Better Environment*, *supra*, 103 Cal.App.4th at 114.
[500] See CEQA Guidelines, § 15064.7(b).
[501] *Gray, supra,* 167 Cal. App. 4th 1099 at 1127–28.
[502] *Id.* at 1127–28.
[503] CEQA Guidelines, § 15130(a)(1).
[504] Draft EIR, Vol. 1 at 5-3 to 5-5.

picture of whether the CTV I will facilitate and incentivize new GHG emissions, rather than reducing existing ones, and whether it will extend the life of existing fossil fuel CO_2-emitting industries. The cumulative analysis fails to include any meaningful discussion of the Project's CO_2 sources.

As described above, the project description section of the Draft EIR lists under "Cumulative Projects" several projects in the County, and provides nothing more than the name, location, type, acreage, and status of these projects.[505] In doing so, the Draft EIR ignores projects that are clearly "probable future projects" and must be analyzed in a proper cumulative impacts analysis. These projects include, at a minimum:

1. Lone Cypress Blue Hydrogen plant

The Draft EIR describes this project as a "Blue Hydrogen project" located at Elk Hills and Skyline Road and classifies the project status as "EIR in Process". It does not include any other information or analysis of its potential cumulative impacts.

Yet documents show that the project's application was deemed complete by Kern County in September 2023,[506] and a draft Notice of Preparation was already prepared for it in December 2023;[507] thus, and as the Draft EIR concedes, this project is already undergoing environmental review.

A Carbon Dioxide Management Agreement (CDMA) for the Lone Cypress Project was entered into by CRC's Carbon TerraVault JV Holdco on December 2022.[508] Moreover, CTV has announced that it is a direct partner in that project, noting in a media release that "the CTV JV has the right to take a majority equity stake in the project, as well as to provide sequestration services for all subsequent Lone Cypress hydrogen projects in California"[509] These facts, together with the fact the project is co-located in the Elk Hills oil field as the CTV I Project, make the Lone Cypress Project a clear "probable future project" that must be analyzed in the cumulative impacts analysis.

2. Golden State Hydrogen plant

The Golden State Hydrogen project, some 60 miles north of the CTV I Project, was approved on January 30, 2024, when the Tulare County Board of Supervisors issued a Notice of Exemption.[510] As discussed above, the plant operating statement contemplates sending its

[505] Draft EIR, Vol. 1 at 3-43 (Table 3-8).
[506] PLN23-00800 Project Meeting, Email from Jamal Ferguson, Kern County, to Greg Brooks, *supra*.
[507] Notice of Preparation/Initial study, Elk Hills Blue Hydrogen by Lone Cypress Energy Services, LLC (Dec. 2023).
[508] CRC, *Lone Cypress CDMA*, https://www.crc.com/carbon-terravault/projects/lone-cypress-cdma/default.aspx (last accessed Feb. 28, 2024).
[509] CRC, *California Resources Corporation Announces Carbon Dioxide Management Agreement For CTV's First Permanent Carbon Storage Project* (Dec. 7, 2022), https://www.crc.com/news/news-details/2022/California-Resources-Corporation-Announces-Carbon-Dioxide-Management-Agreement-For-CTVs-First-Permanent-Carbon-Storage-Project/.
[510] Notice of Exemption No.., CEQ 23-013 - Golden State Hydrogen Plant Pixley, *supra.*

liquified CO_2 for sequestration at the CTV I Project.[511] The Draft EIR fails to even mention this project, and as discussed above, except for an obscure mention of truck travel in the project description section, fails to discuss or analyze any impact of trucking CO_2 into the Project.

This project is clearly a "probable future project," as it is now beyond the environmental review stage. Because this project was approved using a CEQA exemption, it did not go through any meaningful environmental analysis, which makes a proper cumulative impact analysis even more crucial.

3. Projects with a CDMA for carbon sequestration at CTV I

As discussed above, the CTV I Project is dependent on CO_2-sending industries. Therefore, the most significant aspect of cumulative analysis for the Project is the facilities that will send their CO_2 for sequestration. According to CRC's website, a number of Carbon Dioxide Management Agreements (CDMAs) were already entered into with multiple corporations. All the projects that have entered into a CDMA should be included in the cumulative impact analysis.

These projects include, at a minimum: a new renewable dimethyl ether (rDME) production facility by InEnTec, Inc. (CDMA from May 2023), a renewable gasoline plant by Verde Clean Fuels (CDMA from July 2023), and a waste-to-energy production facility by NLC Energy (CDMA from November 2023). All these projects are planned to be co-located at Elk Hills.[512] Moreover, and importantly, several of these projects contemplate CRC, CTV, or affiliated companies possessing an "equity stake" in the CO_2-sending facilities.[513] As the Project proponent has noted publicly, these projects "play an important role within Carbon TerraVault's strategy" in developing the Project.[514]

The result of the Draft EIR's failure to properly account for cumulative projects is that the Draft EIR's cumulative analysis is deeply flawed. Once an agency has a set of projected projects, CEQA requires it to include a summary of the environmental impacts expected to be

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[511] Operating Statement – Golden State Hydrogen Plant Project, *supra*, at 9.
[512] CRC, *Carbon TerraVault Vaults*.
[513] CRC, *Carbon TerraVault Provides Second Quarter 2023 Update* ("CTV JV and Verde are discussing CRC's potential financial participation in the RG facility, including potentially a significant equity stake"); CRC, *Carbon TerraVault Announces Two New Storage-Only Carbon Dioxide Management Agreements and Submission of Another Class VI Permit to the EPA* (May 1, 2023), https://www.crc.com/news/news-details/2023/Carbon-TerraVault-Announces-Two-New-Storage-Only-Carbon-Dioxide-Management-Agreements-and-Submission-of-Another-Class-VI-Permit-to-the-EPA/default.aspx ("CTV and InEnTec are discussing CRC's potential financial participation in the rDME facility, including potentially a significant equity stake").
[514] CRC, *Carbon TerraVault Provides Third Quarter 2023 Update* (Nov. 1, 2023), https://www.crc.com/news/news-details/2023/Carbon-TerraVault-Provides-Third-Quarter-2023-Update/default.aspx ("This project highlights the value proposition of our CTV Clean Energy Park and its important role within Carbon TerraVault's strategy," said Francisco Leon, CRC's President and Chief Executive Officer. "We welcome NLCE as a trusted partner in developing and furthering California's decarbonization efforts and supporting Kern county's ambitions to become the leading carbon sequestration area in the state.").

produced by those projects and an analysis of whether the impacts are cumulatively considerable.[515]

The description and analysis of cumulative impacts should reflect their severity and the likelihood of their occurrence.[516] While this analysis does not have to go into the same details as the primary analysis of the pProject's impacts, it still must be reasonable and show a good faith effort to disclose the impact.[517] As described under each impact area section in these comments, the Draft EIR does not provide any meaningful analysis of the cumulative impacts of the projects, and ignores even the projects it lists as cumulative projects in Table 3-8.

The Draft EIR must be revised to include an adequate cumulative impacts analysis that includes all the projects it lists as cumulative projects, and all the probable future projects discussed above.

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For the reasons set forth above, we urge the County to re-do its analysis, prepare and circulate a revised Draft EIR, and, ultimately, reject the CTV I Project.

We reserve the right to identify new issues, provide additional information, and propose additional mitigation measures during the County's ongoing decisionmaking process for the CTV I Project.

If you have any questions about the foregoing comments, you may reach out to any of us directly or contact the Earthjustice contacts listed below, who helped prepare this submission.

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[515] CEQA Guidelines, § 15065(a)(3).
[516] CEQA Guidelines, §15130(b); *City of Long Beach v. Los Angeles Unified Sch. Dist.* (2009) 176 Cal.App.4th 889.
[517] *Citizens for Open Gov't v. City of Lodi* (2012) 205 Cal.App.4th 296, 320.

Respectfully submitted,

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ATTACHMENT A

Comment on the Air Quality and Greenhouse Gas (GHG) Analysis Provided in the Draft Environmental Impact Report (SCH# 2022030180) for the Carbon TerraVault 1 (CTV1) Project in Kern County, California Proposed by California Resources Corporation, December 2023

by

Dr. Ranajit (Ron) Sahu[1]

I provide the following technical comments based on my review of the air quality and GHG analyses provided for the proposed CTV1 project in the DEIR. The lead agency for the EIR is Kern County's Planning and Natural Resources Department (Mr. Keith Alvidrez).

The figure below, taken from the DEIR shows the two dis-jointed parcels (at the surface) where the proposed project will be implemented.

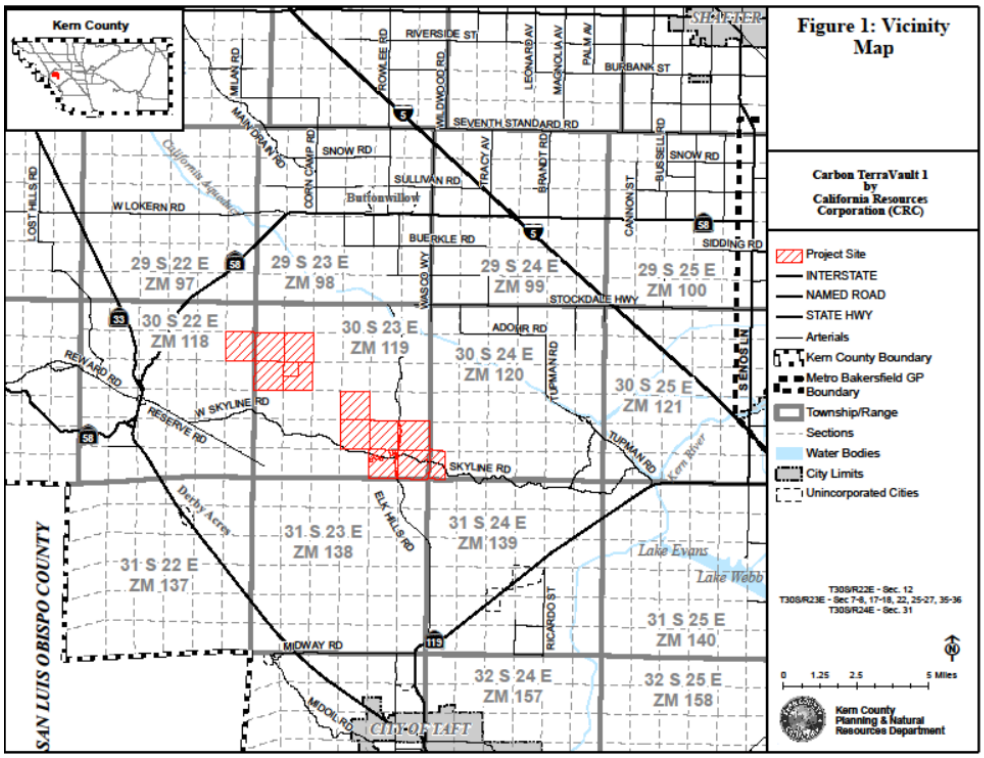

Figure 1: Regional Vicinity Map

[1] Resume provided in Attachment A.

My comments are based on information provided in the body of the DEIR (in Volume 1) and Appendix B (in Volume 2, specifically the report prepared by Trinity Consultants[2]) which contains the supporting information on the air quality and GHG analyses. My comments point out the deficiencies in the analysis, including the lack of support or rationale for critical inputs which should be addressed. Given the lack of publicly available information on the proposed project, I am unable to provide an independent, alternate set of analyses and results.

Comment 0 – Inconsistent Description of the Proposed Project

Page 1-1 (Introduction) and page 3-1 (Project Description) of the DEIR state:

> The Carbon TerraVault I (Kern County) Project (CTV I) proposed by California Resources Corporation (CRC, or project proponent) would request the approval of multiple Conditional Use Permits (CUPs)…for the construction and operation of an approximately 9,130-acre carbon capture and storage (CCS) facility with related capture facilities and pipeline for the initial source and request associated Zone Change Case (ZCC) No. 5, Map 119 and ZCC No. 4, Map 120 from A-1 (Limited Agriculture) to A (Exclusive Agriculture) on approximately 6,160 acres."[3]

Appendix B.1 of the DEIR states that:

> "…[T]he Project will involve a 5,332-acre carbon capture and sequestration field, associated sequestration injection wells and related improvements for storage of Carbon Dioxide (CO_2)."[4]

Yet, later in the same document, it states that:

> "[T]he Carbon TerraVault 1 Carbon Capture and Sequestration Project is consideration of the approval of multiple Conditional Use Permits (CUP) (CUP No. 13, Map no. 118, CUP No. 5, Map 119, CUP No. 3, Map 120) and related changes in zoning designations (ZCC No.5, Map No.118, ZCC No. 5, Map 119, ZCC No. 4, Map 120 for the construction and operation of a 7,385.67 acre carbon capture and storage (CCS) facility, with associated Class VI Underground Injection Control (UIC) wells, 13 miles of facility pipeline for capture from the pre-combustion gas and related infrastructure improvements for the capture, transfer, and storage of CO_2."[5]

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[2] DEIR, Appendix B.1. Air Quality Impact Analysis, May 2023 (revised November 2023), prepared by Trinity Consultants.

[3] DEIR, pages 1-1, 3-1.

[4] DEIR, Appendix B.1, p. 1-1. (emphasis added)

[5] DEIR, Appendix B.1, Section 2.2. (emphasis added)

Please clarify the discrepancies between the three very different acreages noted above.

Comment 1 – Missing Details and Energy/Air Quality Impacts of the Carbon Capture System

The DEIR contains no engineering information about specific design and/or details regarding the operations of the carbon capture (CC) system that is/will be implemented at the Elk Hills power plant or at the existing cryogenic and fractionation natural gas plant (CGP-1) facility (or any other sources of GHG) before those emissions are then managed, ultimately being injected into geologic formations for sequestration.

As an example, while CC systems naturally involve additional equipment such a blowers and ductwork, which incur energy penalties in order to operate, the DEIR does not provide the details supporting the approximately 31 MW per year[6] of energy it estimates that will be needed to operate the CC facilities and associated equipment.

In addition, while the DEIR notes that the energy/power needed to operate the CC facilities would be sourced from the Elk Hills Power Plant, it does not discuss how this additional power generation will change the load factor and other operating characteristics of the power plant. The DEIR, in summary fashion at Appendix B.1, simply states that "…[T]he Elk Hills Power Plant provides about one third of its power to the oilfield for operations and the remainder is distributed to the California power grid via the Pacific Gas and Electric (PG&E) substation in Buttonwillow." It does not discuss how the additional power/energy needed by the proposed CC facilities would be accommodated by the Elk Hills power plant. I note that the DEIR simply assumes that the power plant will continue to operate at an annual (and constant) capacity factor of 93%[7] for every single year of the 30 year duration of the proposed project. The justification for this capacity factor and whether or not it includes the additional energy needed for the CC system is not clear. That should be clarified.

In addition, given that the expected duration of the proposed project is 30+ years, it is presumed that the Elk Hills Power Plant will need to operate for the next three decades to support the project, whether or not the plant would have continued to run for all this additional time into the future without the project. As it stands, the Elk Hills Power Plant is approximately 20 years old already. So, that means the proposed project would require the power plant to operate till it is 50+ years old. Without significant additional investments to extend the life of the power plant, it is likely that the Elk Hills power plant would have shut down but for the proposed project. The DEIR

[6] DEIR, p. 4.6-15.

[7] DEIR, Appendix B, tables on pdf pages 310-311.

should address whether or not the proposed project enables the life extension of the Elk Hills power plant and the impacts of any such extension.

Comment 2 – Cursory and Missing Aspects of GHG Leakage

There is little to no detail on the leakage of GHGs, including but not limited to the various types of potential leakage of CO_2 from different aspects of the entire project.

While the DEIR makes a gross assumption that the GHG capture will be 95%,[8] it is not clear if, therefore, the remaining 5% uncaptured GHG is presumed to be an annual leakage level for the duration of the project. If so, what specifically is included in this 5% leakage is not discussed. That should be clarified.

It appears however, that, at best, this uncaptured GHG might include losses during capture of the power plant's exhaust as well as certain fugitive losses in processing the exhaust waste gases containing GHG to and through the amine system, followed by its conveyance to the injection wells. Importantly, three additional potential loss mechanisms and their GHG losses (and associated leakage) do not appear to have been addressed or quantified:

(i) GHG losses associated with ruptures or failures of the additional new pipelines or pipeline components proposed as part of the project. Given the large geographic extent of CTV1, including the gathering and injection infrastructure and given the assumed three decades of operation, such failures are quite likely;

(ii) GHG losses associated with the maintenance of equipment, including "blowdown" or similarly necessary emissions in order to allow for proper preventive maintenance. Pipeline maintenance typically requires evacuation of pipeline sections in order to safely effect such maintenance. Such evacuation necessitates "blowdown" of the gas contained in the pipeline sections. Unless otherwise gathered or captured – which is not discussed in the DEIR – these events can result in emissions of waste gases, containing GHG and other pollutants to the atmosphere; and

(iii) GHG losses from the geologic formation itself due to the injected GHG/CO_2.[9] While the DEIR generally admits that there could be potentially significant leakage[10], the DEIR does not provide any details including the probabilities of such leakage, the circumstances

[8] Curiously, in Section 4.11 of Appendix B.1, this 95% capture is at the amine units. Why that is the case is not clear. The DEIR should clarify.

[9] DEIR, Appendix B.1, Section 2.2 notes that annually 1.5 million metric tons of CO_2 will be injected, with an overall total project injection of 48 million metric tons. This is roughly a 32 year time period.

[10] For example, DEIR at p. 4.8-26.

under which such leakage may occur, or any quantification of the leakage.

The DEIR does include a few monitoring wells but the logic of their placement (including depths) in the various locations and how just the small number of proposed monitoring wells will provide enough assurance that GHG once injected will not migrated from the intended injected formation, is not provided and is not supported by evidence. This un-sequestered GHG migration may not just be towards the surface (i.e., vertically upwards) but also laterally and even downwards from the formation, eventually manifesting themselves as leakage to the surface. While the timing of this subsurface leakage mechanisms may not occur just during the presumed thirty or so year project period (and its GHG accounting of the benefits of sequestration), that does not mean that leakage after (or long after) the thirty or so year time period should simply be assumed to be zero, with little to no support and little to no verification.

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The remainder of my comments address specifics about the air quality and GHG analyses presented in the DEIR. For air quality, I focus mainly on the discussion provided in Chapter 4.3 (specifically Sections 4.3.4 and 4.3.5) and Appendix B (specifically Appendix B.1 – the Trinity Consultants report, from which much of the analysis in the body of the DEIR is drawn from), including certain mitigation measured proposed in the DEIR. For GHG, I have reviewed the analysis presented in Section 4.8 of the DEIR and also in Appendix B. I have also reviewed Appendix F in Volume 2 relating to a site-specific risk assessment.

Comment 3 – Air Quality Emissions Estimates

It is crucial that an air quality analysis fully support the assumptions underlying its emissions estimates, as those assumptions and resulting emissions estimates ultimately affect the DEIR's assessment of project impacts and feasible mitigation.

This is true for all types of air pollutants (i.e., criteria pollutants, air toxics or hazardous air pollutants, and GHG) and from all potential emissions generating sources and activities of the proposed project, including both construction and operational phases.

While it is customary in conducting EIR-type air quality analyses to rely on "standard" models to develop emission estimates as has been done in this DEIR,[11] those models typically only have emission factors (i.e., mass of emissions of pollutant X from a source Y – like piece of fuel-burning

[11] DEIR, Section 4.3.4.

equipment, for example). That such standard models have been used in the present instance is confirmed by the DEIR:

> "[T]he construction and operational emissions were estimated from several emissions models and associated spreadsheet calculations, depending on the source type and data availability. The primary emissions models used included CARB's on-road vehicle emission factor model (EMFAC) version 2021 and the California Emissions Estimator Model (CalEEMod) version 2021.1.13." In addition, the DEIR states that "[T]he capture facilities (new amine unit valve) fugitive emissions have been quantified using the California Implementation Guidelines for Estimating Mass Emissions of Fugitive Hydrocarbon Leaks at Petroleum Facilities…"[12]

The user of the model or the analyst has to input the corresponding activity factor (i.e., how many and what types of equipment, of what sizes, hours of usage, etc.) in order to run the model and obtain estimates of the mass of emissions (i.e., pounds or tons) from those activities over the desired time period (hours, days, weeks, year, etc.).

An accurate analysis and robust evaluation of impacts is especially important here given that the proposed project will be located in an area that is already non-attainment for several criteria pollutants including: ozone (Federal and State); PM_{10} (State); and $PM_{2.5}$ (Federal and State).[13] I should note also that, for $PM_{2.5}$, the EPA has now proposed to make the primary (i.e., health based) annual National Ambient Air Quality Standard (NAAQS) more stringent from its current level of 12 ug/m^3 to a range between 9 – 10 ug/m^3, reflecting the current science on adverse health impacts of this zero-threshold air pollutant.[14] The adoption of the stricter standard means that the air quality in the area is even more unhealthy than understood previously and even further from attaining the health-based NAAQS than acknowledged in the DEIR.

Comment 3.1 – Emission Factors and Errors

I should note for the record that just because the "standard" models incorporate emission factors for various pollutants and for various types of equipment and activities, that does not mean that those emission factors do, in fact, accurately or conservatively represent the emissions of the respective pollutants from specific equipment and specific activities that are part of the project.

[12] *Id.*

[13] DEIR, Table 4.3-2.

[14] https://www.epa.gov/newsreleases/epa-proposes-strengthen-air-quality-standards-protect-public-harmful-effects-soot

First, there are issues of representativeness of the emission factors, especially as they apply to not just new equipment but also to older equipment and the inevitable deterioration of their emissions (including deterioration of any air pollution controls) over time. This specifically applies to the emission factors that are included as part of the "standard" models used to develop emission estimates as noted prior.

Second, there are always issues of precision and error in emission factors (and activity factors, which I discuss later) and the resultant emissions estimates. The emissions estimates in the DEIR in many instances provide values to many significant digits (i.e., implying greater – and false – precision than warranted), thereby misleading the reader as to the accuracy of the air quality emissions estimated. The DEIR contains no estimates of the errors in any of the calculations. In fact, a proper analysis should provide some guidance of the error (or the range) of the emissions as opposed to misleadingly precise estimates for the reader. The DEIR fails completely on this score. To meaningfully inform the public and decision makers, the DEIR should quantify and disclose uncertainties in the emissions estimates.

Comment 3.2 – "Existing" Air Quality Information is Dated And May Not Be Representative

Section 3.2 of Appendix B.1 summarizes "existing" air quality – i.e., ambient monitoring concentrations of several pollutants. Yet, even though the report in Appendix B.1 was revised in November 2023, this "existing" ambient data is only provided for the years 2019 through 2021. Further, the description misleadingly states that these are "the last three years." Clearly that is not the case since no data is provided for 2022. There is also no mention of why 2022 data could not have been reported. That should be fixed. Notably, quality-assured data from 2022 is readily available.[15]

I also note that this "existing" three-year time period of 2019-2021 was substantially impacted by COVID-19 for the years 2020 and 2021. As such, due to changes in economic activities including transportation patterns, and many other factors, it is not assumable, without further discussion, that this impacted three-year period is representative of "existing" air quality. I suggest that a broader time period, say, 5 or even more years, including 2022, be included to describe existing air quality, with comments, as necessary, on any patterns in the data.

Comment 3.3 – None of the Assumptions Made For Estimating Project-Related Emissions Are Supported by Any Justification and/or Rationale

[15] See, https://www.arb.ca.gov/aqmis2/display.php?param=OZONE&units=007&statistic=DAVG&year=2022&mon=12&day=31&county_name=15-Kern&basin=--AIR+BASIN--&latitude=--PART+OF+STATE--&report=7DAY&order=basin%2Ccounty_name%2Cs.name&submit=Retrieve+Data&ptype=aqd&std15=

I will provide examples of these unsupported assumptions in this comment. I also note, that in each instance, there is no verification of any of these assumptions proposed in the DEIR either.

(i) for short-term construction emissions, it is assumed that the construction schedule will be 11 days per well pad, 18 days per well, 2 years for the capture facilities, and 1 year for the pipelines (later noted as 220 days). None of these timelines are supported.

Specifically, Table 4-12 in Appendix B.1 shows the details of the wells to be constructed/repurposed as part of the project. It is excerpted below for easy reference.

Table 4-12. Total Emissions on a Per Well Basis

Well Name	Description	Depth (ft)	Emissions (Tons)
26R Reservoir			
363C-27R	Injector	6290	4.55
353XC-35R (new)	Injector	6390	4.55
373-35R (new)	Injector	7010	5.36
345C-35R (new)	Injector	5690	3.98
341-27R	Plume monitoring	6981	4.55
328-25R	Plume monitoring	5268	3.98
376-36R	Plume monitoring	5832	3.98
355X-26R	Above-zone monitoring	4063	2.35
USDW Monitoring (new)	USDW monitoring	400	1.28
A1/A2 Reservoir			
355-7R	Injector	8387	6.17
357-7R	Injector	8420	6.17
353A-7R	Plume monitoring	8773	6.17
335X-7R	Plume monitoring	8737	6.17
327-7R-RD1	Above-Zone monitoring	3782	2.03
345-7R	A3+ Monitoring	8904	6.17
388X-7R	A3+ Monitoring	8800	6.17
342-17R	A3+ Monitoring	8844	6.17
USDW Monitoring (new)	USDW monitoring	740	1.28
Total			**81.08**

I note that the well depths, excluding the groundwater monitoring wells, in Table 4.12 range from as low as 3782 ft to as high as 8904 feet. Given this wide range of well depths and many other depths noted in Table 4-12, it makes no sense to presume that there will be 18 days required to construct each well. If the intent is to presume that 18 days is the "average" for all wells/various depths noted above, that should be justified. Clearly, the wells in the A1/A2 reservoir will be drilled to deeper depths as compared to the wells in the 26R reservoir. Since they are not expected to be drilled all at once, the construction schedule for the wells should be provided in greater detail, along with supported construction durations.

In addition, it is not clear how the well depths in Table 4-12 were so precisely estimated, right down to the last foot (for example, 6981 feet, 4063 feet, etc.). Please provide the rationale since the depths will affect construction timelines.

(ii) Section 4.2.1 of Appendix B.1 contains a number of mobile source activity assumptions. These include: a 40-mile trip distance; 160 average daily trips (ADTs) for workers during construction; 32 ADTs by 1-ton trucks and 20 ADTs using 5-ton trucks, in addition to 8 water trucks; 16 ADTs by workers and 2 ADTs by vendors during well pad construction; and 12 ADTs by workers and 10 ADTs by vendors during well construction. There is no justification provided for any of these assumptions. Thus, the emission estimation approach is nothing more than an algebraic exercise. As a simple example, it is not clear why there should be a 40-mile trip distance for both workers and vendors. Also, since there is no description of the work that will be done during construction of the well pad and the well, there is no context for understanding if the assumed numbers of workers/vendors, as well as equipment proposed, makes any sense.

These types of assumptions should be supported by actual data that is undoubtedly available to the project proponent since these are not the first well pads nor first wells that are going to be drilled in this area.

(iii) Similarly, there are numerous assumptions about the types, numbers, and operating hours of various construction equipment that will be used in developing the construction emissions. These are inputs to the emissions calculations in the standard models used to develop those estimated. I have excerpted Tables 4-3 through 4-6 from Appendix B.1 below that contain these assumptions.

Table 4-3. Facilities Construction Equipment

Equipment	CalEEMod Equipment Designation	Quantity	Total Operating Hours per	Average Daily Operating Hours
Hydro Crane	Cranes	5	1968.75	3.8
ForkLift	Forklifts	7	1968.75	3.8
Excavator	Excavators	1	1968.75	3.8
Backhoe	Tractors/Loaders/Backhoes	4	1968.75	3.8
Air Compressor	Air Compressors	20	246.09	0.5
Crane	Cranes	3	246.09	0.5
Loader	Rubber Tired Loader	3	246.09	0.5
Dozer	Rubber Tired Dozers	1	1968.75	3.8
Dump Truck	Off-Highway Trucks	2	1968.75	3.8
Welding Truck	Welders	8	1968.75	3.8

Table 4-4. Pipeline Construction Equipment

Equipment	CalEEMod Equipment Designation	Quantity	Average Daily Operating Hours
Crane	Cranes	3	5.0
Boom Truck	Other Construction Equipment	3	5.0
Crane	Cranes	3	2.5
Side Boom	Other Construction Equipment	6	5.0
Bending Machine	Other Material Handling Equipment	1	2.5
Air Compressor	Air Compressors	4	5.0
Air Compressor	Air Compressors	1	2.5
Welding Machines	Welders	8	5.0
DitchWitch	Off-Highway Trucks	1	2.5
Vacuum Truck	Other Construction Equipment	2	2.5

Table 4-5. Well Pad Construction Equipment (Per Well)

Equipment	CalEEMod Equipment Designation	Quantity	Total Operating Hours per	Average Daily Operating Hours
Grader	Graders	1	16	1.5
Front Loader	Tractors/Loaders/Backhoes	1	40	3.6
Excavator	Excavators	1	32	2.9
Water Truck	Other Construction Equipment	1	40	3.6

Table 4-6. Well Drilling Construction Equipment (Per Well)

Equipment	CalEEMod Equipment Designation	Quantity	Total Operating Hours per	Average Daily Operating Hours
Forklift	Forklifts	1	72.0	4.0
Drilling Rig Motor	Bore/Drill Rigs	1	275.4	15.3
Drilling Rig Motor	Bore/Drill Rigs	1	322.2	17.9
Drilling Rig Motor	Bore/Drill Rigs	1	216.0	12.0
Small Generator	Generator Sets	1	8.0	0.4
Light Tower	Generator Sets	2	216.0	12.0
Water Truck	Other Construction Equipment	1	144.0	8.0
Vacuum Truck	Other Construction Equipment	1	432.0	24.0

The DEIR/Appendix B.1 should provide justifications for the equipment type, the numbers of each equipment, and the expected operating hours in each instance. It is also clear that the operating hours are provided with a high degree of precision, with no rationale. For example, 3.8 hours of operation per day for several types of equipment (along with the equally precise annual operating hours (246.09, 1968.75), in Table 4-3. What is the basis of such precision? Similar comments also apply to the other tables above.

(iv) Long-term, i.e., operational emissions are discussed in Section 4.2.2 of the Appendix B.1 for fugitive (dust) emissions (Section 4.2.2.1) and mobile sources (Section 4.2.2.2). However, fugitive dust emissions are simply not quantified. Instead it is noted that these are "…not expected to present a substantial source of fugitive dust (PM_{10}) emissions…" What is the basis for this conclusionary assertion, with no supporting data or calculations?

In addition, the DEIR presumes that the main source of PM_{10} emissions would be from vehicular traffic associated with the project.[16] While this is true, PM_{10} also results from soil disturbance associated with land grading, including stockpiling of soils and also from the storage of other erodible construction materials.

Further, the DEIR does not address fugitive $PM_{2.5}$, for which the area is non-attainment at present and likely to be even more so when the NAAQS for $PM_{2.5}$ is revised downward per EPA's current proposed, as noted prior.

(v) As for mobile source exhaust emissions during operations, like in the case of construction, the DEIR/Appendix B.1 makes numerous unsupported assumptions, with the exception of a reference to a traffic study estimating 20 ADTs from workers. However, other assumptions such as: the 40-mile trip distance; the assumption for 10 additional workers; the complete lack of any vendor-related trips or emissions are not justified or

[16] DEIR, p. 4.3-65.

supported at all. The DEIR should provide that support or revise as needed. The DEIR should provide the justification for why no vendor support would be needed as operational support for the various injection and monitoring wells.

(vi) In addition to the fugitive and mobile source emissions during operations, the only stationary source emissions included in the analysis are from fugitives from component leaks from the two new amine units that will be installed are estimated (in Table 4-11 of Appendix B.1) using the previously mentioned Implelentation Guidelines for Estimating Mass Emissions of Fugitive Hydrocarbon Leaks at Petroleum Facilities. However, the applicability of these estimates for "petroleum facilities" to the amine units is not clear. Please provide the justification. Also, please clarify what fractions of the components of each type are expected to be "leakers" at different levels of assumed leakage, i.e., 50 ppm, 100 ppm, 250 ppm, 500 ppm, 1000 ppm, 10,000 ppm, etc. And, how these leakers have been included (or not) in the current calculations.

(vii) Previously, I have excerpted Table 4-12 showing the depths of the 18 new wells that will be drilled, for the various purposes shown in that table. In connection with the drilling schedule, I have also provided a comment about the precisions of the well depths noted in Table 4-12. In addition, I have additional comments/questions:

- First, I note that the DEIR provided no justification provided for the well depths for just/only the two above-zone monitoring wells (i.e., one for each reservoir) noted in that table.
- Second, the DEIR provides no justification (geologic or otherwise) for the depths of these two monitoring wells, that are approximately 2000 feet or higher than the reservoirs themselves.
- Third, the DEIR does not state how such a single monitoring well will be placed exactly where some leakage might manifest itself, given the vast area/acreages in each reservoir.
- Finally, the DEIR does not discuss or address potential leakages that may occur from the formation in directions other than vertically, such as initially laterally or even downward from the formations, later finding their way to the surface. The DEIR does not address how these potential leakage paths will be monitored.

In sum, it appears that, at least as far as the monitoring of the injection/sequestration at each reservoir is concerned, there are too few wells. Of course including additional wells, at justified and proper depths, will increase construction (and operational) emissions that have not been properly included in the DEIR.

Comment 4 – Mitigation Measures

As an overall comment, none of the mitigation measures for air quality and GHG have verification or monitoring requirements that would provide even reasonable confidence that: (i) the proposed measures are, in fact, being implemented as promised in the DEIR; and (ii) that even if they are being implemented, their effectiveness is similar to that claimed. This includes, for example, monitoring to quantify GHG leakages via the various pathways and sources previously discussed as well as monitoring to address emissions of criteria and air toxic air pollutants from the facilities that are part of the proposed project.

Comment 4.1 – Emission Reduction Agreements and Their Limitations As Proposed Mitigation

The DEIR states repeatedly that, as mitigation, the proposed project will avail itself of a Development Mitigation Contract (DMC) or Voluntary Emission Reduction Agreement (VERA) to address the project's criteria pollutant emissions of NO_x, reactive organic compounds (ROGs) and particulate matter (PM). The goal is to "fully mitigate the project's air quality impacts such that development of the project could be considered to result in no net increase in the designated criteria pollutant emissions over the criteria pollutant emissions that would otherwise exist without the development of the project, all to be verified by the SJVAPCD." In addition, Section 4.10 of Appendix B.1 also makes a similar claim, justifying the lack of any air quality impact (or modeling).

First, this entire construct does not work if the emissions from the project are not properly estimated and/or verifiably and accurately measured. Without such accurate measurements, the amount of mitigation, to achieve "no net increase" using the DMC or similar mechanism is meaningless. Yet, there is nothing in the DEIR that provides any assurance of actual measurements of even these criteria pollutants from each of the project's activities.

Second, as noted in the DEIR, the DMC does not extend to other pollutants, including additional criteria pollutants such as carbon monoxide (CO) or sulfur dioxide (SO_2).

The DMC also does not extend to any of the air toxic compounds that will be emitted as a result of combustion sources and the amine system used for CO_2 concentration. This is true for such air toxics emissions during construction and operations.

Since none of the mitigations identified contain any verifiable measures of their effectiveness and the emissions estimates are simply not verifiable since no monitoring is required, there is a significant uncertainty as to the actual emissions and their impacts (mitigated or otherwise) of air toxic compounds.

Comment 4.2 – Lack of Verification and Effectiveness of PM_{10} Reduction Measures

These are listed in Mitigation Measure 4.3-2. I will not repeat all/both of them for the sake of brevity. But every single item on these lists is simply a promise, with no recordkeeping or

verification. At a minimum, such record-keeping and verification should be included in as part of an enforceable mitigation monitoring plan for PM_{10} (and $PM_{2.5}$) reduction.

Comment 4.3 – The 4,000-foot Setback in MM 4.3-5 Should Be Expanded, as Needed

A reasonable setback distance from any injection well to sensitive receptors is necessary. The DEIR proposes that the setback be 4,000 feet but provides no explanation for this distance.

However, while MM 4.3-5 addresses the setback from injection wells, it is not clear why similar setback distances are not also proposed for other physical infrastructure like pipelines, from which ruptures can cause CO_2 to also escape and could result in adverse impacts to humans and wildlife. For example, if any pipeline passes through a topographically low area, any CO_2 that might escape can accumulate locally and cause adverse impacts. For these reasons, setbacks should be provided from all physical infrastructure associated with the proposed project, based on a site-specific factors such as the locations of such infrastructure and nearby receptors in order to meet CEQA's requirement to provide all feasible mitigation for significant impacts.

Comment 4.4 – MM 4.3-7 and Additional Details of Fence Line Monitoring

While I agree with the goal of MM 4.3-7 that an Air Monitoring program for fence line monitoring of all air constituents generated by the CCS project – including but not limited to criteria pollutants, CO_2, and H_2S – should be developed and implemented, MM 4.3-7 provides no details of how such fence line monitoring will occur. Even basic details of whether this will consist of periodic sampling at specific locations along the fence line (of, say, a well pad; or near the amine units, etc.) or continuous open-path measurements along the entire perimeter of such locations, is not provided in the DEIR. Without this, and additional detail, the efficacy of MM 4.3-7 is not clear. The DEIR should provide additional details, like, for example: (i) specific monitoring parameters (e.g., spacing of monitors, equipment sensitivity, frequency of monitoring) and/or performance standards to be used to select monitoring parameters; (ii) requirements for reporting monitoring results to the County and responsible agencies and for public disclosure of monitoring data and/or performance standards to be used to develop reporting and public disclosure requirements; (iii) any threshold levels (by pollutant) that, if detected at the fence line, will trigger mitigation and/or performance standards to be used to select appropriate thresholds for mitigation; and (iv) mitigation measures to be implemented if monitoring thresholds are exceeded and/or performance standards to be used to select effective mitigation measures.

Attachment A
to Technical Comments of Dr. Ranajit (Ron) Sahu:
Qualifications and Experience

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EXPERIENCE SUMMARY

Dr. Sahu has over thirty two years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment for a wide range of emissions sources including stationary and mobile sources; soils and groundwater remediation including landfills as remedy; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

He has over thirty years of project management experience and has successfully managed and executed hundreds of projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past three decades include various trade associations as well as individual companies such as steel mills, petroleum refineries, chemical plants, cement manufacturers, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, land development companies, and various entities in the public sector including EPA, the US Dept. of Justice, several states (including New York, New Jersey, Connecticut, Kansas, Oregon, New Mexico, Pennsylvania, and others), various agencies such as the California DTSC, and various cities and municipalities. Dr. Sahu has executed projects in all 50 US states, numerous local jurisdictions and internationally.

In addition to consulting, for approximately two decades, Dr. Sahu taught numerous courses in several Southern California universities as adjunct faculty, including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management). He also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental and engineering areas discussed above in both state and Federal courts as well as before administrative bodies (please see Annex A).

EXPERIENCE RECORD

2000-present **Independent Consultant.** Providing a variety of private sector (industrial companies, land development companies, law firms, etc.), public sector (such as the US Department of Justice), and public interest group clients with project management, environmental

consulting, project management, as well as regulatory and engineering support consulting services.

1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for** Air Quality/Geosciences/Hazardous Waste Groups, Pasadena, CA.

Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.

1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department.

1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department.

1989-1990 Kinetics Technology International, Corp. **Development Engineer.** Involved in thermal engineering R&D and project work related to low-NOx ceramic radiant burners, fired heater NOx reduction, SCR design, and fired heater retrofitting.

1988-1989 Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1984 M. S., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.

"Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.

“Thermodynamics and Heat Transfer,” Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

"Advanced Hazardous Waste Management" University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

"Environmental Risk Assessment," Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 1998.

"Hazardous Waste Remediation" Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

"Environmental Planning and Management," 5 week program for visiting Chinese delegation, 1994.

"Environmental Planning and Management," 1 day program for visiting Russian delegation, 1995.

"Air Pollution Planning and Management," IEP, UCR, Spring 1996.

"Environmental Issues and Air Pollution," IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-mid-1990s.

Air and Waste Management Association, West Coast Section, 1989-mid-2000s.

PROFESSIONAL CERTIFICATIONS

EIT, California (#XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, 2000 - 2021.

CEM, State of Nevada (#EM-1699).

PUBLICATIONS (PARTIAL LIST)

"Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).

"Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).

"On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).

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"Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).

"A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).

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"Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.

"Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).

"HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).

"Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).

"Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).

"NOx Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).

“From Purchase of Landmark Environmental Insurance to Remediation: Case Study in Henderson, Nevada,” with Robin E. Bain and Jill Quillin, presented at the AQMA Annual Meeting, Florida, 2001.

"The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants," with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

PRESENTATIONS (PARTIAL LIST)

"Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).

"Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).

"Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).

"Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AAEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

Annex A

Expert Litigation Support

A. Occasions where Dr. Sahu has provided Written or Oral testimony before Congress:

1. In July 2012, provided expert written and oral testimony to the House Subcommittee on Energy and the Environment, Committee on Science, Space, and Technology at a Hearing entitled "Hitting the Ethanol Blend Wall – Examining the Science on E15."

B. Matters for which Dr. Sahu has provided affidavits and expert reports include:

2. Affidavit for Rocky Mountain Steel Mills, Inc. located in Pueblo Colorado – dealing with the technical uncertainties associated with night-time opacity measurements in general and at this steel mini-mill.

3. Expert reports and depositions (2/28/2002 and 3/1/2002; 12/2/2003 and 12/3/2003; 5/24/2004) on behalf of the United States in connection with the Ohio Edison NSR Cases. *United States, et al. v. Ohio Edison Co., et al.,* C2-99-1181 (Southern District of Ohio).

4. Expert reports and depositions (5/23/2002 and 5/24/2002) on behalf of the United States in connection with the Illinois Power NSR Case. *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

5. Expert reports and depositions (11/25/2002 and 11/26/2002) on behalf of the United States in connection with the Duke Power NSR Case. *United States, et al. v. Duke Energy Corp.*, 1:00-CV-1262 (Middle District of North Carolina).

6. Expert reports and depositions (10/6/2004 and 10/7/2004; 7/10/2006) on behalf of the United States in connection with the American Electric Power NSR Cases. *United States, et al. v. American Electric Power Service Corp., et al.*, C2-99-1182, C2-99-1250 (Southern District of Ohio).

7. Affidavit (March 2005) on behalf of the Minnesota Center for Environmental Advocacy and others in the matter of the Application of Heron Lake BioEnergy LLC to construct and operate an ethanol production facility – submitted to the Minnesota Pollution Control Agency.

8. Expert Report and Deposition (10/31/2005 and 11/1/2005) on behalf of the United States in connection with the East Kentucky Power Cooperative NSR Case. *United States v. East Kentucky Power Cooperative, Inc*., 5:04-cv-00034-KSF (Eastern District of Kentucky).

9. Affidavits and deposition on behalf of Basic Management Inc. (BMI) Companies in connection with the BMI vs. USA remediation cost recovery Case.

10. Expert Report on behalf of Penn Future and others in the Cambria Coke plant permit challenge in Pennsylvania.

11. Expert Report on behalf of the Appalachian Center for the Economy and the Environment and others in the Western Greenbrier permit challenge in West Virginia.

12. Expert Report, deposition (via telephone on January 26, 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) in the Thompson River Cogeneration LLC Permit No. 3175-04 challenge.

13. Expert Report and deposition (2/2/07) on behalf of the Texas Clean Air Cities Coalition at the Texas State Office of Administrative Hearings (SOAH) in the matter of the permit challenges to TXU Project Apollo's eight new proposed PRB-fired PC boilers located at seven TX sites.

14. Expert Testimony (July 2007) on behalf of the Izaak Walton League of America and others in connection with the acquisition of power by Xcel Energy from the proposed Gascoyne Power Plant – at the State of Minnesota, Office of Administrative Hearings for the Minnesota PUC (MPUC No. E002/CN-06-1518; OAH No. 12-2500-17857-2).

15. Affidavit (July 2007) Comments on the Big Cajun I Draft Permit on behalf of the Sierra Club – submitted to the Louisiana DEQ.

16. Expert Report and Deposition (12/13/2007) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

17. Expert Reports and Pre-filed Testimony before the Utah Air Quality Board on behalf of Sierra Club in the Sevier Power Plant permit challenge.

18. Expert Report and Deposition (October 2007) on behalf of MTD Products Inc., in connection with *General Power Products, LLC v MTD Products Inc*., 1:06 CVA 0143 (Southern District of Ohio, Western Division) .

19. Expert Report and Deposition (June 2008) on behalf of Sierra Club and others in the matter of permit challenges (Title V: 28.0801-29 and PSD: 28.0803-PSD) for the Big Stone II unit, proposed to be located near Milbank, South Dakota.

20. Expert Reports, Affidavit, and Deposition (August 15, 2008) on behalf of Earthjustice in the matter of air permit challenge (CT-4631) for the Basin Electric Dry Fork station, under construction near Gillette, Wyoming before the Environmental Quality Council of the State of Wyoming.

21. Affidavits (May 2010/June 2010 in the Office of Administrative Hearings))/Declaration and Expert Report (November 2009 in the Office of Administrative Hearings) on behalf of NRDC and the Southern Environmental Law Center in the matter of the air permit challenge for Duke Cliffside Unit 6. Office of Administrative Hearing Matters 08 EHR 0771, 0835 and 0836 and 09 HER 3102, 3174, and 3176 (consolidated).

22. Declaration (August 2008), Expert Report (January 2009), and Declaration (May 2009) on behalf of Southern Alliance for Clean Energy in the matter of the air permit challenge for Duke Cliffside Unit 6. *Southern Alliance for Clean Energy et al., v. Duke Energy Carolinas, LLC*, Case No. 1:08-cv-00318-LHT-DLH (Western District of North Carolina, Asheville Division).

23. Declaration (August 2008) on behalf of the Sierra Club in the matter of Dominion Wise County plant MACT.us

24. Expert Report (June 2008) on behalf of Sierra Club for the Green Energy Resource Recovery Project, MACT Analysis.

25. Expert Report (February 2009) on behalf of Sierra Club and the Environmental Integrity Project in the matter of the air permit challenge for NRG Limestone's proposed Unit 3 in Texas.

26. Expert Report (June 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*

27. Expert Report (August 2009) on behalf of Sierra Club and the Southern Environmental Law Center in the matter of the air permit challenge for Santee Cooper's proposed Pee Dee plant in South Carolina).

28. Statements (May 2008 and September 2009) on behalf of the Minnesota Center for Environmental Advocacy to the Minnesota Pollution Control Agency in the matter of the Minnesota Haze State Implementation Plans.

29. Expert Report (August 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

30. Expert Report and Rebuttal Report (September 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

31. Expert Report (December 2009) and Rebuttal reports (May 2010 and June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

32. Pre-filed Testimony (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

33. Pre-filed Testimony (July 2010) and Written Rebuttal Testimony (August 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions*, No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

34. Expert Report (August 2010) and Rebuttal Expert Report (October 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Liability Phase.

35. Declaration (August 2010), Reply Declaration (November 2010), Expert Report (April 2011), Supplemental and Rebuttal Expert Report (July 2011) on behalf of the United States in the matter of DTE Energy Company and Detroit Edison Company (Monroe Unit 2). *United States of America v. DTE Energy Company and Detroit Edison Company*, Civil Action No. 2:10-cv-13101-BAF-RSW (Eastern District of Michigan).

36. Expert Report and Deposition (August 2010) as well as Affidavit (September 2010) on behalf of Kentucky Waterways Alliance, Sierra Club, and Valley Watch in the matter of challenges to the NPDES permit issued for the Trimble County power plant by the Kentucky Energy and Environment Cabinet to Louisville Gas and Electric, File No. DOW-41106-047.

37. Expert Report (August 2010), Rebuttal Expert Report (September 2010), Supplemental Expert Report (September 2011), and Declaration (November 2011) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (District of Colorado).

38. Written Direct Expert Testimony (August 2010) and Affidavit (February 2012) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

39. Deposition (August 2010) on behalf of Environmental Defense, in the matter of the remanded permit challenge to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

40. Expert Report, Supplemental/Rebuttal Expert Report, and Declarations (October 2010, November 2010, September 2012) on behalf of New Mexico Environment Department (Plaintiff-Intervenor), Grand Canyon Trust and Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. Public Service Company of New Mexico* (PNM), Civil No. 1:02-CV-0552 BB/ATC (ACE) (District of New Mexico).

41. Expert Report (October 2010) and Rebuttal Expert Report (November 2010) (BART Determinations for PSCo Hayden and CSU Martin Drake units) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

42. Expert Report (November 2010) (BART Determinations for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

43. Declaration (November 2010) on behalf of the Sierra Club in connection with the Martin Lake Station Units 1, 2, and 3. *Sierra Club v. Energy Future Holdings Corporation and Luminant*

Generation Company LLC, Case No. 5:10-cv-00156-DF-CMC (Eastern District of Texas, Texarkana Division).

44. Pre-Filed Testimony (January 2011) and Declaration (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

45. Declaration (February 2011) in the matter of the Draft Title V Permit for RRI Energy MidAtlantic Power Holdings LLC Shawville Generating Station (Pennsylvania), ID No. 17-00001 on behalf of the Sierra Club.

46. Expert Report (March 2011), Rebuttal Expert Report (June 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

47. Declaration (April 2011) and Expert Report (July 16, 2012) in the matter of the Lower Colorado River Authority (LCRA)'s Fayette (Sam Seymour) Power Plant on behalf of the Texas Campaign for the Environment. *Texas Campaign for the Environment v. Lower Colorado River Authority*, Civil Action No. 4:11-cv-00791 (Southern District of Texas, Houston Division).

48. Declaration (June 2011) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

49. Expert Report (June 2011) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

50. Declaration (August 2011) in the matter of the Sandy Creek Energy Associates L.P. Sandy Creek Power Plant on behalf of Sierra Club and Public Citizen. *Sierra Club, Inc. and Public Citizen, Inc. v. Sandy Creek Energy Associates, L.P.*, Civil Action No. A-08-CA-648-LY (Western District of Texas, Austin Division).

51. Expert Report (October 2011) on behalf of the Defendants in the matter of *John Quiles and Jeanette Quiles et al. v. Bradford-White Corporation, MTD Products, Inc., Kohler Co., et al.*, Case No. 3:10-cv-747 (TJM/DEP) (Northern District of New York).

52. Declaration (October 2011) on behalf of the Plaintiffs in the matter of *American Nurses Association et. al. (Plaintiffs), v. US EPA (Defendant)*, Case No. 1:08-cv-02198-RMC (US District Court for the District of Columbia).

53. Declaration (February 2012) and Second Declaration (February 2012) in the matter of *Washington Environmental Council and Sierra Club Washington State Chapter v. Washington State Department of Ecology and Western States Petroleum Association*, Case No. 11-417-MJP (Western District of Washington).

54. Expert Report (March 2012) and Supplemental Expert Report (November 2013) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.*, Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

55. Declaration (March 2012) in the matter of *Center for Biological Diversity, et al. v. United States Environmental Protection Agency*, Case No. 11-1101 (consolidated with 11-1285, 11-1328 and 11-1336) (US Court of Appeals for the District of Columbia Circuit).

56. Declaration (March 2012) in the matter of *Sierra Club v. The Kansas Department of Health and Environment*, Case No. 11-105,493-AS (Holcomb power plant) (Supreme Court of the State of Kansas).

57. Declaration (March 2012) in the matter of the Las Brisas Energy Center *Environmental Defense Fund et al., v. Texas Commission on Environmental Quality,* Cause No. D-1-GN-11-001364 (District Court of Travis County, Texas, 261st Judicial District).

58. Expert Report (April 2012), Supplemental and Rebuttal Expert Report (July 2012), and Supplemental Rebuttal Expert Report (August 2012) on behalf of the states of New Jersey and Connecticut in the matter of the Portland Power plant *State of New Jersey and State of Connecticut (Intervenor-Plaintiff) v. RRI Energy Mid-Atlantic Power Holdings et al.*, Civil Action No. 07-CV-5298 (JKG) (Eastern District of Pennsylvania).

59. Declaration (April 2012) in the matter of the EPA's EGU MATS Rule, on behalf of the Environmental Integrity Project.

60. Expert Report (August 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Harm Phase.

61. Declaration (September 2012) in the Matter of the Application of *Energy Answers Incinerator, Inc.* for a Certificate of Public Convenience and Necessity to Construct a 120 MW Generating Facility in Baltimore City, Maryland, before the Public Service Commission of Maryland, Case No. 9199.

62. Expert Report (October 2012) on behalf of the Appellants (Robert Concilus and Leah Humes) in the matter of Robert Concilus and Leah Humes v. Commonwealth of Pennsylvania Department of Environmental Protection and Crawford Renewable Energy, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2011-167-R.

63. Expert Report (October 2012), Supplemental Expert Report (January 2013), and Affidavit (June 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

64. Pre-filed Testimony (October 2012) on behalf of No-Sag in the matter of the North Springfield Sustainable Energy Project before the State of Vermont, Public Service Board.

65. Pre-filed Testimony (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

66. Expert Report (February 2013) on behalf of Petitioners in the matter of Credence Crematory, Cause No. 12-A-J-4538 before the Indiana Office of Environmental Adjudication.

67. Expert Report (April 2013), Rebuttal report (July 2013), and Declarations (October 2013, November 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

68. Declaration (April 2013) on behalf of Petitioners in the matter of *Sierra Club, et al., (Petitioners) v Environmental Protection Agency et al. (Resppondents),* Case No., 13-1112, (Court of Appeals, District of Columbia Circuit).

69. Expert Report (May 2013) and Rebuttal Expert Report (July 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

70. Declaration (August 2013) on behalf of A. J. Acosta Company, Inc., in the matter of *A. J. Acosta Company, Inc., v. County of San Bernardino*, Case No. CIVSS803651.

71. Comments (October 2013) on behalf of the Washington Environmental Council and the Sierra Club in the matter of the Washington State Oil Refinery RACT (for Greenhouse Gases), submitted to the Washington State Department of Ecology, the Northwest Clean Air Agency, and the Puget Sound Clean Air Agency.

72. Statement (November 2013) on behalf of various Environmental Organizations in the matter of the Boswell Energy Center (BEC) Unit 4 Environmental Retrofit Project, to the Minnesota Public Utilities Commission, Docket No. E-015/M-12-920.

73. Expert Report (December 2013) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

74. Expert Testimony (December 2013) on behalf of the Sierra Club in the matter of Public Service Company of New Hampshire Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250, to the State of New Hampshire Public Utilities Commission.

75. Expert Report (January 2014) on behalf of Baja, Inc., in *Baja, Inc., v. Automotive Testing and Development Services, Inc. et. al*, Civil Action No. 8:13-CV-02057-GRA (District of South Carolina, Anderson/Greenwood Division).

76. Declaration (March 2014) on behalf of the Center for International Environmental Law, Chesapeake Climate Action Network, Friends of the Earth, Pacific Environment, and the Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. the Export-Import Bank (Ex-Im Bank) of the United States*, Civil Action No. 13-1820 RC (District Court for the District of Columbia).

77. Declaration (April 2014) on behalf of Respondent-Intervenors in the matter of *Mexichem Specialty Resins Inc., et al., (Petitioners) v Environmental Protection Agency et al.,* Case No., 12-1260 (and Consolidated Case Nos. 12-1263, 12-1265, 12-1266, and 12-1267), (Court of Appeals, District of Columbia Circuit).

78. Direct Prefiled Testimony (June 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17319 (Michigan Public Service Commission).

79. Expert Report (June 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).

80. Direct Prefiled Testimony (August 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of Consumers Energy Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17317 (Michigan Public Service Commission).

81. Declaration (July 2014) on behalf of Public Health Intervenors in the matter of *EME Homer City Generation v. US EPA* (Case No. 11-1302 and consolidated cases) relating to the lifting of the stay entered by the Court on December 30, 2011 (US Court of Appeals for the District of Columbia).

82. Expert Report (September 2014), Rebuttal Expert Report (December 2014) and Supplemental Expert Report (March 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

83. Expert Report (November 2014) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

84. *Declaration (January 2015) relating to Startup/Shutdown in the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.*

85. Pre-filed Direct Testimony (March 2015), Supplemental Testimony (May 2015), and Surrebuttal Testimony (December 2015) on behalf of Friends of the Columbia Gorge in the matter of the Application for a Site Certificate for the Troutdale Energy Center before the Oregon Energy Facility Siting Council.

86. Brief of Amici Curiae Experts in Air Pollution Control and Air Quality Regulation in Support of the Respondents, On Writs of Certiorari to the US Court of Appeals for the District of Columbia, No. 14-46, 47, 48. *Michigan et. al., (Petitioners) v. EPA et. al., Utility Air Regulatory Group (Petitioners) v. EPA et. al., National Mining Association et. al., (Petitioner) v. EPA et. al.,* (Supreme Court of the United States).

87. Expert Report (March 2015) and Rebuttal Expert Report (January 2016) on behalf of Plaintiffs in the matter of *Conservation Law Foundation v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

88. Declaration (April 2015) relating to various Technical Corrections for the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.

89. Direct Prefiled Testimony (May 2015) on behalf of the Michigan Environmental Council, the Natural Resources Defense Council, and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Increase its Rates, Amend its Rate Schedules and Rules Governing the Distribution and Supply of Electric Energy and for Miscellaneous Accounting Authority, Case No. U-17767 (Michigan Public Service Commission).

90. Expert Report (July 2015) and Rebuttal Expert Report (July 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

91. Declaration (August 2015, Docket No. 1570376) in support of "Opposition of Respondent-Intervenors American Lung Association, et. al., to Tri-State Generation's Emergency Motion;" Declaration (September 2015, Docket No. 1574820) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors for Remand Without Vacatur;" Declaration (October 2015) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors to State and Certain Industry Petitioners' Motion to Govern, *White Stallion Energy Center, LLC v. US EPA*, Case No. 12-1100 (US Court of Appeals for the District of Columbia).

92. Declaration (September 2015) in support of the Draft Title V Permit for Dickerson Generating Station (Proposed Permit No 24-031-0019) on behalf of the Environmental Integrity Project.

93. Expert Report (Liability Phase) (December 2015) and Rebuttal Expert Report (February 2016) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., Environmental Law and Policy Center, and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

94. Declaration (December 2015) in support of the Petition to Object to the Title V Permit for Morgantown Generating Station (Proposed Permit No 24-017-0014) on behalf of the Environmental Integrity Project.

95. Expert Report (November 2015) on behalf of Appellants in the matter of *Sierra Club, et al. v. Craig W. Butler, Director of Ohio Environmental Protection Agency et al.*, ERAC Case No. 14-256814.

96. Affidavit (January 2016) on behalf of Bridgewatch Detroit in the matter of *Bridgewatch Detroit v. Waterfront Petroleum Terminal Co., and Waterfront Terminal Holdings, LLC.*, in the Circuit Court for the County of Wayne, State of Michigan.

97. Expert Report (February 2016) and Rebuttal Expert Report (July 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

98. Direct Testimony (May 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

99. Declaration (June 2016) relating to deficiencies in air quality analysis for the proposed Millenium Bulk Terminal, Port of Longview, Washington.

100. Declaration (December 2016) relating to EPA's refusal to set limits on PM emissions from coal-fired power plants that reflect pollution reductions achievable with fabric filters on behalf of Environmental Integrity Project, Clean Air Council, Chesapeake Climate Action Network, Downwinders at Risk represented by Earthjustice in the matter of *ARIPPA v EPA, Case No. 15-1180.* (D.C. Circuit Court of Appeals).

101. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

102. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Backus Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

103. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Drakulic Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

104. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Deutsch Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

105. Affidavit (February 2017) pertaining to deficiencies water discharge compliance issues at the Wood River Refinery in the matter of *People of the State of Illinois (Plaintiff) v. Phillips 66 Company, ConocoPhillips Company, WRB Refining LP (Defendants)*, Case No. 16-CH-656, (Circuit Court for the Third Judicial Circuit, Madison County, Illinois).

106. Expert Report (March 2017) on behalf of the Plaintiff pertaining to non-degradation analysis for waste water discharges from a power plant in the matter of *Sierra Club (Plaintiff) v. Pennsylvania Department of Environmental Protection (PADEP) and Lackawanna Energy Center*, Docket No. 2016-047-L (consolidated), (Pennsylvania Environmental Hearing Board).

107. Expert Report (March 2017) on behalf of the Plaintiff pertaining to air emissions from the Heritage incinerator in East Liverpool, Ohio in the matter of *Save our County (Plaintiff) v. Heritage Thermal Services, Inc. (Defendant), Case No. 4:16-CV-1544-BYP*, (US District Court for the Northern District of Ohio, Eastern Division).

108. Rebuttal Expert Report (June 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight (Plaintiffs) v Coyote Creek Mining Company LLC (Defendant),* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

109. Expert Affidavit (August 2017) and Penalty/Remedy Expert Affidavit (October 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant,)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

110. Expert Report (August 2017) on behalf of Appellant in the matter of *Patricia Ann Troiano (Appellant) v. Upper Burrell Township Zoning Hearing Board (Appellee)*, Court of Common Pleas of Westmoreland County, Pennsylvania, Civil Division.

111. Expert Report (October 2017), Supplemental Expert Report (October 2017), and Rebuttal Expert Report (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

112. Declaration (December 2017) on behalf of the Environmental Integrity Project in the matter of permit issuance for ATI Flat Rolled Products Holdings, Breckenridge, PA to the Allegheny County Health Department.

113. Expert Report (Harm Phase) (January 2018), Rebuttal Expert Report (Harm Phase) (May 2018) and Supplemental Expert Report (Harm Phase) (April 2019) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

114. Declaration (February 2018) on behalf of the Chesapeake Bay Foundation, et. al., in the matter of the Section 126 Petition filed by the state of Maryland in *State of Maryland v. Pruitt (Defendant)*, Civil Action No. JKB-17-2939 (Consolidated with No. JKB-17-2873) (US District Court for the District of Maryland).

115. Direct Pre-filed Testimony (March 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of *NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC*, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

116. Expert Affidavit (April 2018) and Second Expert Affidavit (May 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

117. Direct Pre-filed Testimony and Affidavit (December 2018) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

118. Expert Report (February 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

119. Declaration (March 2019) on behalf of Earthjustice in the matter of comments on the renewal of the Title V Federal Operating Permit for Valero Houston refinery.

120. Expert Report (March 2019) on behalf of Plaintiffs for Class Certification in the matter of *Resendez et al v Precision Castparts Corporation* in the Circuit Court for the State of Oregon, County of Multnomah, Case No. 16cv16164.

121. Expert Report (June 2019), Affidavit (July 2019) and Rebuttal Expert Report (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

122. Affidavit/Expert Report (August 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

123. Expert Report (October 2019) relating to the appeal of air permit (Plan Approval) on behalf of Appellants in the matter of *Clean Air Council and Environmental Integrity Project (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection and Sunoco Partners Marketing and Terminals L.P.*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-057-L.

124. Expert Report (December 2019), Affidavit (March 2020), Supplemental Expert Report (July 2020), and Declaration (February 2021) on behalf of Earthjustice in the matter of *Objection to the*

Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

125. Affidavit (December 2019) on behalf of Plaintiff-Intervenor (Surfrider Foundation) in the matter of *United States and the State of Indiana (Plaintiffs), Surfrider Foundation (Plaintiff-Intervenor), and City of Chicago (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant),* Civil Action No. 2:18-cv-00127 (US District Court for the Northern District of Indiana, Hammond Division).

126. Declarations (January 2020, February 2020, May 2020, July 2020, and August 2020) and Pre-filed Testimony (April 2021) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE),* before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

127. Expert Report (April 2020) on behalf of the plaintiff in the matter of Orion Engineered Carbons, GmbH (Plaintiff) vs. Evonik Operations, GmbH (formerly Evonik Degussa GmbH) (Respondent), before the German Arbitration Institute, Case No. DIS-SV-2019-00216.

128. Expert Independent Evaluation Report (June 2020) for *PacifiCorp's Decommissioning Costs Study Reports dated January 15, 2020 and March 13, 2020 relating to the closures of the Hunter, Huntington, Dave Johnston, Jim Bridger, Naughton, Wyodak, Hayden, and Colstrip (Units 3&4) plants*, prepared for the Oregon Public Utility Commission (Oregon PUC).

129. Direct Pre-filed Testimony (July 2020) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

130. Expert Report (August 2020) and Rebuttal Expert Report (September 2020) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware Operating – NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A)*, before the State of New Mexico, Environmental Improvement Board.

131. Expert Report (July 2020) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

132. Expert Report (August 2020) and Supplemental Expert Report (February 2021) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the* Conservation *Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)

133. Expert Report (August 2020) and Supplemental Expert Report (December 2020) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

134. Pre-filed Direct Testimony (October 2020) and Sur-rebuttal Testimony (November 2020) on behalf of petitioners (Ten Persons Group, including citizens, the Town of Braintree, the Town of Hingham, and the City of Quincy) in the matter of Algonquin Gas Transmission LLC, Weymouth MA, No. X266786 Air Quality Plan Approval, before the Commonwealth of Massachusetts, Department of Environmental Protection, the Office of Appeals and Dispute Resolution, OADR Docket Nos. 2019-008, 2019-009, 2019010, 2019-011, 2019-012 and 2019-013.

135. Expert Report (November 2020) on behalf of Protect PT in the matter of *Protect PT v. Commonwealth of Pennsylvania Department of Environmental Protection and Apex Energy (PA) LLC*, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2018-080-R (consolidated with 2019-101-R)(the "Drakulic Appeal").

136. Expert Report (December 2020) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (Defendants)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

137. Pre-filed Testimony (January 2021) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

138. Expert Reports (March 2021 and May 2021) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, Central Planning Board, City of Newark, New Jersey.

139. Expert Report (April 2021) for *Charles Johnson Jr. (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-CV-01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Eastern District of Louisiana, New Orleans Division).

140. Affidavit (April 2021) for *Clayton Faerber et.al., (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 20-CV-00328 01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Southern District of Mississippi).

141. Expert Report (April 2021, June 2023) for *Floyd Ruffin (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-cv-00334-CJB-JCW (US District Court for the Eastern District of Louisiana, New Orleans Division).

142. Expert Report (April 2021) and Sur-Rebuttal Report (June 2021) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

143. Expert Report (May 2021) for *Clifford Osmer (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendants)* related to No. 18-CV-12557 (US District Court for the Eastern District of Louisiana).

144. Expert Report (May 2021) and Rebuttal Expert Report (January 2022) for *James Noel (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:19-CV-00694-JB-MU-C (US District Court for the Southern District of Alabama, Southern Division).

145. Expert Report (June 2021) and Declarations (May 2021 and June 2021) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division.)

146. Expert Witness Disclosure (June 2021) on behalf of the Plaintiffs in the matter of *Jay Burdick, et. al., (Plaintiffs) v. Tanoga Inc. (d/b/a Taconic) (Defendant)*, Index No. 253835, (State of New York Supreme Court, County of Rensselaer).

147. Expert Report (June 2021) on behalf of Appellants in the matter of *PennEnvironment and Earthworks (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection (Appellee) and MarkWest Liberty Midstream and resource, LLC (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2020-002-R.

148. Expert Report (June 2021) for *Antonia Saavedra-Vargas (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:18-CV-11461 (US District Court for the Eastern District of Louisiana, New Orleans Division).

149. Affidavit (June 2021) for Lourdes Rubi in the matter of *Lourdes Rubi (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendants)*, related to 12-968 BELO in MDL No. 2179 (US District Court for the Eastern District of Louisiana, New Orleans Division).

150. Expert Report (June 2021) for *Wallace Smith (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:19-CV-12880 (US District Court for the Eastern District of Louisiana, New Orleans Division).

151. Declaration (July 2021) on behalf of Plaintiffs in the matter of *Stephanie Mackey and Nick Migliore, on behalf* of *themselves and all others similarly situated (Plaintiffs) v. Chemtool Inc. and Lubrizol Corporation (Defendants)*, Case No. 2021-L-0000165, State of Illinois, Circuit Court of the 17th Judicial Circuit, Winnebago County.

152. Declaration (July 2021, August 2021) on behalf of Petitioners in the matter of the Petition for a Hearing on the Merits Regarding Air Quality Permit No. 3340-RMD issued to New Mexico Terminal Services, LLC by *Mountain View Neighborhood Association et. al., (Petitioners) v. City of Albuquerque Environmental Health Department*, AQCB Petition No. 2020-1 before the Albuquerque-Bernalillo County Air Quality Control Board.

153. Expert Disclosure (September 2021) and Affidavit (May 2023) on behalf of the Plaintiffs in the matter of *State of New York, Town of Hempstead, Town of Brookhaven, Incorporated Village of Garden City and Long Island Power Authority et. al., (Plaintiffs) v. Covanta Hempstead Company et. al., (Defendants)*, Index No. 7549/2013 before the Supreme Court of the State of New York, County of Nassau.

154. Expert Report (October 2021) for *John A. Battiste (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:21-CV-00118 (US District Court for the Southern District of Alabama, Mobile Division)

155. Declaration/Expert Report (October 2021) for *Charles K. Grasley et. al., (Plaintiffs) v. Chemtool Incorporated (Defendant)*, Case No. 2021-L-0000162 (State of Illinois, In the Circuit Court of the 17th Judicial Circuit, Winnebago County).

156. Declaration (October 2021) and Expert Report (November 2021) on behalf of the Plaintiffs in the matter of Toll Brothers, Inc., and Porter Ranch Development Company (Plaintiffs) v. Sempra Energy, Southern California Gas Company et. al., (Defendants), Southern California [Aliso Canyon] Gas Leak Cases, JCCP No.: 4861, Lead Case No.: BC674622, Superior Court of the State of California for the County of Los Angeles.

157. Expert Report (November 2021) and Declaration (September 2022) on behalf of Plaintiffs in Re: Deepwater Horizon BELO Cases, Case No. 3:19cv963-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).

158. Declaration (November 2021) for the *United States of America and the State of Kansas, Department of Health and Environment (Plaintiffs) v. Coffeyville Resources Refining & Marketing, LLC (Defendant)*, Civ. No. 6:04-cv-01064-JAR-KGG (US District Court for the District of Kansas).

159. Expert Report/Affidavit (December 2021) on behalf of the City of Detroit in the matter of Marathon Petroleum Company (Claimant) v. City of Detroit Building Safety Engineering and Environmental Department, BSEED Case No. MCR 2018-2525, DAH Appeal No. 21-SWA-01, before the State of Michigan, City of Detroit Department of Appeals and Hearings.

160. Expert Report (December 2021) for *John Pabst (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 21-CV-00290 (US District Court for the Eastern District of Louisiana).

161. Expert Report (December 2021) for *Audrey Annette Tillery-Perdue individually and as person representative of the estate of Eddie Lewis Perdue (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendant)*, Civil Action No. 5:19-cv-00052-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).

162. Expert Report (February 2022) for *Richard Dufour (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 19-cv-00591 (US District Court for the Southern District of Mississippi).

163. Expert Report (February 2022) and Rebuttal Expert Report (June 2022, in preparation) for *Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant),* Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

164. Expert Report (February 2022) in the matter of the *Appeal Petition for Hearing on Air Quality Permit No. 8585 on behalf of Earth Care New Mexico et. al., (Petitioners) v. New Mexico Environment Department and Associated Asphalt and Materials, LLC (Applicant),* No. EIB 21-48 before the State of New Mexico Environmental Improvement Board.

165. Expert Report (March 2022), Affidavit (June 2022), Supplemental Expert Report (April 2023) in the matter of *Clean Air Council et. al., (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection (Appellee) and Renovo Energy Center (Permittee)* EHB Docket No. 2021-055-R before the Commonwealth of Pennsylvania Environmental Hearing Board.

166. Declaration (March 2022) in the matter of Max Midstream Texas LLC Air Quality Permit No. 162941 for the Seahawk Crude Condensate Terminal in Calhoun County Texas, TCEQ Docket No. 2022-0157-AIR, before the Texas Commission on Environmental Quality.

167. Expert Pre-filed Testimony (April 2022) in the matter of Application of TPC Group LLC for New State and PSD Air Quality Permits (various), TCEQ Docket No. 2021-1422-AIR, SOAH Docket No. 582-22-0799, Before the Texas State Office of Administrative Hearings.

168. Expert Report (April 2022) and Rebuttal Report (August 2022) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant),* Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)

169. Rule 26 Disclosure (May 2022) in the matter of the *Water Works and Sewer Board of the City of Gadsden (*Plaintiff*) v. 3M Company, et. al., (Defendants),* Civil Action No.: 31 CV-2016-900676.00 (Circuit County of Etowah County, Alabama)

170. Expert Report (June 2022) for *Heather Schumacher (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant),* Case No. 2018-L-011939 (Circuit Court of Cook County, Illinois.)

171. Expert Report (June 2022), Rebuttal Reports (August 2022, September 2022) for Plaintiffs in *Phylliss Grayson et. al. (Plaintiffs), v Lockheed Martin Corporation (Defendant),* Case No. 6:20-cv-01770. (US District Court for the Middle District of Florida – Orlando Division.)

172. Expert Affidavit (July 2022) for Center for Environmental Rights in connection with the 2019 South Africa Integrated Resource Plan in *African Climate Alliance et. al. v. The Minister of Mineral Resources and Energy et. al.,* in the High Court of South Africa, Gauteng Division, Pretoria.

173. Expert Affidavit (July 2022) for Center for Environmental Rights in connection with the Limpopo Mine (Lephalale Coal Mines Ltd.) in *Earthlife Africa v. The Minister of Forestry, Fisheries and Environment et. al.,* in the High Court of South Africa, Gauteng Division, Pretoria, Case No. 9149/2022.

174. Pre-filed Testimony (July 2022) and Rebuttal Testimony (September 2020) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)* before the Washington Utilities and Transportation Commission, Docket UE-220066 and UG-220067 (Consolidated).

175. Expert Report (September 2022) *Clean Air Council, Citizens for Pennsylvania's Future, Mountain Watershed Association (Appellants) v. Allegheny County Health Department (Appellee) and Allegheny Energy Center (*Intervenor*, Permittee),* Case No. 21-043 before the Hearing Officer of the Allegheny County Health Department.

176. Expert Affidavit (October 2022) for *Concerned Citizens of Cook County GA (Petitioner) v. Georgia Department of Natural Resources (Respondent) and Spectrum Energy Georgia, LLC (Respondent Intervenor)* before the Office of State Administrative Hearings, State of Georgia, Docket No: 2303405-OSAH-BNR-AQ-37-Barnes.

177. Expert Rebuttal Report (January 2023), Supplemental Rebuttal Expert Report (March 2023, May 2023, November 2023) for *Ann Jordan et. al., and Blake Darnell (Plaintiffs) v. Terumo BCT et. al., (Defendants)* before District Court, Jefferson County, Colorado Case Numbers: 2020CV031457, 2021CV030474 (consolidated with 2020CV031457) and 2020CV03148.

178. Expert Report (January 2023) and Rebuttal Expert Report (April 2023) for *Potomac Riverkeeper and Sierra Club (Plaintiffs) v. Virginia Electric and Power Company (Defendant)*, Civil Action No. 2:21-CV-23 (Kleeh) (US District Court for the Northern District of West Virginia, Elkins Division).

179. Affidavit (January 2023) for *Richard Dufour (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:19-cv-00591-HSO-BWR (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Southern District of Mississippi).

180. Expert Report (January 2023) and Supplemental Expert Report (July 2023) on behalf of Plaintiffs in the matter of *Stephanie* Mackey *et. al., (Plaintiffs) v. Chemtool Inc. et. al., (Defendants) and Holian Insulation Company Inc. (Third-party Defendant)*, Case No.: 3:21-cv-50283, U.S. District Court, Northern District of Ilinois, Western Division.

181. Expert Report (February 2023) for *Vervicia Henderson, et al. (Plaintiff) v. Lockheed Martin Corporation (Defendant)*, Case No. 6:21-cv-01363, U.S. District Court, Middle District of Florida, Orlando Division.

182. Expert Report (February 2023) for *Carol Davis (Plaintiff) v. Lockheed Martin Corporation (*Defendant*)*, Case No. 6:22-cv-81-RBD-EJK, U.S. District Court, Middle District of Florida, Orlando Division.

183. Expert Report (February 2023) for Mark Letart (Plaintiff), et al. v. Union Carbide Corporation, et al. (Defendants), Case No. 2:19-cv-877, U.S. District Court, Southern District of West Virginia, Charleston Division.

184. Affidavit (March 2023) on behalf of plaintiffs in the matter of the *State of New Mexico, ex rel. Raul Torrez, Attorney General (Plaintiffs) v. Sterigenics US LLC, Sotera Health Holdings, LLC, Sotera Health LLC and Sotera Health Company (Defendants)*, Case No.: D-307-CV-2020-02629, State of New Mexico, Third Judicial District Court, County of Dona Ana

185. Pre-filed Direct Testimony (March 2023) in the matter of *Algonquin Gas Transmission LLC., on behalf of Community Residents (*Petitioners*)*, Commonwealth of Massachusetts Department of Environmental Protection, Office of Appeals and Dispute Resolution, OADR Docket Nos. 2017-011 and 012, Waterways Application License No. W16-4600, Weymouth Mass.

186. Declaration (April 2023) in the matter of Sierra Club (Plaintiff) v. Tennessee Valley Authority in the matter of the Johnsonville Aeroderivative Combustion Turbines Project, Case No.: 3:22-cv-1054, U.S>, District Court, Middle District of Tennessee, Nashville Division.

187. Expert Report (May 2023/June 2023), Affidavit (April 2023) and Declaration (July 2023) for *Ezequiel Caraballo-Pache (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 8:20-cv-00263-SCB-JSS (US District Court for the Middle District of Florida, Tampa Division).

188. Affidavit (May 2023) for *Lawrence Tucei (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:22-cv-00078-HSO-BWR (US District Court for the Southern District of Mississippi).

189. Expert Report (May 2023/June 2023) for *Vincent Culliver (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 3:21-cv-4942-MCR/HTC (US District Court for the Northern District of Florida).

190. Expert Report (June 2023) for *Matthew Williams (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:22-cv-00278-LG-BWR (US District Court for the Southern District of Mississippi).

191. Declaration (June 2023) in support of public commenters relating to the Michigan Department of Environment Great Lakes and Energy (EGLE)'s Annual Network Monitoring Plan 2024.

192. Expert Report (July 2023) and Rebuttal Expert Report (September 2023) relating to Greenhouse Gas and Energy Management (GEMM2) for Manufacturing in Colorado (September 2023) on behalf of Environmental Defense Fund.

193. Pre-filed Direct Testimony (July 2023) on behalf of Citizens for Environmental Justice in the matter of the permit Application of Valero Refining-Texas, LP for Modification to State and Prevention of Significant Deterioration Air Quality Permits No. 38754 and PSDTX324M15 before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-23-14975, TCEQ Docket No. 2023-0203-AIR.

194. Declaration (August 2023) in support of comments by Environmental Defense Fund in connection with the "Good Neighbor Plan" for the 2015 Ozone National Ambient Air Quality Standards, published at 88 Fed. Reg. 36,654 (June 5, 2023) ("Final Rule"), Docket ID No. EPA-HQ-OAR-2021-0668.

195. Expert Report (August 2023) on behalf of Appellants in the matter of *PennEnvironment and Sierra Club (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection, (Appellee), and PPG Industries, Inc. (Permittee)*, EHB Docket No. 2022-032-B. Environmental Hearing Board, Department of Environmental Protection, State of Pennsylvania.

196. Pre-filed Testimony (September 2023) and Cross Answering Testimony (October 2023) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)*, Docket: UG-230393. Before the Washington Utilities and Transportation Commission.

197. Expert Report (December 2023) on behalf of plaintiffs in the matter of *PennEnvironment and Sierra Club (Plaintiffs) v. PPG Industries, Inc. (Defendant).* Case No.: Civil Action Nos. 2:12-cv-00342, 2:12-cv-00527, 2:13-cv-01395, 1:13-cv-01396, 2:14cv-00229 (consolidated). U.S. District Court Western District of Pennsylvania.

C. Occasions where Dr. Sahu has provided oral testimony <u>in depositions, at trial or in similar proceedings</u> include the following:

198. Deposition on behalf of Rocky Mountain Steel Mills, Inc. located in Pueblo, Colorado – dealing with the manufacture of steel in mini-mills including methods of air pollution control and BACT in steel mini-mills and opacity issues at this steel mini-mill.

199. Trial Testimony (February 2002) on behalf of Rocky Mountain Steel Mills, Inc. in Denver District Court.

200. Trial Testimony (February 2003) on behalf of the United States in the Ohio Edison NSR Cases, *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

201. Trial Testimony (June 2003) on behalf of the United States in the Illinois Power NSR Case, *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

202. Deposition (10/20/2005) on behalf of the United States in connection with the Cinergy NSR Case. *United States, et* al. *v. Cinergy Corp., et al.*, IP 99-1693-C-M/S (Southern District of Indiana).

203. Oral Testimony (August 2006) on behalf of the Appalachian Center for the Economy and the Environment re. the Western Greenbrier plant, WV before the West Virginia DEP.

204. Oral Testimony (May 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) re. the Thompson River Cogeneration plant before the Montana Board of Environmental Review.

205. Oral Testimony (October 2007) on behalf of the Sierra Club re. the Sevier Power Plant before the Utah Air Quality Board.

206. Oral Testimony (August 2008) on behalf of the Sierra Club and Clean Water re. Big Stone Unit II before the South Dakota Board of Minerals and the Environment.

207. Oral Testimony (February 2009) on behalf of the Sierra Club and the Southern Environmental Law Center re. Santee Cooper Pee Dee units before the South Carolina Board of Health and Environmental Control.

208. Oral Testimony (February 2009) on behalf of the Sierra Club and the Environmental Integrity Project re. NRG Limestone Unit 3 before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

209. Deposition (July 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al*.

210. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Coleto Creek coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

211. Deposition (October 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

212. Deposition (October 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

213. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Tenaska coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH). (April 2010).

214. Oral Testimony (November 2009) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

215. Deposition (December 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

216. Oral Testimony (February 2010) on behalf of the Environmental Defense Fund re. the White Stallion Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

217. Deposition (June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

218. Trial Testimony (September 2010) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, State of Maryland, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case in US District Court in the Western District of Pennsylvania. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

219. Oral Direct and Rebuttal Testimony (September 2010) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

220. Oral Testimony (September 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

221. Oral Testimony (October 2010) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

222. Oral Testimony (November 2010) regarding BART for PSCo Hayden, CSU Martin Drake units before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

223. Oral Testimony (December 2010) regarding BART for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

224. Deposition (December 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

225. Deposition (February 2011 and January 2012) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).

226. Oral Testimony (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

227. Deposition (August 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

228. Deposition (July 2011) and Oral Testimony at Hearing (February 2012) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

229. Oral Testimony at Hearing (March 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

230. Oral Testimony at Hearing (April 2012) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

231. Oral Testimony at Hearing (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

232. Deposition (March 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

233. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

234. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation*

Company LLC, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

235. Deposition (February 2014) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

236. Trial Testimony (February 2014) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.*, Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

237. Trial Testimony (February 2014) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

238. Deposition (June 2014) and Trial (August 2014) on behalf of ECM Biofilms in the matter of the *US Federal Trade Commission (FTC) v. ECM Biofilms* (FTC Docket #9358).

239. Deposition (February 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

240. Oral Testimony at Hearing (April 2015) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

241. Deposition (August 2015) on behalf of Plaintiff in the matter of *Conservation Law Foundation (Plaintiff) v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

242. Testimony at Hearing (August 2015) on behalf of the Sierra Club in the matter of *Amendments to 35 Illinois Administrative Code Parts 214, 217, and 225* before the Illinois Pollution Control Board, R15-21.

243. Deposition (May 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

244. Trial Testimony (October 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

245. Deposition (April 2016) on behalf of the Plaintiffs in *UNatural Resources Defense Council, Respiratory Health Association, and Sierra Club (Plaintiffs) v. Illinois Power Resources LLC and Illinois Power Resources Generation LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (Central District of Illinois, Peoria Division).

246. Trial Testimony at Hearing (July 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

247. Trial Testimony (December 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

248. Trial Testimony (July-August 2016) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

249. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

250. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Backus Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

251. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Drakulic Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

252. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Deutsch Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

253. Deposition Testimony (July 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight v Coyote Creek Mining Company LLC (Defendant)* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

254. Deposition Testimony (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

255. Deposition Testimony (December 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

256. Deposition Testimony (January 2018) in the matter of National Parks Conservation Association (NPCA) v. State of Washington Department of Ecology and British Petroleum (BP) before the Washington Pollution Control Hearing Board, Case No. 17-055.

257. Trial Testimony (January 2018) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

258. Trial Testimony (April 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

259. Deposition (June 2018) (harm Phase) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

260. Trial Testimony (July 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

261. Deposition (January 2019) and Trial Testimony (January 2019) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

262. Deposition (February 2019) and Trial Testimony (March 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric

Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

263. Deposition (June 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

264. Deposition (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

265. Deposition (December 2019) on behalf of the Plaintiffs in the matter of David Kovac, individually and on behalf of wrongful death class of Irene Kovac v. BP Corporation North America Inc., Circuit Court of Jackson County, Missouri (Independence), Case No. 1816-CV12417.

266. Deposition (February 2020, virtual) and testimony at Hearing (August 2020, virtual) on behalf of Earthjustice in the matter of *Objection to the Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation*, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

267. Hearing (July 14-15, 2020, virtual) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

268. Hearing (September 2020, virtual) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware* Operating – *NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A)*, before the State of New Mexico, Environmental Improvement Board.

269. Deposition (December 2020, March 4-5, 2021, all virtual) and Hearing (April 2021, virtual) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE)*, before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

270. Hearing (September 2020, virtual) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

271. Deposition (December 2020, virtual and Hearing February 2021, virtual) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

272. Deposition (January 2021, virtual) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

273. Deposition (February 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (*Defendants*)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

274. Deposition (April 2021, virtual) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the* Conservation *Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)

275. Deposition (June 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division).

276. Deposition (June 2021, virtual) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

277. Testimony (June 2021, virtual) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, (Central Planning Board, City of Newark, New Jersey).

278. Testimony at Hearing (October 2021) on behalf of Evraz Rocky Mountain Steel in the matter of Colorado's Proposed Revisions to Regulation 22, the Greenhouse Gas Emissions and Energy Management for the Manufacturing Sector in Colorado (GEMM Rule), before the Colorado Air Quality Control Commission.

279. Deposition (November 2021) for *Charles Johnson Jr. (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-CV-01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Eastern District of Louisiana).

280. Testimony at Hearing (November 2021) on behalf of *National Parks Conservation Association, et. al*., in the matter of the Proposed Revisions to Colorado's Regional Haze State Implementation Plan (SIP) and Colorado Regulation 23, before the Colorado Air Quality Control Commission.

281. Deposition (December 2021) on behalf of Plaintiffs in Re: Deepwater Horizon BELO Cases, Case No. 3:19cv963-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).

282. Deposition (December 2021) for *James Noel (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:19-CV-00694-JB-MU-C (US District Court for the Southern District of Alabama, Southern Division).

283. Testimony at Hearing (February 2022, virtual) in the matter of the *Appeal Petition for Hearing on Air Quality Permit No. 8585 on behalf of Earth Care New Mexico et. al., (Petitioners) v. New Mexico Environment Department and Associated Asphalt and Materials, LLC (Applicant)*, No. EIB 21-48 before the State of New Mexico Environmental Improvement Board.

284. Deposition (March 2022) and Rebuttal Deposition (July 2022) for *Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois.)

285. Deposition (April 2022, virtual) in the matter of Application of TPC Group LLC for New State and PSD Air Quality Permits (various), TCEQ Docket No. 2021-1422-AIR, SOAH Docket No. 582-22-0799, Before the Texas State Office of Administrative Hearings.

286. Deposition (May 2022, virtual) in the matter of the *Water Works and Sewer Board of the City of Gadsden (Plaintiff) v. 3M Company, et. al., (*Defendants*)*, Civil Action No.: 31 CV-2016-900676.00 (Circuit County of Etowah County, Alabama)

287. Deposition (June 2022 and September 2022, both virtual) for *Teresa* Fornek *(Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)

288. Deposition (June 2022, virtual) on behalf of the Plaintiffs in the matter of Toll Brothers, Inc., and Porter Ranch Development Company (Plaintiffs) v. Sempra Energy, Southern California Gas Company et. al., (Defendants), Southern California [Aliso Canyon] Gas Leak Cases, JCCP No.: 4861, Lead Case No.: BC674622, Superior Court of the State of California for the County of Los Angeles.

289. Deposition (July 2022) for *Richard Dufour (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 19-cv-00591 (US District Court for the Southern District of Mississippi).

290. Trial (August 2022) on behalf of the Plaintiffs in the matter of Modern *Holdings, LLC, et al. (Plaintiffs) v. Phillips (Defendants),* Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

291. Trial (August 2022, in person) for *Susan Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

292. Deposition (September 2022, virtual) for *Heather Schumacher (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)

293. Deposition (September 2022) on behalf of Plaintiffs in *Phylliss Grayson et. al. (Plaintiffs), v Lockheed Martin Corporation (Defendant),* Case No. 6:20-cv-01770. (US District Court for the Middle District of Florida – Orlando Division.)

294. Deposition (September 2022) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

295. Hearing (October 2022) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)* before the Washington Utilities and Transportation Commission, Docket UE-220066 and UG-220067 (Consolidated).

296. Trial (October 2022, in person) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

297. Depositions (March 2023, June 2023) for *Ann Jordan et. al., and Blake Darnell (Plaintiffs) v. Terumo BCT et. al., (Defendants)* before District Court, Jefferson County, Colorado Case Numbers: 2020CV031457, 2021CV030474 (consolidated with 2020CV031457) and 2020CV03148.

298. Depositions (March 2023, April 2023, May 2023) for Quinn Buczek (Plaintiff) v. Sterigenics US, LLC, Sotera Health, LLC, Prologis First US Properties, LP, et. al., (Defendants) before State Court of Gwinnett County, State of Georgia, Case No. Civil Action File No. 20-C-05918-S1.

299. Deposition (May 2023) for *Potomac Riverkeeper and Sierra Club (Plaintiffs) v. Virginia Electric and Power Company (Defendant),* Civil Action No. 2:21-CV-23 (Kleeh) (US District Court for the Northern District of West Virginia, Elkins Division).

300. Deposition (May 2023) for Mark Letart (Plaintiff), et al. v. Union Carbide Corporation, et al. (Defendants), Case No. 2:19-cv-877, U.S. District Court, Southern District of West Virginia, Charleston Division.

301. Testimony at Hearing on behalf of Evraz North America In the Matter of Colorado Air Quality Regulation Proposed Revisions to Regulation Number 3 to establish enhanced Modeling, monitoring and permitting requirements for Stationary sources in disproportionately impacted communities 5 CCR 1001-5, before the Air Quality Control Commission, State of Colorado.

302. Deposition (2023) for *Vervicia Henderson, et al. (Plaintiff) v. Lockheed Martin Corporation (Defendant)*, Case No. 6:21-cv-01363, U.S. District Court, Middle District of Florida, Orlando Division.

303. Testimony at Hearing (July 2023) *Clean Air Council, Citizens for Pennsylvania's Future, Mountain* Watershed *Association (Appellants) v. Allegheny County Health Department (Appellee) and Allegheny Energy Center (*Intervenor, *Permittee),* Case No. 21-043 before the Hearing Officer of the Allegheny County Health Department.

304. Deposition (July 2023) for *Ezequiel Caraballo-Pache (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 8:20-cv-00263-SCB-JSS (US District Court for the Middle District of Florida, Tampa Division).

305. Deposition (August 2023) for *Floyd Ruffin (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-cv-00334-CJB-JCW (US District Court for the Eastern District of Louisiana, New Orleans Division).

306. Deposition (August 2023) on behalf of petitioners in *Doreen Carey et; al., (Petitioners) v. Fulcrum Centerpoint LLC. (Permittee/Respondent) and Indiana Department of Environmental Management (Respondent)*, Permit Number 089-44042-00660, before the Indiana Office of Environmental Adjudication.

307. Deposition (August 2023) on behalf of the Plaintiff in the *Water Works and Sewer Board of the Town of Centre, Alabama v. 3M Company, et. al.*, Civil Action No.: CV-2017-900049. Circuit Court of Cherokee County, State of Georgia.

308. Deposition (August 2023) for *Matthew Williams (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:22-cv-00278-LG-BWR (US District Court for the Southern District of Mississippi).

309. Deposition (September 2023) for *Vincent Culliver (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 3:21-cv-4942-MCR/HTC (US District Court for the Northern District of Florida).

310. Testimony at Hearing for Greenhouse Gas and Energy Management (GEMM2) for Manufacturing in Colorado (September 2023) on behalf of Environmental Defense Fund.

311. Testimony at Hearing (October 2023) in the matter of *Algonquin Gas Transmission LLC., on behalf of Community Residents (*Petitioners*)*, Commonwealth of Massachusetts Department of Environmental Protection, Office of Appeals and Dispute Resolution, OADR Docket Nos. 2017-011 and 012, Waterways Application License No. W16-4600, Weymouth Mass.

312. Testimony at Hearing (August 2023) on behalf of Citizens for Environmental Justice in the matter of the permit Application of Valero Refining-Texas, LP for Modification to State and Prevention of Significant Deterioration Air Quality Permits No. 38754 and PSDTX324M15 before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-23-14975, TCEQ Docket No. 2023-0203-AIR.

313. Testimony at Hearing (September 2023) on behalf of Appellants in the matter of *PennEnvironment and Sierra Club (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection, (Appellee), and PPG Industries, Inc. (Permittee)*, EHB Docket No. 2022-032-B. Environmental Hearing Board, Department of Environmental Protection, State of Pennsylvania.

314. Testimony at Hearing (November 2023) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)*, Docket: UG-230393. Before the Washington Utilities and Transportation Commission.

ATTACHMENT B

Evaluation of Draft Environmental Impact Report on Geological Storage of Carbon Dioxide at the Carbon TerraVault I Facility in Kern County, California

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February 25, 2024

About the Author: Dr. DiGiulio is a retired geoscientist from the U.S. Environmental Protection Agency's Office of Research and Development. He has conducted research on: emissions of volatile organic compounds from abandoned wells, leakage of produced water, condensate, and drilling fluids from impoundments to groundwater, contamination of groundwater from hydraulic fracturing, subsurface methane and carbon dioxide migration (stray gas), intrusion of subsurface vapors into indoor air (vapor intrusion), gas flow-based subsurface remediation (soil vacuum extraction, bioventing), groundwater sampling methodology, soil-gas sampling methodology, gas permeability testing, and solute transport of contaminants in soil. He assisted in the development of EPA's original guidance on vapor intrusion and the EPA's Class VI Rule on geologic sequestration of carbon dioxide (Tier II Committee). He has served as an expert witness in litigation relevant to oil and gas development, testified before State oil and gas commissions on proposed regulation, and testified before Congress on the impact of oil and gas development on water resources. His consulting services to non-government organizations have included reports on: stray methane gas migration, geological carbon storage in Louisiana, storage of natural gas liquids in solution mined caverns, proposed oil and gas regulations in Colorado, impact to groundwater resources from Class II disposal wells in Ohio, Idaho, and Florida, produced water transport in barges along the Ohio River, proposed EPA regulation on discharge of produced water to surface water, and Bureau of Land Management leases in Wyoming, Montana, and Colorado.

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Background

A Draft Environmental Impact Report (DEIR) was prepared by Kern County as the Lead Agency under the California Environmental Quality Act (CEQA). In volume 1 of the DEIR, it is stated that Carbon TerraVault 1 LLC (CTV), a wholly owned subsidiary of the California Resources Corporation, proposes to inject supercritical carbon dioxide (CO_2) at two locations (26R and A1-A2 reservoirs) in the Monterey Formation at the Elk Hills Oil Field in Kern County, California (DEIR, 2024a). The source of CO_2 for injection is pre-combustion Elk Hills Oil Field gas, from which CO_2 is captured and processed at the existing cryogenic and fractionation natural gas plant facility and the Elk Hills Power Plant within the Elk Hills Oil Field (DEIR, 2024a). Currently, the Elk Hills Power Plant provides electricity for both oilfield operations and the California wide power system (DEIR, 2024a). The project would consist of six injection wells - four (one converted Class II well, three new) within the 26R reservoir and two converted Class II wells within the A1 – A2 reservoir.

At the 26R reservoir, the Monterey Formation is approximately 6,000 feet deep with oil and gas production from turbidite sands (DEIR, 2024a). Turbidite deposited sands are interbedded with siliceous shale. Sand porosity and permeability averages 25% and 45 millidarcy (mD), respectively (DEIR, 2024b). At the A1 – A2 reservoir, the Monterey Formation is approximately 8,500 feet deep with oil and gas production also from turbidite sands. Turbidite deposited sands are interbedded with and bound above and below by siliceous shale. Sand porosity and permeability averages 16% and 60 mD, respectively (DEIR, 2024b).

The 26R reservoir was discovered in the 1940s while the A1-A2 reservoir was discovered in the 1970s (DEIR, 2024b). In addition to primary extraction, oil and gas wells have been used for enhanced recovery using water and gas injection over the past 40 years (DEIR, 2024b).

The Reef Ridge Shale is present over the southern San Joaquin Basin and serves as the primary confining layer for both the 26R and A1-A2 reservoirs (DEIR, 2024a). The Reef Ridge Shale is dominated by gray to grayish-black silty or sandy shale with rare silty and clay beds. The Reef Ridge Shale is continuous and ranges from 750 to 1,600 feet thick and has a permeability of less than 0.01 mD and 7% porosity (DEIR, 2024b). To date, over 7,500 wells have been drilled to various depths within the Elk Hills Oil Field (DEIR, 2024b). There are numerous well penetrations in the Monterey Formation outside the 26R and A1 – A2 storage areas as illustrated in figures in Volume 2 of the DEIR. The DEIR fails to specify the exact number of well penetrations.

At full operation, the project is designed to inject up to 1.46 million tons of CO_2 per year into the 26R reservoir (up to 26 years) and up to 0.75 million tons per year in the A1-A2 reservoir, for a total capacity of 2.21 million tons per year (DEIR, 2024a). Additionally, 10 existing wells will be converted to monitoring wells, and six existing wells would be converted into seismic monitoring wells (DEIR, 2024a).

Setbacks and Encroachment

Leakage of CO_2 from wellbores is widely considered to be one of the most significant leakage pathways for geologic storage of CO_2 (Jordan and Benson, 2009, Zhang and Bachu, 2011). There is interest in using depleted oil and gas reservoirs for geological storage of CO_2 due to extensive preexisting geological

characterization and infrastructure but the presence of a large number of well penetrations increases the possibility of leakage (Celia et al., 2005).

From a health and safety perspective, if large-scale leakage were to occur at the surface, asphyxiation and suffocation are of concern. Continued exposure to CO_2 concentrations above 20–30% is associated with suffocation to humans and most air-breathing animals (Damen et al., 2006). Since CO_2 is denser than air, topography and prevailing meteorologic conditions would largely govern risk from a large-scale release with gas buildup being greater in valleys and low-lying areas.

As discussed in Volume 2 of the DEIR (DEIR, 2024b), in 2008 in Mönchengladbach, Germany, over 100 residents suffered from respiratory problems due to a CO_2 release, of which 19 were hospitalized. The incident involved the release of about 15 metric tons of fire suppression CO_2 inside a factory, which leaked out of the building. At the time there was no wind, so the dense CO_2 cloud drifted down hill to the lowest lying region where there was a village about 1,500 feet away (DEIR, 2024b).

Probably the best-known anthropogenic release of CO_2 occurred in February 2020 from a CO_2 pipeline rupture in proximity to Satartia, MS. The rupture followed heavy rains that resulted in a landslide, creating excessive axial strain on a pipeline weld (DEIR, 2024b). Pipeline operators are required to establish atmospheric models to prepare for emergencies. Denbury's model did not contemplate a release that could affect the Village of Satartia (DEIR, 2024b). Local emergency responders were not informed by Denbury of the rupture and the nature of the unique safety risks of the CO_2 pipeline. As a result, responders had to guess the nature of the risk, in part making assumptions based on reports of a "green gas" and "rotten egg smell" and had to contemplate appropriate mitigative actions (DEIR, 2024b). Fortunately, responders decided to quickly isolate the affected area by shutting down local highways and evacuating people in proximity to the release (DEIR, 2024b). Denbury reported that 200 residents surrounding the rupture location were evacuated, and forty-five people were taken to the hospital. No fatalities were reported (PHMSA, 2022).

Following this incident, a large release of CO_2 to the atmosphere occurred later in 2020 in Yazoo County, Mississippi due to a blowdown valve freezing open (DEIR, 2024b). Work was being conducted to reconnect the pipeline that had ruptured near Satartia. An 8-inch valve froze in the open position due to internal dry-ice formation as CO_2 flashed across the valve (DEIR, 2024b). A total of approximately 5,299 metric tons of CO_2 were released over about 24 hours until the pipeline segment pressure had reduced enough to allow the valve to thaw and be closed. A large CO_2 cloud formed, and the nearby highway closed. Air monitoring was conducted in the surrounding area (DEIR, 2024b).

A clearly unacceptable release from a wellbore would be a CO_2 well blowout. A CO_2 well blowout is considered a low probability high consequence incident (Oldenburg and Budnitz, 2016) that could cause an immediate danger to public health in the vicinity of an abandoned well. The Sheep Mountain CO_2 blowout in March 1982 is a well-documented case in the literature (GEM Wiki, 2024). The leakage rate was estimated to be 13,000 metric tons CO_2 per day (GEM Wiki, 2024). 100% CO_2 flow was observed in the well with chunks of dry ice occasionally ejected hundreds of feet into the air. Other examples of CO_2 well blowouts include the Travale geothermal field, Italy in 1972 having a CO_2 release rate of 113 kg/s and the Torre Alfina geothermal field, Italy in 1973 (Lewicki et al., 2007) having a CO_2 leakage release rate of 76 kg/s (Lewicki et al., 2007; Aines et al., 2009).

Another example of CO_2 release via a wellbore is Crystal Geyser in Utah (the largest cold geyser in the world). The geyser was unintentionally created in the 1930s after a prospective oil well was drilled about 2,600-foot-deep into a fault zone above a natural CO_2 reservoir (DEIR, 2024b). Shortly after drilling, the well was improperly abandoned allowing CO_2 to be released through the well (DEIR, 2024b). Crystal Geyser eruptions last from 7 to 98 minutes with a release rate between 2.5 and 6 kg/s. Downwind CO_2 concentrations have been measured during eruptions, averaging about 4,000 parts per million (ppm) (0.4 percent) at 160 feet, and 800 ppm at 330 feet (DEIR, 2024b).

In 2011, an improperly plugged and abandoned well failed at the Tinsley Field, Mississippi during CO_2 enhanced oil recovery (EOR) (DEIR, 2024b). There were incomplete records of abandoned wells at the site (DEIR, 2024b). A 2,000-foot-deep well failed when the reservoir pressure increased on injection of CO_2. The blowout took 37 days to bring under control, sickened one worker and suffocated deer and other animals (DEIR, 2024b). In 2013, an underground CO_2 blowout occurred at the CO_2-EOR Delhi field in Louisiana, when two or more plugged and abandoned wells failed underground (DEIR, 2024b). Methane, CO_2, oil, water, brine and sands migrated to the surface in a sparsely populated, marshy area. The release lasted for more than six weeks and contaminated the air with CO_2 and methane (DEIR, 2024b).

Comment: As evidenced in the Satartia, MS CO_2 pipeline release and other documented incidences of CO_2 release, including those from wellbores, release of CO_2 from an injection well or failed plugged or unplugged wellbores could be catastrophic depending on surface topography and meteorologic conditions. The closest sensitive receptor to the project site is McKittrick Elementary School, which is 2.5 miles southwest of the facility pipeline and 4.46 miles from injection well 357-7R. The nearest residence is approximately 4.5 miles southeast of the injection line and 4.4 miles from injection well 345-36R. Buttonwillow Recreation and Park District is approximately 7 miles northeast of injection well 355-7R and 6.9 miles from the injection pipeline (DEIR, 2024a). Based on project-specific and site-specific considerations, the County should determine safe distance(s) for injection wells, wellbores, and pipelines from human receptors and adopt setback(s) that prohibit development at unsafe distance(s).

Comment: Another issue of concern is future development encroaching near land used for CO_2 storage. The land area containing wellbores and vicinity of this land area (e.g., within 1 mile) could conceivably not be suitable for public use for hundreds of years. The DEIR does not address whether or how land uses on surrounding properties might change (soon or in the long term) in ways that would increase the dangers posed by the project.

Mineralization of Injected CO_2

CTV states that full mineralization of CO_2 is expected to occur in two to five years (DEIR, 2024a) - a gross misstatement. If this were true, there would be little concern with geological storage of CO_2 at the CTV facility. Research is ongoing in formations having high divalent cation concentrations (iron, calcium, magnesium) (e.g., basalt) where mineralization is much more rapid. As correctly stated in the Class VI permit applications (EPA, 2024), based on previous studies on reactive transport modeling and geochemical reactions during geological storage, the amount of CO_2 predicted to be trapped by mineralization reactions at the TerraVault 1 Project is extremely small over a 100-year post injection time frame. For this reason, CO_2 mineralization was not included as a part of the compositional simulation modeling for Terravault (EPA, 2024).

Computational modeling indicates that CO_2 injected into the Monterey Formation 26R reservoir will be soluble in both water and oil. Due to remaining saturation of oil and water in the depleted reservoir, total dissolved CO_2 in oil and water is estimated to be 20% and 8% of the CO_2 injected respectively (EPA, 2024). Hence, 72% of injected CO_2 is expected to remain in a supercritical state for an extended period of time (e.g., thousands of years). In the A1 - A2 storage area, CTV states that because of low water saturation within the Monterey Formation A1 - A2 storage reservoir results in greater than 98% of the CO_2 injectate remaining supercritical phase, minimizing the quantity of CO_2 dissolving in formation water through time (DEIR, 2024b). The phase (supercritical fluid, dissolved in water or oil) and form (mineralization) of CO_2 is important because storage as a supercritical fluid is the least secure phase of storage while formation of carbonates during mineralization is by far the most secure form of storage.

Comment: Assessment of mineralization of injected CO_2 in Volume 1 of the DEIR is incorrect and contradicts Volume 2 of the DEIR and the Class VI permit applications. Mineralization of CO_2 is not expected to occur to any appreciable degree during storage in the 26R and A1 – A2 storage reservoirs. The DEIR must be updated to reflect an accurate assessment of mineralization and the additional potential impacts of CO_2 storage in a supercritical state. Also, less storage in water and oil than expected would result in a more rapid pressure increase than expected and necessitate updating computational modeling before the mandatory five-year reevaluation period.

Lateral Confinement to Storage Areas

The Elk Hills Oil Field is a large WNW-ESE trending anticlinal structure, approximately 17 miles long and over seven miles wide (DEIR, 2024b). With increasing depth, the structure subdivides into three distinct anticlines, separated at depth by inactive high-angle reverse faults (DEIR, 2024b). The project would be developed in two phases. In Phase 1, three new wells and one modified existing well used for enhanced oil recovery will be used to inject CO_2 into the Monterey Formation in the 26R reservoir portion of 31S anticline (DEIR, 2024a). In Phase 2, two modified wells used for enhanced oil recovery would be used to inject CO_2 into the Monterey Formation in the A1 - A2 reservoir portion of the Northwest Stevens anticline (DEIR, 2024a). CTV states that it plans to maintain the reservoir pressure at or beneath the discovery pressure of the reservoir to ensure that CO_2 does not migrate beyond the edges of the anticline structure (DEIR, 2024a).

Comment: CTV states that the Monterey Formation in the A1-A2 storage reservoir has "*minimal*" connection outside the Area of Review (DEIR, 2024b). The DEIR is vague about what this means for the project. Do anticlinal structures provide full containment or not? The Monterey Formation A1-A2 CO_2 sequestration reservoir is located in the Northwest Stevens anticline. As discussed by Zumberge et al. (2005), the Northwest Stevens anticline and the western 29R structure share some of the same turbidite sand bodies. Sandstone reservoirs on the two structures also share the same oil family. After filling of the Northwest Stevens anticline reservoirs, oil appears to have spilled into and filled the 24Z trap. This same oil family may also have reached the 2B trap on the east nose of the 29R anticline and the 26R reservoir at the west end of the 31S anticline, again moving within turbidite sand bodies from the Northwest Stevens structure. It appears then that there is hydraulic communication between the Monterey Formation inside and outside of the 26R and A1 - A2 storage areas and injection must be carefully managed to avoid migration of injected CO_2 outside of these storage areas (exceedance of spill point). From schematics provided by CTV (DEIR, 2024b), there are a large number of wellbores screened in the Monterey

Formation outside of storage areas. At least some of these wellbores should be converted to monitoring wells to monitor for both pressure perturbation and CO_2 leakage during injection.

Comment: CTV states that confinement of the Reef Ridge Shale has been demonstrated in the 26R reservoir by the injection of 841 billion cubic feet of gas and 114 million barrels of water with no leakage (DEIR, 2024a). CTV states that confinement of the Reef Ridge Shale has been demonstrated in the A1 – A2 reservoir by the injection of 175 billion cubic feet of gas and five million barrels of water with no leakage. Referring to the work by Zumberge et al. (2005), CTV further states that geochemical analysis of reservoirs confirms compartmentalization through several million years and effectiveness of the Reef Ridge Shale to contain the CO_2 injectate (DEIR, 2024b). However, as discussed in the previous comment, this geochemical analysis also confirmed migration of oil between anticlinal traps, which the DEIR does not disclose. More importantly, there is no discussion of how leakage was monitored. It does not appear that CRC used monitoring wells in the Monterey Formation outside the 26R and A1- A2 reservoir areas to evaluate migration of injected fluids beyond anticlinal structures associated with these formations. It also does not appear that CRC monitored oil and gas wells for gas leakage during enhanced oil recovery operations. Hence, until CRC or CTV provides sufficient documentation, the veracity of these claims cannot be independently evaluated. CTV should provide evidence for claims of full confinement during injection. As previously discussed, CTV should convert several existing oil and gas wells screened in the Monterey Formation outside storage reservoirs into additional monitoring wells.

Permanence Criteria and Monitoring Plan

The primary purpose of geological storage of CO_2 is mitigation of climate change. Leakage of CO_2 from a storage formation through wellbores will occur to at least some extent (Celia and Bachu, 2003). Hence, the important question is not whether there will be leakage, but whether the extent of leakage is acceptable (Celia and Bachu, 2003) and how leakage will be monitored and quantitated.

A leakage rate of less than 1% per thousand years is necessary for geological storage of CO_2 to achieve the same climate benefits as renewable energy sources (Shaffer, 2010). In a Special Report on Carbon Dioxide Capture and Storage, the Intergovernmental Panel on Climate Change (IPCC, 2005) stated that for a well selected, designed, operated and appropriately monitored system, the balance of available evidence suggests that it is very likely the fraction of stored CO_2 retained is more than 99% over the first 100 years and it is likely the fraction of stored CO_2 retained is more than 99% over the first 1000 years. Leak rates of 0.01% per year, equivalent to 99% retention of the stored CO2 after 100 years, may be adequate to ensure the effectiveness of CO_2 storage (Hepple and Benson, 2005). As part of an application for Sequestration Site Certification, the California Air Resources Board (CARB) requires a greater than 90% probability of occurrence that 99% of CO_2 will be retained in the storage complex over 100 years post-injection to be eligible to receive Permanence Certification required for operation in California (CARB, 2018). There are no storage effectiveness criteria in the Class VI federal regulations. This is a major regulatory deficiency that now must be resolved on a state-by-state level.

To assess the risk of leakage of CO_2 through wellbores, Callas et al. (2022) used a storage security calculator developed by Alcalde et al. (2018) to estimate the percent of CO_2 leaked for different densities of wells per square kilometer (km) in a well-regulated environment. Callas et al. (2022) determined that a well density greater than 8 wells/km^2 would result in more than 1% cumulative CO_2 leaked in 1,000 years in a well-regulated environment. They state that well densities of 8 wells/km^2 are of concern. They

categorize the density of existing or abandoned wells as >8 wells/km^2, 6–7 wells/km^2, 4–5 wells/km^2, 2–3 wells/km^2, and <1 well/km^2 as worst to best for wellbore leakage concerns. Given the presence of 354 well penetrations through the confining layer and a storage area of 5332 acres (21.58 km^2), a well penetration density of 16.4 wells/km^2 represents a worst-case scenario for permanence for geologic storage of CO_2. The presence of a large number of well penetrations necessitates a robust evaluation of wellbore integrity of both plugged and unplugged wells prior to injection.

Comment: Information presented in the DEIR and Class VI permit applications does not support a finding that the project will retain 99% of stored CO_2 in excess of 100 years at cessation of injection, as required by the California Air Resources Board. Such a retention finding is not credible because: (1) the large number of wellbores (354) penetrating the Reef Ridge Shale serving as primary pathways for leakage, (2) the high pressure (~4,000 psi) (the driving force for leakage) of storage, (3) storage occurring primarily as a separate phase supercritical fluid resulting in direct contact of supercritical CO_2 with all 354 well penetrations, and (4) the high probability of elevated magnitude seismic activity in the vicinity of the project area capable of inducing levels of peak ground acceleration that would likely induce wellbore damage after plugging.

Comment: In Impact statement 4.8-1 - Generate Greenhouse Gas Emissions, Either Directly or Indirectly, that may have a Significant Impact on the Environment, the level of significance before mitigation is categorized as potentially significant (DEIR, 2024a). In mitigation measure MM 4.8-1 it is stated that, "*Prior to any injection of CO2 the owner/operator shall submit a monitoring plan that complies with all requirements of the EPA UIC permit issued for the project to demonstrate the retention of CO_2 in the injection/hydrocarbon reservoir zone. The plan shall be submitted to the Kern County Planning and Natural Resources Department concurrent with submittal to the EPA for review. A copy of the final approved plan from the EPA shall be provided to the Kern County Planning and Natural Resources Department"* (DEIR, 2024a). The monitoring plan submitted in the Class VI permit applications and attached in Volume 2 of the DEIR does not directly consider leakage from well penetrations – the most likely source of loss of retention of CO_2. Hence, MM 4.8-1 is deficient and should be rejected. It will be necessary to combine continuous areal monitoring of leakage with periodic monitoring of individual well penetrations to ensure retention of CO_2 and to quantify leakage.

Use of 10% per Year Pressure Loss as a Leakage Verification Criterion

CTV states that in the 26R reservoir, starting in 1998, pressure maintenance ceased, and the gas cap reservoir was "blown-down", depleting reservoir pressure. Since blow-down, reservoir gas pressure has remained at 150-300 psig. At the 26R Reservoir, maximum allowable downhole pressure will vary from 3847 to 4294 psig with planned bottomhole injection pressure between 3558 to 4060 psig. The initial discovery pressure was 3,250 psig (DEIR, 2024b).

Comment: CTV states that computational modeling results calibrated with monitoring data (e.g., pressure) will be used to support that the plume has stabilized and that the pressure change is negligible (less than 10 psi per year) and poses no risk for potential vertical migration after cessation of injection (DEIR, 2024b). In the A1 - A2 Storage Area, CTV states that pressure at the injection wells are expected to stabilize within one year after injection ceases and that final pressure will target the initial reservoir pressure at the time of discovery (DEIR, 2024b). Again, CTV states that monitoring data will be reviewed to ensure that the CO_2 plume has stabilized post-injection and that the reservoir pressure change is

negligible (less than 10 psi per year) (DEIR, 2024b). CTV states that pressure stabilization will be used for non-endangerment assessment (DEIR, 2024b). There does not appear to be any corresponding discussion of a 10% per year pressure loss criterion for leakage verification in the Class VI permit applications. A simple back of the envelope calculation indicates that a pressure loss of 10 psi per year results in a decrease in pressure from 3250 psi (initial reservoir and final target pressure) to 2250 psi in 100 years resulting in appreciable CO_2 loss. In reality, the rate of pressure loss will decrease somewhat as pressure decreases in the formation (i.e., reduction in driving force). Nevertheless, this metric of leakage verification is not sufficiently sensitive to be of practical use and should be reexamined if not rejected for both the 26R and A1 - A2 storage areas.

Wellbore Abandonment Evaluation to Support Plugging

DiGiulio et al. (2023) found that approximately 9 of 27 (33%) of plugged oil and gas wells were leaking gas through vent pipes at the surface and 3 of 26 (10%) of plugged wells examined were leaking gas through soil at the surface in western Pennsylvania, clearly demonstrating that oil and gas wells can continue to leak gas after plugging. Kang et al. (2016, 2017) and DiGiulio et al. (2023) found mean emission rates of leakage of methane from plugged wells in western Pennsylvania were 360 and 390 g/d, respectively. However, the computation of the mean emission rate from plugged wells in the dataset from DiGiulio et al. (2023) excluded an outlier, a plugged well leaking at a rate of 83 kg/d. It is important to realize that these rates are from depleted oil and gas fields. Higher emission rates of gas (in this case CO_2) would be expected if reservoirs were repressurized as is the case for geological storage of CO_2 in depleted oil and gas fields such as at the TerraVault I Project. Emission rates from both unplugged and plugged oil and gas wells follow a distribution whereby leakage from a relatively small number of wells accounts for the majority of total leakage. It is plausible that leakage of CO_2 from abandoned wells would follow a similar distribution.

Wellbore integrity failure is not uncommon. Rates of wellbore integrity failure range from 2 to 75% (Davies et al., 2014). Recent analysis of state and provincial databases show that wellbore integrity issues are widespread in oil and gas well populations in Canada and the U.S. and are likely under-reported or not reported at all depending on the jurisdiction (Wisen et al., 2020; Lackey et al., 2021; Ingraffea et al., 2014, 2020; Abboud et al., 2021).

Wellbore integrity failures are not necessarily addressed through well plugging and can persist after the well is “properly” plugged (Bowman et al., 2023; Kang et al., 2021; Wisen et al., 2020). Surface casing vent flow or sustained casing pressure in an oil or gas well may be due to annular gas flow which may not have been properly addressed during plugging. Gas migration and surface casing vent flows require wellbore treatments such as cement squeezes and casing repair (Hachem et al., 2023; Ingraffea et al., 2014; Yousuf et al., 2021). The process of remediating subsurface leakage is typically more complex and expensive than the average plugging procedure (Raimi et al., 2021) but must be addressed prior to plugging. Once plugged, subsurface leakage via the annulus may go unchecked leading to persistent groundwater impacts and emissions to the atmosphere.

As stated in the Class VI permit applications, the permittee shall not construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of injection, annulus or formation fluids into underground sources of drinking water (USDWs) or any unauthorized zones. The objective of this permit is to prevent the movement of fluids into or between USDWs or into

any unauthorized zones consistent with the requirements at 40 CFR 146.86(a) (EPA, 2024). Hence, even in the absence of a USDW in the 26R Reservoir, as a result of an aquifer exemption, the permittee cannot allow migration of CO_2 or other fluids (brine, oil) into overlying or underlying formations or to the surface.

Within the Area of Review the owners or operators must identify all potential conduits for fluid movement out of the injection zone, including both geologic features and artificial penetrations (40 CFR 146.84(c)(1)(iii)). The owner or operator must then evaluate artificial penetrations that may penetrate the confining layer(s) of the injection project for the quality of casing and cementing, and in the case of abandoned wells, for the quality of plugging and abandonment, and perform corrective action on any identified artificial penetrations that could serve as a conduit for fluid movement (40 CFR 146.84(c)(2), 146.84(c)(3), and 146.84(d)).

In its guidance document on Area of Review and Corrective Action, EPA emphasizes the need for a robust evaluation of both plugged and unplugged wellbores that penetrate the primary confining layer (EPA, 2013). EPA provides an extensive set of recommendations and guidelines for evaluation of artificial penetrations (EPA, 2013). Evaluation commences with review of available information including drilling logs, well completion and plugging reports, casing and cementing records, records on internal and external mechanical integrity tests, cement bond/variable density logs, information on well deviation, and wellbore diagrams (EPA, 2013). Information should also include testing for sustained casing pressure and surface casing vent flows which are indicators of wellbore integrity failures and increase the potential for gas emissions and groundwater contamination (Ingraffea et al., 2014, 2020; Lackey and Rajaram, 2019; Soares et al., 2021). Leak testing using procedures developed by Kang et al. (2016) could also be utilized to evaluate well integrity.

EPA states that if available records cannot establish wellbore integrity prior to plugging (e.g., corrosion in well casing and competent cement outside casing at critical locations such as at the interface of the injection zone and confining layer) additional testing is required (EPA, 2013). Additional testing could include multi-finger caliper logging, cement evaluation logging, internal and external mechanical integrity testing similar to that conducted on injection wells, and sidewall coring (EPA, 2013).

EPA also states that after all the available records have been reviewed, any wells located within the Area of Review that cannot be proven to have plugs adequate to prevent migration of carbon dioxide or formation fluids out of the injection zone must be evaluated by field tests in order to determine the quality of plugging, as required in the Class VI Rule (40 CFR 146.84(c)(3)) (EPA, 2013).

Comment: In the Class VI permit applications for the 26R Reservoir Area, CTV identified 204 wellbores that penetrate the Reef Ridge Shale. CTV states that three wells will be repurposed as monitoring wells, and one well, 373-35R, will be repurposed as a CO_2 injection well. CRC states that it has identified 157 wellbores that require plugging because the wellbores will not be used for injection or monitoring. Of the remaining 200 wellbores, 35 wellbores have been plugged back for sidetrack and have API-12 status for plugging and abandonment. No wellbores in the 26R Reservoir area have been permanently plugged back to surface. The disposition of the other 8 wellbores is unclear. It is also unclear why all 200 unused wellbores will not be plugged back to the surface prior to injection. In the DEIR, CRC states that 36 wellbores have been plugged back for sidetrack, leaving 164 wellbores that require standard plugging

procedures. Discrepancies in the number of wellbores requiring plugging between the Class VI permit applications and the DEIR need to be resolved.

Comment: In the DEIR, CTV states that 33 wells in the A1-A2 have been identified for abandonment. The DEIR must disclose the disposition of the other 78 unplugged wellbores, and the plan to plug back to the surface those wells that will not be used for injection or monitoring.

Comment: In Attachment B of Volume 2 of the DEIR, CTV identified 204 wellbores in the 26R reservoir and 150 wellbores in the A1 - A2 reservoirs that penetrate the Reef Ridge Shale - the primary confining layer in both storage areas. For the 26R Reservoir area, CTV states that "*Appendix 1*" lists the wells individually and provides information including well name, API-12, well type, status, spud date, surface coordinates, and pre-operational requirements. Despite several references throughout the DEIR, the DEIR fails to include Appendix 1 itself. In addition, there is no mention of preparation of the same type of Appendix for the A1 – A2 Reservoir area. A detailed wellbore-by-wellbore evaluation for both reservoirs will be necessary to assess wellbore integrity issues prior to plugging to plug wells in a manner to minimize leakage to the extent possible.

Comment: Class VI permit applications require "A tabulation of all wells within the area of review which penetrate the injection or confining zone(s). Such data must include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Director may require" (§146.82(a)(4)). In the Class VI permit applications, CTV states that an appendix entitled "*Well Table with Corrective Action Assessment*" lists the wells individually and provides a description of each well's type, construction, date drilled, location, depth, and record of plugging and/or completion. This table also purportedly identifies pre-operational requirements and the corrective action assessment for each wellbore. Despite explicitly being required in the Class VI permit applications, the appendix with tabulation of wells with the Area of Review was not added to EPA's Class VI docket until 2/7/2024. In addition, the provided appendix is still missing critical information and riddled with vague and indefinite terms. For example, in its tabulation, records of plugging and/or completion only consist of dates. Records of plugging and/or completion should at least include wellbore schematics including actual details of plugging and completion. The table also repeatedly evaluates the annular isolation within the upper confining later as "*adequate*" which fails to provide any meaningful criteria or performance standards. Information submitted in this regard by CTV is insufficient and does not appear to be in compliance with §146.82(a)(4).

Moreover, inclusion of what appears to be part of the DEIR's missing Appendix 1 in EPA's Class VI docket does not absolve Kern County from its own obligation to include the full Appendix with the DEIR for public review and comment, and to use it to inform its own analysis of impacts and appropriate mitigation for the CTV 1 project. The failure of the DEIR to include the Appendix means the DEIR must be recirculated with the missing information included. CTV should submit all information associated with wellbores relevant to wellbore integrity (e.g., internal and external mechanical integrity tests, drilling and cementing records, cement bond/variable density logs, cement squeeze operations, etc.).

Comment: In the Class VI permit application for the 26R Reservoir, CTV states that it accessed internal databases as well as California Geologic Energy Management Division information to identify and confirm wells within the Area of Review (EPA, 2024). CTV states that the corrective action assessment included the generation and detailed review of wellbore/casing diagrams for each well in the Area of

Review (EPA, 2024). Information used in the review included depths and dimensions of all hole sections, casing strings, cement plugs, and other wellbore equipment that isolates portions of the wellbore or otherwise establishes plugback depth (EPA, 2024). Perforated intervals are described with depth and status of perforations. Top of cement determination supported the review for annular isolation. Depths to relevant geologic features such as formation tops and injection zone were reviewed for both measured and true vertical depths (EPA, 2024). The depth of the confining zone in each of the wells penetrating the Reef Ridge shale was determined through open-hole well logs and utilized the deviation survey to convert measured depth along the borehole to true vertical depth from surface (EPA, 2024). All of this information is missing in the DEIR. This information (wellbore diagrams, cement evaluation logs, internal and external mechanical integrity tests, etc.) should immediately be made available to the public. This information is critical in determining the retention of CO_2 in storage reservoirs. A detailed wellbore-by-wellbore evaluation is necessary to assess wellbore integrity issues prior to plugging in order to plug wells in a manner that minimizes leakage to the extent possible.

Comment: In the DEIR, CTV identified 204 wellbores in the 26R reservoir and 150 wellbores in the A1-A1 reservoirs (DEIR, 2024b). No wellbores were deemed deficient in either reservoir and none require corrective action. This is a 0.0% wellbore barrier failure rate for 354 wellbores, at odds with the published rates of wellbore failure rates ranging from 2-75% in the literature. Since no information (sustained casing pressure, surface casing vent flow, gas migration in soil, internal and external mechanical integrity testing, cement evaluation logs, wellbore diagrams, drilling logs, etc.) was provided, it is impossible to verify the accuracy of this statement, which should be regarded with a degree of skepticism. It does not appear that EPA conducted an independent evaluation of wellbore integrity of well penetrations. It is both inappropriate and negligent to simply accept a statement of no wellbore barrier failure without supporting information. Again, all supporting information (wellbore diagrams, cement evaluation logs, internal and external mechanical integrity tests, etc.) should immediately be made available to the public to enable an independent evaluation of wellbore integrity.

Comment: In the Corrective Action Plan (EPA 2024), CTV states that all wellbores within the Area of Review will, "*if necessary"*, be pressure tested prior to abandonment and monitored and/or have a technical demonstration of adequate zonal confinement prior to the commencement of CO_2 injection or based on an agreed upon phased schedule after CO_2 injection commences, "*if conditions allow"*. It is unclear as to what conditions would preclude pressure testing. What is a demonstration of adequate zonal confinement? These statements are far too vague to be of any use. Hence, this Corrective Action Plan is unacceptable. Under CEQA, all feasible mitigation is required. The terms of the Corrective Action Plan do not constitute all feasible mitigation. Since all wellbores penetrating the confining layer will be in direct contact with supercritical CO_2 at high pressure, internal (pressure) and external (e.g., temperature, noise, oxygen-activation logging) mechanical integrity tests should logically be conducted on these wellbores prior to plugging and abandonment, similar to regulatory requirements for plugging injection wells.

Comment: In the A1-A2 area, CTV states that it assessed USDW protection using the following criteria: (1) surface or intermediate casing over the USDW; (2) if the well is abandoned, a cement plug across base of USDW; and (3) cement in the annulus in intermediate casing above the surface casing shoe and "*sufficient*" annular cement within the confining Reef Ridge Shale. Since all wellbores will be exposed to supercritical CO_2 for presumably thousands of years at high pressure in both the 26R and A1-A2 reservoirs, it is critical that existing wellbores not being used for injection or monitoring be plugged in a

manner consistent with regulatory requirements for plugging injection wells (4 plugs). As per Class VI regulations, all well penetrations should include a cement plug through the primary confining zone, and/or across the injection zone/confining zone contact, with sufficient integrity to contain separate-phase carbon dioxide and elevated pressures. Cement plugs should also be located across the bottom of any casings and at the base of the lowermost USDW. A surface plug would also typically be required by local well abandonment regulations to ensure that there is no risk of anyone physically falling into the well bore. Materials that are compatible with CO_2 must be used where appropriate (40 CFR 146.84(d)). A wall-to-wall barrier throughout the confining layer is critical to zonal isolation of CO_2. If well casing is not removed prior to plugging, the integrity of annular cement must be verified through the use of external mechanical tests and recent cement evaluation logs.

Comment: As stated in the Class VI applications, the Etchegoin Formation is between the Reef Ridge confining zone and the Upper Tulare Formation, is continuous across the Area of Review, and will dissipate CO_2 injectate that may migrate upward from the injection zone. The Etchegoin will be monitored continuously for pressure and temperature changes at one monitoring well in the 26R Reservoir. The DEIR does not adequately explain why there is only one monitoring well in Etchegoin. What is the minimum magnitude of leakage that would be detected from pressure perturbation from the injection well located at the greatest distance from the monitoring well? The permittee needs to evaluate this to justify the existence of only one monitoring well in the Etchegoin Formation.

Comment: In the Class VI permit applications, CTV states that surface air monitoring, including broad aerial monitoring and targeted monitoring at wells and pipelines, will be conducted using eddy covariance towers (DEIR, 2024b). In regard to leakage to the atmosphere, under 40 CFR Part 98 Subpart RR, an operator must submit a proposed monitoring, reporting, and verification (MRV) plan to EPA within 180 days of receiving a final Class VI permit (§98.448(b)(2)). As part of the MRV plan, the operator must: (1) "identify potential surface leakage pathways for CO_2 in the maximum monitoring area and the likelihood, magnitude, and timing, of surface leakage of CO_2 through these pathways" (§98.448(b)(2)); (2) develop "a strategy for detecting and quantifying any surface leakage of CO_2" (§98.448(b)(3)); and (3) develop "a strategy for establishing the expected baselines for monitoring CO_2 surface leakage" (§98.448(b)(4)). Hence, leakage to the atmosphere will be considered at some point. However, a monitoring program should be specific to evaluating leakage from plugged well penetrations as general air monitoring may not be sufficiently sensitive to determine leakage. MM 4.8-1 needs to include specific monitoring for leakage from plugged and unplugged well penetrations. Methods employed by Kang et al. (2016) can be used for CO_2 monitoring at both plugged and unplugged wells.

Seismic Risk Evaluation

Of particular concern at the TerraVault I project is the effect of natural or induced seismicity on wellbores. After a well is permanently plugged and abandoned, natural or induced seismicity can damage wellbores. For example, hundreds of oil well casings were sheared in the Wilmington oil field in Los Angeles during five or six earthquakes of relatively low seismic moment magnitude (**M** 2 to **M** 4) during a period of maximum subsidence in the 1950s (Dusseault et al., 2001). The seismic moment magnitude is the product of the area of rupture, the average displacement on the fault (a fracture or zone of fracture between two blocks of rock), and the shear modulus, a parameter related to the rigidity of rocks in the fault zone measured on a logarithmic scale (GWPC, 2021). Recently, Pozzobon et al. (2023) documented increased

leakage of gas from plugged oil and gas wells resulting from seismic activity due to injection of produced water into disposal wells and hydraulic fracturing.

Impacts of earthquakes on buildings and pipelines, including those that are buried, have long been an active area of civil engineering research. There are empirical estimates of pipeline damage that relate the number of repairs to peak ground acceleration, peak ground velocity, maximum ground strain, and other factors. There is a need to extend this existing body of research to subsurface wellbore leakage caused by earthquakes (Kang et al., 2019). Hence, seismic monitoring and hazard assessment should be based not only on the magnitude of seismic event but on ground motion.

USEPA's Class VI regulations require permit applicants to provide a determination that seismic activity will not compromise subsurface containment of injected carbon dioxide (40 CFR 146.82(a)(3)(v)). The Class VI rule provisions do not address potential damage to buildings and infrastructure (including wellbore cement sheaths of active and abandoned wells) associated with geologic storage of CO_2. However, as part of its permanence requirements for geologic sequestration, the California Air Resources Board (CARB) has developed requirements which include consideration of natural and induced seismicity (CARB, 2018). In the California Carbon Capture and Sequestration Protocol under the Low Carbon Fuel Standard (CARB, 2018), if an earthquake of $\mathbf{M} \geq 2.7$ is detected within a radius of one mile of CO_2 injection operations, a determination must be made whether the mechanical integrity of any well, facility, or pipeline within this radius has been compromised. This protocol however does not consider a naturally occurring major seismic event at distance from an injection well which could induce ground movement damaging wellbores. In addition, the California Energy Commission has developed guidelines to evaluate the potential for induced seismicity during geological storage of CO_2 (CEC, 2017).

Given uncertainty in potential impact due to natural and induced seismicity during geological storage of CO_2, protocols developed by U.S. Department of Energy's (DOE) Recommended Practices for Managing Induced Seismicity Risk Associated with Geologic Carbon Storage (Templeton et al., 2021, 2023) should be used when permitting a facility for geological storage of CO_2. This integrated and risk-based protocol is a product of the DOE's National Risk Assessment Partnership, a multi-year collaborative research effort of Los Alamos National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, National Energy Technology Laboratory, and Pacific Northwest National Laboratory. This protocol specifically addresses the risk of seismicity at a geologic carbon storage facility and is relevant to CO_2 injection at Carbon TerraVault I. Recommendations by Templeton et al. (2021, 2023) and regulatory requirements and guidelines by EPA and the State of California are used here as the basis of evaluation for the seismicity portion of the permit application.

Review of Applicable Local, State, and Federal Laws and Requirements on Seismicity

Relevant local, state, and federal laws and regulations should be reviewed to determine how induced seismicity, however minor or unlikely, is regulated and its effects prevented or mitigated (Templeton et al., 2021). In California, the Alquist-Priolo Earthquake Fault Zoning Act (1972) and the Seismic Hazards Mapping Act (1990) direct the State Geologist to delineate regulatory "Zones of Required Investigation" to reduce the threat to public health and safety and to minimize the loss of life and property posed by earthquake-triggered ground failures and other hazards. Cities and counties affected by the zones must regulate certain development projects within them, based on the CA CGS Information Warehouse: Regulatory Map Portal (https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/). As

stated in the DEIR, the Carbon TerraVault I project does not appear to be within a Zone of Required Investigation. In the DEIR, Kern County reviewed compliance with other applicable laws and regulations for this project.

Review of Naturally Occurring Seismic Events and Delineation of a Region of Concern

To support a Class VI rule application, an owner/operator is required to submit a narrative description and information on the seismic history of the area, including the presence and depths of seismic sources, and a determination that seismicity will not interfere with containment of injected carbon dioxide (40 CFR 146.82(a)(3)(v)).

CARB requires an evaluation of the seismic history of the proposed sequestration site, including the date, magnitude, depth, and location of the epicenter of seismic sources and a determination that the seismicity would not cause a catastrophic loss of containment, either by breaching the integrity of the well or the sequestration formation (CARB 2018).

To evaluate the impact of a major naturally occurring seismic event distant from a site on a site, it is necessary to define a Region of Concern (ROC). The ROC is defined as the area in which a ground motion threshold over the lifetime of a project could be exceeded causing impact to infrastructure (Templeton et al., 2021), which in this case includes wellbores. An assessment or literature search should identify any tectonic events that may have occurred in the region and a map and catalog should be created for seismic events which have occurred within at least 200 km from the reservoir (Templeton et al., 2021).

Previous seismic activity should be characterized within a region of at least 200 km radius around planned injection operations to ensure that wider regional trends are considered in the seismic hazard assessment (Templeton et al., 2021, 2023). This consideration reduces the possibility of overlooking infrequent but possibly large events that could impact the local hazard. Elements of the seismicity characterization should include:

- Catalogs of instrumentally recorded earthquakes from national, state, or regional agencies.
- Historical records of earthquakes and observed fault ruptures, including but not limited to, historical earthquake catalogs, and newspaper and other contemporary records, and published reports of field geological investigations. Historic reports of significant earthquakes can provide important information on time periods that predate instrumental recording. For rare events that occur once every few hundred to thousands of years, this may be the only evidence of seismic activity.
- Fault maps and fault characterizations, including but not limited to, scientific maps and publications.
- Paleoseismic fault displacement data, including but not limited to, published trenching studies.
- Previous induced earthquake activity, including but not limited to, earthquake catalogs and scientific publications investigating possible induced activity. If the targeted region has a history of induced seismicity, this would be a strong indication of a critically stressed crust.

In Volume II of the DEIR, Soils Engineering Inc. conducted a review of naturally occurring seismic events since 1852. Their identified Region of Concern however was limited to 100 km from the Carbon

TerraVault I project. Major faults within this area are illustrated in Figure 1. From 1852 through 2020, southern California has experienced at least 20 major earthquakes with estimated Richter scale magnitudes ranging from 5.9 to 8.0. As Soils Engineering Inc. discuss, the nearest major active faults in the western portion of the CTV Project are the San Andreas Fault located approximately 23.0 to 23.3 km to the southwest, the Kern Front Fault located approximately 39.7 to 39.9 km to the northeast, the Pleito Fault located approximately 48.3 to 48.7 km to the southeast, the White Fault located approximately 48.6 to 48.9 km to the east-southeast, and the Buena Vista Fault (minor active fault) located approximately 15.42 km to the southeast. The nearest major active faults in the eastern portion of the CTV Project are the San Andreas Fault located approximately 23.9 to 24.6 km to the southwest, the Kern Front Fault located approximately 35.5 to 36.8 km to the northeast, the White Fault located approximately 39.2 to 42.5 km to the east-southeast, the Pleito Fault located approximately 40.0 to 42.9 km southeast, and the Buena Vista Fault located approximately 9.41 km to the southeast.

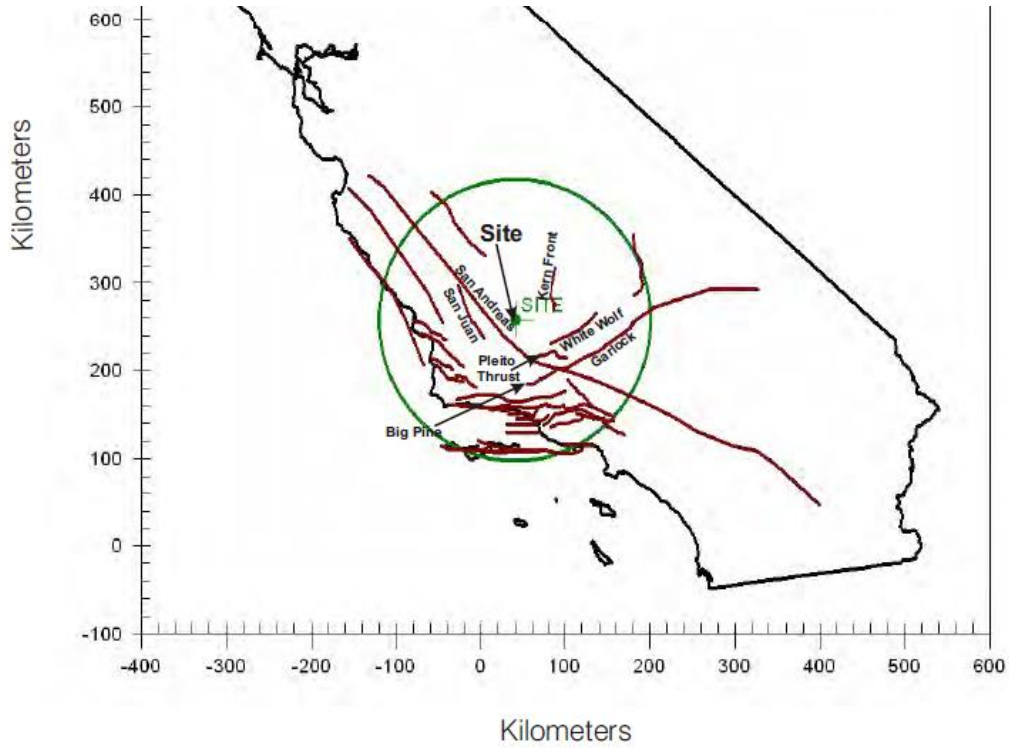

Figure 1. Identification of major faults in the vicinity of the TerraVault 1 Project. Figure from Soils Engineering, Inc. in Vol 2. of DEIR.

Some of these faults have produced earthquakes in excess of seismic moment magnitude **M** 7 (Figure 2). The San Andreas fault is a strike-slip fault (two blocks slide horizontally past each other). The 1857 **M** 7.9 Fort Tejon earthquake along the San Andreas fault, with an epicenter (the surface location directly above the depth or hypocenter where rupture is initiated) in Parkfield, CA (Figure 3) was one of the greatest earthquakes ever recorded in the United States. The San Andreas fault broke the surface continuously for at least 350 km (220 miles), possibly as much as 400 km (250 miles). In Figure 3, the estimated earthquake intensity using the Modified Mercalli (MM) scale (Table 1) is estimated with distance from the epicenter. Intensity is a qualitative measure of the strength of shaking at a specific place

and is characterized in terms of impact of shaking on individuals as well as on objects and structures. It is not a measure of the size of the earthquake.

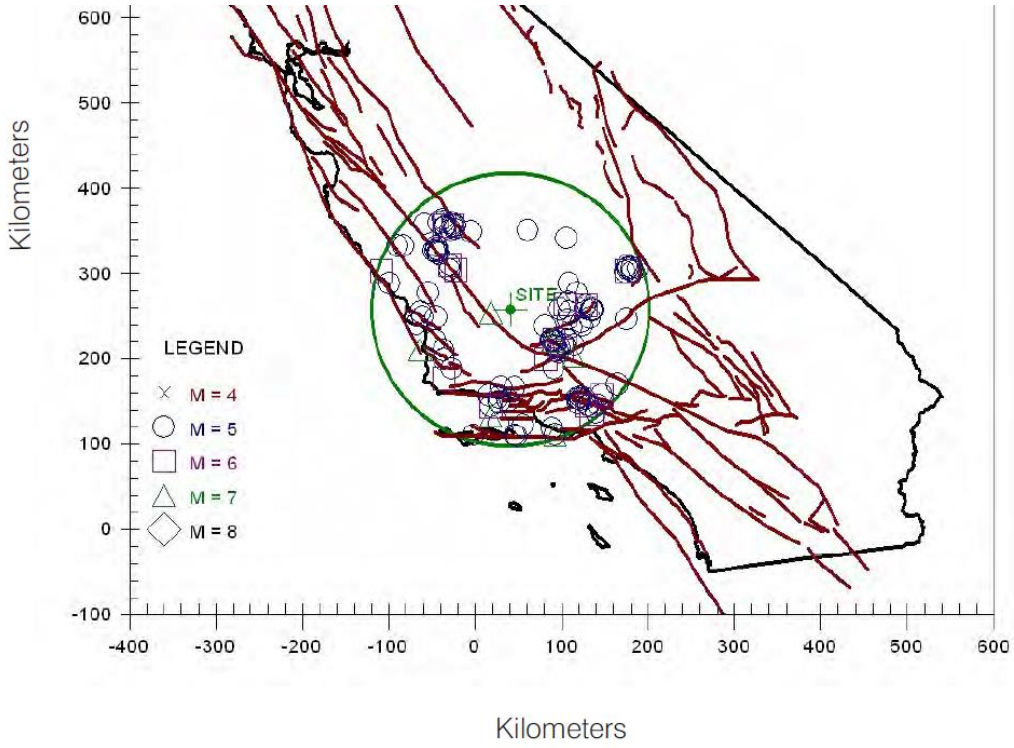

Figure 2. Magnitude of earthquakes along major faults in the vicinity of the CTV project. Figure from Soils Engineering, Inc. in Vol 2. of DEIR.

During the Fort Tejon earthquake, horizontal displacement as much as 9 meters was observed on the Carrizo Plain. As a result of the shaking, the current of the Kern River was turned upstream, and water ran four feet deep over its banks. The waters of Tulare Lake were thrown upon its shores, stranding fish miles from the original lake bed. The waters of the Mokelumne River were thrown upon its banks, reportedly leaving the bed dry in places. The Los Angeles River was reportedly flung out of its bed, too. Some of the artesian wells in Santa Clara Valley ceased to flow, and others increased in output. New springs were formed near Santa Barbara and San Fernando (USGS, 2023).

At the time of the earthquake, California was sparsely populated, especially in the regions of strongest shaking. Were the Fort Tejon shock to happen today, the damage would easily run into billions of dollars, and the loss of life would likely be substantial (USGS, 2023). Strong shaking was reported to have lasted for at least one minute but possibly lasted two or three minutes. The portion of the fault that ruptured in 1857 has settled into a period of dormancy and this has given rise to suggestions that future slip along that zone may be characterized by a very large 1857-type event followed by another period of inactivity (Sieh, 1978).

The Elkhorn Thrust, a thrust fault (reverse fault having a shallow or low angle dip) near the San Andreas fault, may have slipped simultaneously in the 1857 Fort Tejon quake indicating that future movements along the San Andreas fault zone might produce simultaneous rupture on thrust faults causing a "double

earthquake" (Southern California Earthquake Center). Reverse faults (hanging wall moves up and over the foot wall) are common in southern California and other areas experiencing tectonic compression (GWPC, 2021).

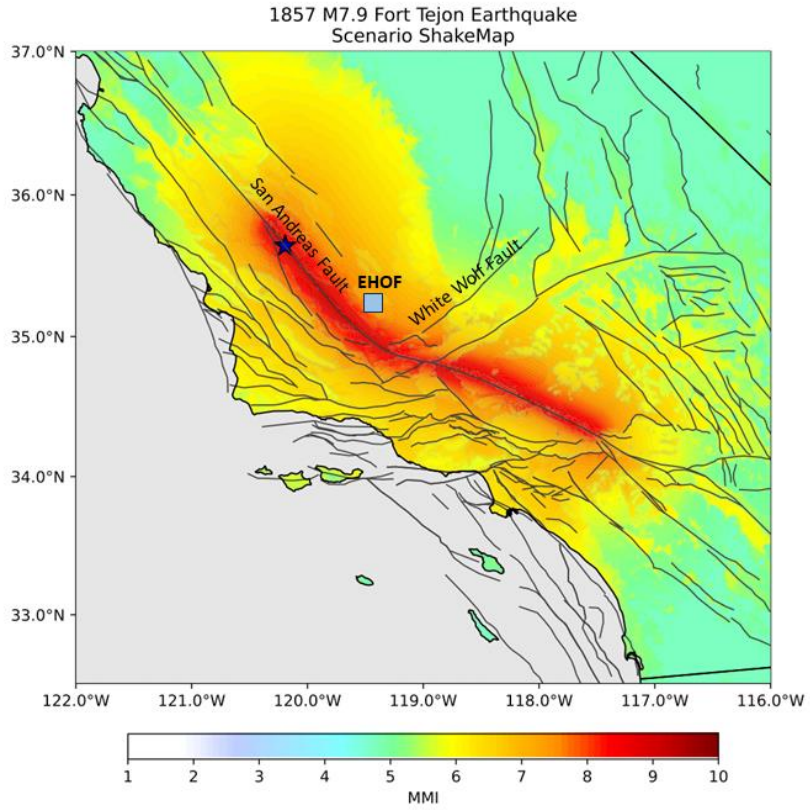

Figure 3. Location of faults in southern California and of the 1857 Tejon earthquake on the San Andreas Fault and estimated Modified Mercalli Intensity. The Epicenter illustrated by dark blue star. Approximate location of Elk Hills Oil Field (EHOF) illustrated by light blue box. San Andreas and White Wolf Faults identified. Figure modified from Southern California Earthquake Data Center.

As discussed by Soils Engineering, Inc. in Volume 2 of the DEIR, an earthquake of **M** 8.0 has been estimated for this segment of the San Andreas Fault having a conditional probability of occurrence of 0.1 (10%) over the 30-year period of 1988 to 2018. Other segments of the San Andreas fault include the Cholame (north) and Mojave (south) segments. Their respective distances from the site and characteristic magnitudes are 58 miles and **M** 7.3 (Cholame) and 78 miles and **M** 7.8 (Mojave). The associated conditional probabilities of occurrence, for the 30-year period of 1988 to 2018 were 0.3 (30%) for both segments.

The White Wolf Fault is a high-angle reverse fault with a small component of left-lateral slip. Movement along this fault was the cause of the **M** 7.5 1952 Bakersfield Earthquake, which most consider to be the third largest historic quake in California, after the 1857 Tejon and 1906 San Francisco quakes. The White Wolf fault is traceable for only about 48 km (34 miles), much less than the fault length typically thought necessary to produce such a major earthquake. The earthquake caused severe damage as far away as Las Vegas. In addition, there were at least 20 aftershocks of **M** 5 or greater associated with the initial **M** 7.5 event (San Joaquin Valley Geology).

Table 1. Modified Mercalli Intensity, peak ground acceleration (PGA), and peak ground velocity (PGV) for the central United States. Source: GWPC (2021).

MMI	Description	PGA (g)	PGV (cm/sec)	Observations (Richter 1958)
I	Not felt	< 0.00007	< 0.003	Not felt except by a few under especially favorable circumstances.
II to III	Weak	0.0008	0.04	Felt by only a few people, often indoors. Hanging objects swing. May not be recognized as an earthquake.
IV	Light	0.01	0.5	Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frames creak.
V	Moderate	0.05	3.0	Felt outdoors; direction estimated. Sleepers awakened, liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.
VI	Strong	0.09	6.5	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry cracked. Small bells ring (church, school). Trees, bushes shaken.
VII	Very strong	0.15	14	Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roofline. Fall of plaster, loose bricks, stones, tiles, cornices, un-braced parapets, and architectural ornaments. Some cracks in masonry. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
VIII	Severe	0.27	30	Steering of motor cars affected. Damage to masonry; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.

Ground motion can cause structural and nonstructural damage to buildings as well as to civil structures, such as dams, bridges, highways, railroads, tunnels, pipelines, tanks, and airport runways. It is commonly accepted that structural damage to modern engineered structures generally happens for earthquakes larger than **M** 5.0 (GWPC, 2021). For example, for the National Seismic Hazard Maps, which are the basis for the building code in the U.S. (International Building Code), the USGS uses a minimum magnitude of **M** 5.0 in the western U.S. and **M** 4.75 in the central and eastern U.S. in their hazard calculations (Petersen et al. 2014). Poorly designed or constructed buildings, such as unreinforced masonry, for example, brick and adobe, and buildings built before modern building codes can be subject to nonstructural damage at magnitudes as low as **M** 4.0 and, in some rare cases, as low as **M** 3.0 (GWPC, 2021). It is unclear what magnitude seismic event would be sufficient to cause damage to wellbores. However, as previously stated, seismic events below **M** 3 or 4 can damage wellbores. Hence, the California Carbon Capture and Sequestration Protocol requiring a determination of integrity of any well, facility, or pipeline when an earthquake of **M** ≥ 2.7 has been detected within a radius of one mile of CO_2 injection operations is reasonable.

Comment: CTV states that during the 1952 Kern County earthquake, there were no reservoir containment issues associated with oil and gas operations at the Elk Hills Oil Field. While the 26R reservoir was discovered in the 1940s, it is stated in Volume 2 of the DEIR that the Monterey Formation reservoir in the

26R anticline was not developed until 1970's. Also, the A1-A2 reservoir was not discovered until the 1970s. Hence, CTV's statement in this regard is misleading and should be removed from the DEIR.

Hazard Evaluation of Natural Seismic Events

Comment: Seismic risk is calculated from four main contributing factors. The first factor is seismic hazard, which is the probability of exceedance of a specified ground motion intensity. The second factor is exposure, which is the infrastructure or population potentially affected by seismicity. The third factor is fragility, which is the susceptibility of each element of exposure to damage from ground motion intensity. The fourth factor is consequence, which is the metric chosen to quantify the risk (e.g., economic impact, loss of CO_2 containment) (Mitchell and Green, 2017). The seismic risk analysis conducted in the DEIR is deficient because it fails to consider all four factors, especially for legacy wells which were not considered at all. In the DEIR, hazard curves were generated, however, legacy wells were not identified as part of exposure to seismicity. Fragility functions were not identified for any infrastructure including legacy wells and the consequences of leakage through legacy wells were not quantified. Hence, a comprehensive seismic risk analysis was not conducted in the DEIR.

Hazard curves can be generated to evaluate a given percent probability of exceedance of a peak ground acceleration or spectral acceleration level over a period of time (e.g., 10% probability of exceedance in 50 years). Peak ground acceleration is a measure of the maximum force experienced by a small mass located at the surface of the ground during an earthquake. It is an index to hazard for short stiff structures. Spectral acceleration is a measure of the maximum force experienced by a mass on top of a rod having a particular natural vibration period. Short buildings (e.g., less than 7 stories) have short natural periods (e.g., 0.2-0.6 sec). Tall buildings have long natural periods (e.g., 0.7 sec or longer) (USGS). Peak ground acceleration appears to be the appropriate metric to evaluate potential to wellbores.

Templeton et al. (2021) state that a site-specific probabilistic seismic hazard analysis should be conducted in accordance with current practice of earthquake hazard estimation to evaluate the baseline hazard from natural tectonic seismicity. Input into the site-specific probabilistic seismic hazard analysis should include the following:

- A database of potentially damaging earthquake sources that may impact the ROC, that experienced activity during the Quaternary Period (past 1.6 million years), including fault-specific sources and areal sources where appropriate. Areal seismic sources are distinct volumes within the Earth's crust that encompass concentrated zones of seismicity,
- Spatial, temporal, and frequency-magnitude distribution models for each seismic source.
- Region appropriate ground motion models for tectonic earthquakes as a function of at least earthquake magnitude and travel path. A ground motion model relates a ground motion parameter such as peak ground acceleration or peak ground velocity to magnitude, distance, and site condition. There are numerous models for tectonically active regions, such as the western U.S. (GWPC, 2021). The models for the western U.S. rely on empirical motion data obtained from instrumental records of earthquakes or numerical modeling in the absence of adequate strong motion data. Empirical models are often developed by performing a statistical regression on a ground motion parameter from the recorded data to find the best fitting model. Current ground motion models do not extend below **M** 3.0 (GWPC, 2021). Common inputs into a ground motion model include magnitude, distance, and site condition. For small earthquakes generally less than

M 4, hypocentral distance is an adequate distance metric. For larger events, a distance metric that accounts for the finite dimensions of the fault rupture area is desirable. For most models, rupture distance (the shortest distance to the fault plane) is used (GWPC, 2021). Site condition inputs also are required to accurately predict ground shaking, particularly at a soil site (GWPC, 2021).

- Information from geological, geophysical, and topographical studies within the ROC should be included to incorporate local site responses.

Templeton et al. (2021) state a seismic hazard report should be prepared by a licensed professional having demonstrated competence in the field of seismic hazard assessment. The seismic hazard report should contain site-specific assessments of the seismic hazard affecting the project and relevant sites within the ROC. The report should identify any known seismic hazards that could adversely affect relevant sites within the ROC in the event of an earthquake. Results from the probabilistic seismic hazard analysis should include multiple hazard curves and hazard maps to report the results from the baseline seismic hazard analysis due to natural seismicity before injection operations commence. Federal and state permitting agencies should then independently review the seismic hazard report to determine the adequacy of the hazard evaluation. The reviews should be conducted by licensed professionals having demonstrated competence in the field of seismic hazard assessment.

Volume 2 of the DEIR contains a report entitled "Preliminary Soil and Geologic Evaluation Terra Vault 1 Carbon Capture Project Elk Hills" completed by Soil Engineering Inc. that contains a probabilistic seismic hazard analysis for the facility. Soils Engineering Inc. used the computer modeling program EQSEARCHWIN version 3.0 (Thomas Blake) to evaluate historical earthquakes in the area of the site over the last 200 years. The largest estimated site accelerations are 0.221g (Section 36) to 0.295g (Section 7/18) from a 7.9 magnitude earthquake on January 9, 1857.

A number of active faults are located within a 50-mile radius of the subject site. Soils Engineering Inc. used the computer modeling program EQFaultwin vers. 3.0 (Thomas Blake) to evaluate the effect that a major earthquake within a 50-mile radius might have on the site. The program computed the maximum peak site ground accelerations resulting from an earthquake. Results of this analysis are presented in Table 2.

This analysis estimates that a maximum peak ground acceleration of up to 0.258g would be felt at the site as a result of a maximum earthquake of magnitude 8.0 on the San Andreas Fault approximately 23 to 24.6 kilometers away. A maximum probable earthquake of magnitude 7.3 on the White Wolf Fault approximately 39.2 to 39.9 kilometers away would create a peak site ground acceleration of up to 0.146g at the site.

Soils Engineering Inc. then utilized USGS's Unified Hazard Tool (USGS, 2024) to generate hazard curves for the site which was re-produced for this report in Figure 4. The USGS program calculates peak ground and spectral acceleration at a site for all the earthquake locations and magnitudes believed possible in the vicinity of the site. Each of these magnitude-location pairs is believed to happen at some average probability per year. Small ground motions are relatively likely, large ground motions are very unlikely. Beginning with the largest ground motions and proceeding to smaller, probabilities are summed to calculate a total probability for a particular period of time (USGS).

Table 2. Identification of faults near the site and associated maximum earthquake magnitude, estimated maximum peak ground acceleration at the site, and associated site intensity. Table from Soils Engineering, Inc. in Vol 2. of DEIR.

FAULT	Approximate Distance (Km)	Maximum Earthquake Magnitude (Mw)	Maximum Peak Ground Acceleration	Estimated Site Intensity (MM)
San Andreas (Other Segments)	**23 to 24.6**	7.4 to **8.0**	0.128 to **0.258**	VIII to **IX**
Kern Front	35.5 to 39.9	6.3	0.085 to 0.093	VII
White Wolf	39.2 to 48.9	7.3	0.123 to 0.146	VIII
Pleito Thrust	40.0 to 48.7	7.0	0.105 to 0.122	VII
San Juan	42.6 to 47.6	7.1	0.093 to 0.101	VII
San Luis Range	72.8 to 76.2	7.2	0.083 to 0.086	VII
Big Pine	64.9 to 73.4	6.9	0.060 to 0.066	VI
Great Valley 14	79.6 to 85.7	6.4	0.050 to 0.052	VI
Garlock (west)	70.3 to 73.6	7.3	0.069 to 0.076	VI to VII

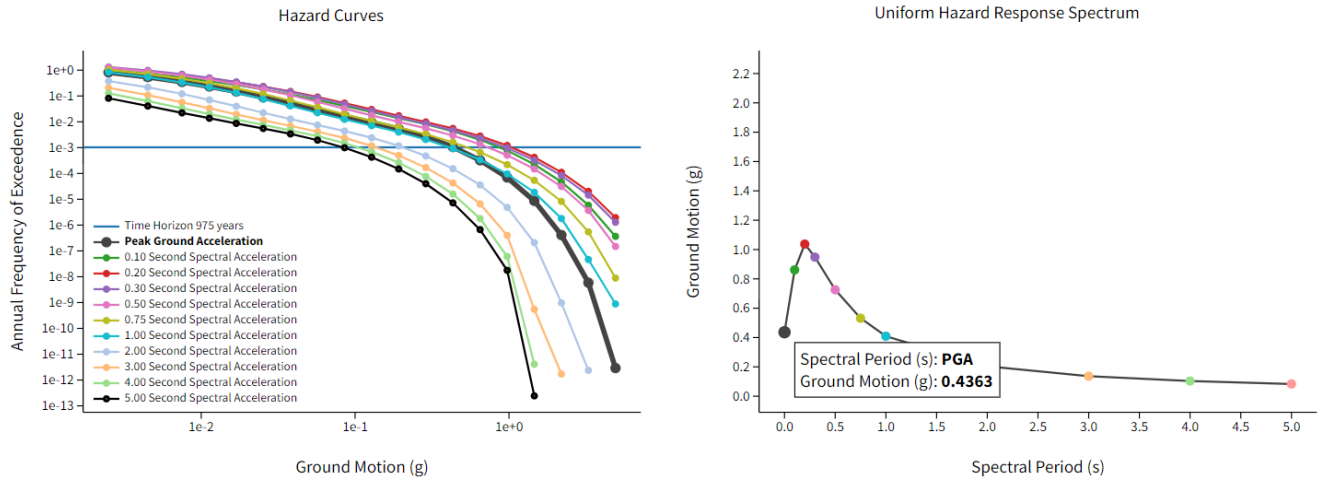

Figure 4. Generation of hazard curves for the site location (latitude 35.325027, longitude, -119.544935) using the USGS Unified Hazard Tool for a probability of exceedance of 5% in 50 years. For an annual frequency of exceedance of 1.025E-03 or return period (inverse of frequency of exceedance) of 975 years, peak ground acceleration = 0.4363g (43.63% of the gravitational constant).

For the project location, a peak ground acceleration rate of 0.4363g was estimated having a 5% probability of exceedance in 50 years with an annual rate of exceedance = 1.025E-03 or a return period of 475 years (DEIR, 2024b). The return period or time horizon is the inverse of the annual rate of

exceedance. Using the USGS "rule of thumb" for calculating return period, this is approximately equivalent to a 9.8% probability of exceedance in 100 years, a 42% probability of exceedance in 500 years, and a 69% probability of exceedance in 900 years. A further examination of the hazard curves (Figure 5) (not included in the DEIR) indicates a peak ground acceleration of 0.3175g having a 10% probability of exceedance in 50 years, 19% probability in 100 years and a 64% probability of exceedance in 400 years. Care was taken in these calculations to ensure that $r^* \leq 1$ where $r^* = r(1+0.5r)$ and r = probability as recommended by USGS (USGS, 2024).

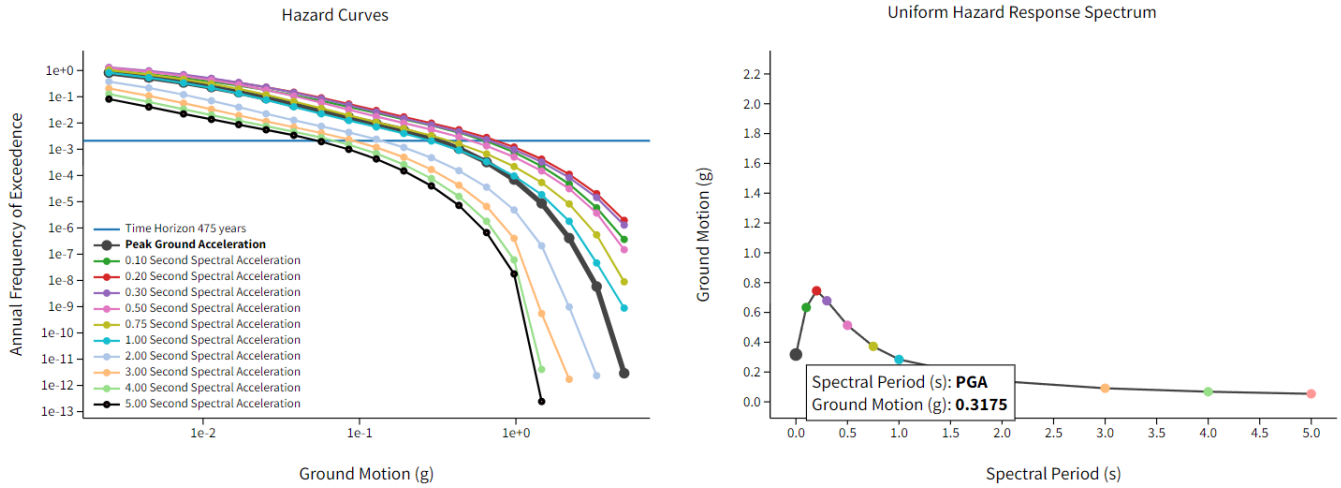

Figure 5. Generation of hazard curves for the site location (latitude 35.325027, longitude, -119.544935) using the USGS Unified Hazard Tool for a probability of exceedance of 10% in 50 years. For an annual frequency of exceedance of 2.105E-03 or return period (inverse of frequency of exceedance) of 475 years, peak ground acceleration = 0.3175g (31.75% of the gravitational constant).

Comment: In Volume 1 of the DEIR, in Impact 4.7-1, it is stated, *"an earthquake may disturb surface and/or subsurface facilities, possibly resulting in loss, injury, or death. Impacts from seismic hazards are considered potentially significant without mitigation and MM 4.7-1 would be required to reduce these potential impacts to a less-than-significant level for this individual project impacts."* Mitigation measure 4.7-1 consists of preparing *"a comprehensive seismic activity monitoring plan that includes, but is not limited to, connection to the Statewide seismic monitoring program of California Seismic Network (CISN)…The final plan shall be approved by the California Air Resources Board and include all requirements of State law including but not limited to: Appropriate subsurface monitoring to ensure geologic sequestration of injected carbon dioxide; Identification of hazards and conditions that may require the suspension of carbon dioxide injections; notification protocols for all applicable agencies and emergency procedures. All requirements for seismic monitoring adopted by the California Air Resources Board – Carbon Capture, Removal, Utilization and Storage Program shall be implemented."*

While a seismic monitoring plan would be able to detect an earthquake, a seismic monitoring program would not reduce damage to surface and subsurface facilities (e.g., wellbores). Unlike induced seismicity as a result of injection of CO_2, monitoring of natural seismicity is not mitigation. Cement used outside of well casing is a brittle material susceptible to damage from ground motion. Hence, a seismic monitoring program would not mitigate damage from a natural major earthquake within 100 km of the Carbon TerraVault I project to a less-than-significant level. In the presence of moderate seismic activity at the

project area (e.g., MMI ≥ 5, PGA ≥ 0.05g, PGV ≥ 3.0 cm/s), mitigation should include assessment of leakage at wellbores and reentry and replugging of wellbores in the event of increased leakage from wellbores. The Level of Significance for Impact 4.7-1 should be changed from Less than Significant to Significant and Unavoidable.

Comment: In Volume 2 of the DEIR, Soils Engineering Inc. states, *"Project proponent will design structures in accordance with state and county code requirements for seismic ground shaking and geotechnical and geohazard constraints. Designs shall comply with seismic, soil response at the site, and structural dynamic characteristics contained in the Kern County Code of Building Regulations and the California Building Code and State of California design standards Chapter 16 and 18. These design standards are required by law for all new structures in Kern County and were established to reduce the potential impact to structures from strong seismic shaking to a less than significant level."*

These regulations do not address wellbore integrity, however. It is not clear whether wellbores can withstand a peak ground acceleration of 0.258g, let alone peak ground accelerations of 0.3175g or 0.4363g. A peak ground acceleration of 0.27 g is associated with a Modified Mercalli Intensity of VIII with observations including: steering of motor cars affected; damage to masonry and some masonry walls; twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks; frame houses moved on foundations if not bolted down; loose panel walls thrown out; changes in flow or temperature of springs and wells; and cracks in wet ground and on steep slopes. Hence, this mitigation measure is not appropriate, at least for wellbores like those that would be impacted at Elk Hills. Also, Templeton et al. (2021) state that an evaluation of the anticipated losses as a function of ground motion intensity can be achieved either directly by using vulnerability functions or indirectly through the use of fragility functions. Vulnerability functions directly relate ground motion intensity to anticipated losses. Fragility functions relate ground motion intensity to the probability of damage and are often expressed as either loss ratio curves, damage probability matrices, or fragility curves (Templeton et al., 2021). There does not appear to be vulnerability and fragility functions associated with oil and gas wellbores. However, based on a Modified Mercalli Intensity of at least VIII, wellbore damage would reasonably be expected from a major seismic event within 100 km of the Carbon TerraVault I project. The Level of Significance for Impact 4.7-2 should be changed from Less than Significant to Significant and Unavoidable. In the presence of moderate seismic activity at the project area (e.g., MMI ≥ 5, PGA ≥ 0.05g, PGV ≥ 3.0 cm/s), mitigation should include assessment of leakage at wellbores and reentry and replugging of wellbores in the event of increased leakage from wellbores.

Comment: CARB requires that an operator use appropriate tools to characterize potential risks of adverse impacts on the environment, health, or safety, by combining the assessment of the probability of occurrence and the magnitude of the adverse impacts of identified project risk scenarios. Risk scenarios identified as part of this assessment must be classified high risk, medium risk, or low risk, according to the combination of probability of occurrence during a 100-year period and the severity of potential consequences (Table 3). Given an approximately 10% and 20% probability of a of a major seismic event inducing a peak ground acceleration of 0.44 g and 0.32 g, respectively, at the TerraVault I Project area, it is difficult to understand how CTV categorized risk as low to medium (Table 4). Risk in assigned scenarios should be classified as high. At a minimum, this high risk classification should mandate robust evaluation and monitoring of wellbore integrity.

Table 3. CARB Risk scenario classification.

	Insubstantial[2]	**Substantial**[2]	**Catastrophic**[2]
> 5%[1]	Medium risk	High risk	High risk
1-5%[1]	Low risk	Medium risk	High risk
< 1%[1]	Low risk	Medium risk	Medium risk

1 Probability of occurrence over 100 years
2 Severity of potential consequences

Table 4. Risk Assessment Results from Volume 2 of DEIR

Scenario	Consequence	Probability	Risk
Injection or Monitoring Well Failure	Insubstantial	<1%	Low
Equipment failure	Insubstantial	<1%	Low
Natural Disaster	Insubstantial to Catastrophic	<1%	Low/ Medium
Fluid Leakage to Shallow Groundwater	Insubstantial	<1%	Low
CO_2 leakage to Atmosphere	Insubstantial to Catastrophic	<1%	Low/ Medium
Induced Seismic Event	Insubstantial	<1%	Low
Well Operations (drilling/workover)	Insubstantial to Catastrophic	<1%	Low/ Medium

Additional Hazard from Induced Seismicity

Induced seismicity is of concern for faults that are optimally oriented, critically stressed, and of sufficient size to cause damage sufficient to induce leakage of sequestered CO_2. Leakage of CO_2 could occur through a damaged confining layer, from activation of faults penetrating a confining layer, or through wellbore damage.

Induced seismicity considerations in the Class VI regulations are largely limited to CO_2 migration through faults penetrating the confining layer. EPA (2013) states that use of seismic hazard maps to demonstrate the reasonable expectation that no induced seismic events would occur during the course of a CCS project may fulfill the requirements at 40 CFR 146.82(a)(3)(v). However, if such maps indicate a substantial likelihood of seismic activity, other required geologic information, such as geomechanical data, depth to confining zones, and fault stability analysis may be needed to demonstrate that seismic activity will not compromise subsurface containment (EPA, 2013) An owner/operator is required to determine the "location, orientation, and properties of known or suspected faults and fractures that may transect the confining zone(s) in the Area of Review, along with a determination that they will not interfere with containment" (40 CFR 146.82(a)(3)(ii)). The owner/operator is also required to demonstrate the presence of a "confining zone(s) free of transmissive faults or fractures and of sufficient areal extent and integrity to contain the injected carbon dioxide stream and displaced fluids" (40 CFR 146.83(a)(2)).

It is stated in the Class VI permit applications that in 2019 three-dimensional (3D) seismic survey data was re-processed to allow a more focused structural image around tight folds and faults (EPA, 2024). Offsetting the 31S anticline are high-angle reverse faults that are oriented NW-SE. It is stated that these inactive faults penetrate the lowest portions of the Monterey Formation but not the lower Reef Ridge Shale above the Monterey Formation in the 26R reservoir. It is also stated the 26R reservoir is continuous across the Area of Review and the sands pinch-out up-dip and on the channel edges. As such, the 26R reservoir has minimal connection outside the Area of Review creating a reservoir with no connection to regional saline aquifers (EPA, 2024). The emphasis of EPA regulations are on upward migration of brine and CO_2 as opposed to downward propagation of pressure. The concern with faults in the Monterey Formation may be uncertainty associated with potential propagation of pressure below the storage formation, such as has occurred during disposal of produced water in Class II disposal wells and during hydraulic fracturing.

Increased subsurface fluid injection activity has led to increased seismicity at some sites, including near oil and gas wastewater (produced water) disposal sites, hydraulic fracturing sites, and engineered geothermal systems (Ellsworth, 2013; Keranen and Weingarten, 2018; Templeton et al., 2020). Induced seismicity has raised concerns about the scalability of geologic storage of CO_2 considering the seismic hazard and risk associated with far-reaching subsurface pressurization and adjacent basement rocks (Zoback and Gorelick, 2012; White and Foxall, 2016). Even in areas of low to moderate natural seismic activity, fluid injection may induce earthquakes in excess of **M** 4 (Templeton et al., 2023).

Seismogenic response to fluid injection may vary strongly from site to site and between different injection intervals (Templeton et al., 2023). Weingarten et al. (2015) and Schultz et al. (2018) show that the potential for inducing earthquakes in wastewater disposal and hydraulic fracturing, respectively, correlates positively with the total injected fluid volume and the rate of injection. However, the causative mechanisms of induced seismicity and geomechanical conditions at injection sites are diverse and involve many poorly constrained or unknown parameters. Significant uncertainties on the likelihood of inducing seismicity can persist even after careful characterization. It is not fully understood why some operations can cause significant induced seismicity while others do not (Templeton et al., 2021).

Before 2011, the **M** 4.8 event in 1967 near Denver, Colorado, was the largest event widely accepted in the scientific community as having been induced by fluid injection. The Rocky Mountain Arsenal earthquakes demonstrated how the diffusion of pore pressure within an ancient fault system can initiate earthquakes many kilometers from the injection point, delayed by months or even years after injection ceased (Hermann et al. 1981). The **M** 5.7 event in November 2011 in central Oklahoma is now the largest known induced seismic event (Kerenan et al., 2013). This earthquake damaged homes and unreinforced masonry buildings in the epicentral area and was felt as far as 1000 km away in Chicago, Illinois.

Seismicity may be induced tens of kilometers away from large-scale injection. The occurrence of seismicity farther away from injection implies that stress changes much smaller than 1 MPa may be sufficient to trigger seismicity even in naturally quiescent areas. Recent studies indicate that effective stress changes on the order of 100 kPa (14.5 psig) or less can found near earthquake hypocenters (Keranen et al., 2014; Barbour et al., 2017; Norbeck and Rubinstein, 2018; Zhai et al., 2020).

Even faults capable of **M** 5 earthquakes may be previously unknown. In many of the induced seismicity cases, faults that hosted even the largest events > **M** 5 were not known beforehand (Templeton et al.,

2023). Even natural events, such as the 2014 Napa, California earthquake, often occur on blind faults (Brocher et al., 2015). This can be related to the difficulty of imaging faults in basement rocks or the lack of vertical offset in the sedimentary overburden from subvertical strike-slip faults.

The largest injection-induced events have all involved faulting that is considerably deeper than the injection interval (Horton, 2012), suggesting that transmission of increased pressure into the basement elevates the potential for inducing earthquakes. Hence, during geologic storage of CO_2, it is important that pressure perturbation from injection not be transmitted below depths of injection.

Few commercial scale geologic CO_2 storage sites exist that can be used as prototypes to study induced seismic response. The Cogdell CO_2 enhanced oil recovery project has been associated with felt earthquakes. The seismicity in the Cogdell project has been attributed to the very high injection rates and the presence of faults in the reservoir (Gan and Frohlich 2013). At the Illinois basin–Decatur project and the associated Illinois Industrial Carbon Capture and Sequestration Sources project, as of 2022, 2.8 million metric tons of CO_2 have been injected into the Mt. Simon saline sandstone reservoir with detection of nearly 20,000 seismic events with **M** up to 1.2, although none have been felt at the surface (Williams-Stroud et al., 2020). As a result of seismic activity, injection was moved to a shallower zone within the Mt. Simon sandstone resulting in fewer seismic events (Williams-Stroud et al., 2020).

Dvory and Zoback (2021) state that since depleted oil and gas fields have decreased pore pressure compared to initial conditions, it is plausible that the risk of induced seismicity in depleted oil and gas fields may be less than that associated with other storage configurations (e.g., saline aquifers) because increased pore pressure beyond initial conditions is one of the main causes of injection-induced seismic events.

One study of particular relevance to the Carbon TerraVault I project is a potentially injection-induced earthquake swarm in 2005 associated with the WhiteWolf Fault (Goebel et al., 2016). It was comprised of a **M** 4.5 event on 22 September, followed by two **M** 4.7 and **M** 4.3 events the same day. The White Wolf swarm is suspected to be connected to fluid-injection activity at the Tejon Oil Field based on a statistical assessment of injection and seismicity rate changes (Goebel et al., 2015). Injection wells at the Tejon Oil Field targeted a 25–30 m thin, highly permeable stratigraphic zone within the Monterey formation composed of turbiditic sand lenses with maximum lateral extents of 1 to 2 km (Goebel et al., 2016). Recall that turbiditic sand lenses are targeted for CO_2 storage at the Carbon TerraVault I project.

Based on geological mapping, seismicity, and well-log data, Goebel et al. (2016) identified a seismically active normal fault referred to as "Tejon Fault" in proximity to the Tejon Oil Field which deepened (7.7 km) toward the northwest below the Wheeler Ridge fault before intersecting with the White Wolf Fault 8 km from injection wells (Figure 6). Pressure diffusion was likely influenced by a 11 km high permeability pathway along the seismically active part of the Tejon fault (Goebel et al., 2016). Numerical modeling indicated that for a fault zone permeability above ~300 mD and fault width below ~800 m, a pressure increase of just 0.01 MPa (1.5 psi) was sufficient to induce seismicity on a fault favorably oriented to slip (Goebel et al., 2016) as also observed by Keranen et al. (2014) and Hornbach et al. (2015). Given the discussion here, the primary concern at the Carbon TerraVault I project is pressure transmission below the Monterey Formation, not above it. Investigative studies have demonstrated that pressure propagation can occur over large distances and depths during injection of fluids and that a very small pressure differential

can induce seismicity. Hence, analysis conducted by CTV in the DEIR and Class VI permit applications does not eliminate the potential for inducted seismicity at the Carbon TerraVault I project.

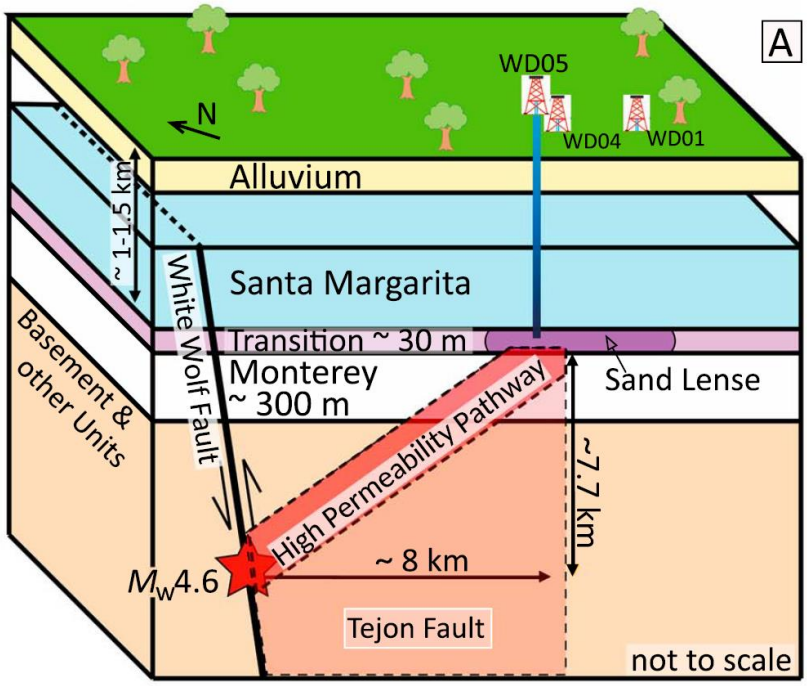

Figure 6. Schematic representation of pressure migration along a high-permeability fault between the Tejon Oil Field and a M 4.6 seismic event along the White Wolf Fault.

Comment: For induced seismicity, the primary concern here is pressure transmission below the Monterey Formation, not above it. In the Class VI regulations, the primary concern is leakage through faults in the confining layer, not transmission of pressure and induced seismicity below the storage formation. Hence, neither EPA regulations nor the DEIR adequately consider induced seismicity. Callas et al. (2022) state that lack of a lower confining seal (permeability > 100 nD) (nD = nanodarcy) is a disqualifying threshold for geologic storage of CO_2 because of potential pressure propagation to basement rock capable of producing seismic activity. According to schematics provided in Volume 2 of the DEIR, the Reef Ridge Shale bounds both the upper lower Monterey Formation and has an average permeability of 0.01 mD (mD=millidarcy) or 10,000 nD. As discussed, in the 26R and A1 - A2 Storage Areas, CTV states that final pressure will target the initial reservoir pressure at the time of discovery. Hence, this would decrease but not eliminate the possibility of induced seismicity.

Seismic Monitoring Network Design

The Class VI regulations do not include an explicit requirement for a seismic monitoring plan. However, in its Class VI Implementation manual for UIC Program Directors, EPA states that concerns about seismicity or uncertainties about the seismic history of the site raised during site characterization may necessitate the inclusion of passive seismic monitoring (EPA, 2013).

Seismic data needs to be gathered, analyzed, and archived during the lifetime of a project for geologic storage of CO_2. These data are needed to accurately assess and periodically reassess the natural and

induced seismic hazard and risk associated with the project and to aid in the rapid and effective detection and characterization of the seismicity at the site. This data is especially needed as input into induced seismicity mitigation plan protocols (e.g., traffic light systems). In general, the National Earthquake Information Center (NEIC) and other national or state monitoring systems are not sufficient for monitoring induced seismicity at a facility for geologic storage of CO_2 (Templeton et al., 2021). Routine detection of small events in the immediate vicinity of the injection site is necessary to detect problematic developments as early as possible.

The California Carbon Capture and Storage Review Panel recommended that seismic risks be considered during the operation and monitoring of CO_2 storage projects and stated that specialized seismic monitoring may be warranted (California Institute for Energy and Environment, 2010). The CARB protocol for CO_2 sequestration requires that the operator deploy and maintain a permanent, downhole seismic monitoring system to determine the presence or absence of any induced micro-seismic activity associated with all wells and near any discontinuities, faults, or fractures in the subsurface (CARB, 2018). Templeton et al. (2023) state that to record seismicity within the ROC, it is expected that the footprint of the seismic network would need to extend beyond the ROC. In the 26R Reservoir and A1 - A2 Area of Review areas, CTV will monitor seismicity with a network of surface and shallow borehole seismometers. Specifically, CTV will deploy 6 sensor locations (borehole and near surface) most of which are outside the Area of Review. CTV states that this data will help establish historical natural seismic event depth, magnitude, and frequency in order to distinguish between naturally occurring seismicity and induced seismicity resulting from CO_2 injection.

The Technical Advisory Committee to the California Carbon Capture and Storage Review Panel recommended that monitoring for induced seismicity should begin during the site selection and assessment phase to establish a baseline record of the natural background seismicity in the region encompassed by the project using the state's existing seismometer network augmented by a local network. Templeton et al. (2023) recommend that prior to commencing injection operations, a seismic monitoring network should be operated for at least 6 months but preferably 1 year or longer and be designed to detect and characterize seismicity occurring in the ROC down to at least **M** 1. CTV states in the Class VI permit application that a seismic monitoring network will establish an understanding of baseline seismic activity within the area of the project and that historical seismicity data from the Southern California Seismic Network will be reviewed to assist in establishing the baseline.

Comment: Templeton et al. (2023) state that a local seismic monitoring network should include a combination of high-gain sensors, which can optimally record weak ground motions from small local earthquakes, and low-gain accelerometers, which can optimally record strong ground motions from nearby larger earthquakes. Templeton et al. (2023) also state that each seismic station should measure ground motion in three orthogonal directions (e.g., up-down, north-south, and east-west) to fully capture the movement of the seismic waves as they travel through the earth. CTV states that high-sensitivity 3-component geophones will be utilized for seismic monitoring (DEIR, 2024b). CTV also states that CTV will monitor data from nearby (~5-8mi) existing broadband seismometers and strong motion accelerometers of the Southern California Seismic Network. It is unclear whether the seismic monitoring network is of sufficient robustness. CTV should provide additional information on specification of geophones to be used for seismic monitoring.

Comment: Information on the resolution of the CTV I seismic network is lacking and should be provided in the DEIR and Class VI permit applications. Templeton et al. (2023) state that the network should be able to record and locate seismicity in the ROC with at least a 2-sigma location accuracy of 0.5 km in the horizontal direction and 1.0 km in the vertical direction.

Comment: Templeton et al. (2023) state that seismic monitoring networks should be designed, and stations located such that ground velocities of 600 nm/s can be recorded with a signal-to-noise ratio of at least 6 in the frequency range 5–40 Hz within the ROC. Information on the signal-to-noise ratio in the seismic network is lacking and should be provided in the DEIR and Class VI permit applications.

Comment: Templeton et al. (2023) state that the data should be recorded using at least a 24-bit digital data acquisition system and a global positioning system-based field timing system to achieve the required timing accuracy of at least 1 ms. CTV states that waveform data is to be transmitted near real-time via cellular modem or other wireless means and archived in a database (DEIR, 2024b). Timing accuracy was not specified in the DEIR and the Class VI permit applications.

Seismicity Mitigation Plan

If the project operator obtains evidence that an earthquake has caused a failure of the mechanical integrity of wells, facilities, or pipelines, which may cause potential CO_2 emissions to the atmosphere, the project operator must implement an Emergency Remedial Response Plan (CARB, 2018). The operator should create a site-specific induced seismicity mitigation plan for the DEIR based on a Traffic Light System (TLS) framework (Templeton et al., 2023). Templeton et al. (2023) state that the TLS framework should include at least three response levels, indicating operation as usual (green), heightened awareness and reassessing and modifying as appropriate of injection operations (yellow), and stopping injection (red). In the Class VI permit application, CTV created a five-response level (green, yellow, orange, magenta, red) seismicity mitigation plan.

Comment: CTV established response levels based on the magnitude of a seismic event. For an induced seismic event having **M** > 2.0, in the Class VI permit application, CTV states that it will initiate gradual shutdown of the injection wells if it is determined "*appropriate*". Words like "*appropriate*" are vague and don't provide measurable performance criteria, per CEQA requirements. CTV also states that it will monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure, and identify and implement appropriate remedial actions in consultation with the UIC Program Director (DEIR, 2024b). There is no mention of evaluation of any other wellbores, which is a critical oversight.

The CARB protocol for CO_2 sequestration requires that the operator continuously monitor for indication of an earthquake of **M** 2.7 or greater occurring within a radius of one-mile of injection operations. If an earthquake of **M** 2.7 or greater is identified, CARB, in consultation with the project operator and the California Geological Survey, or local geological survey or equivalent, must conduct an evaluation of the following: (a) whether there is indication of a causal connection between the injection activity and the earthquake; (b) whether there is a pattern of seismic activity in the area that correlates with nearby

injection activity; and (c) whether the mechanical integrity of any well, facility, or pipeline within the radius specified in subsection C.4.3.2.3(b) has been compromised (CARB, 2018). Hence, if induced seismicity having a magnitude of **M** 2.7 or larger occurs, the operator must conduct an evaluation of the integrity of *all* wellbores including those plugged and abandoned.

Comment: The preliminary results of the seismic evaluation must be reported to CARB within 30 days following the earthquake, with a final report submitted within 120 days (CARB, 2018). The report must include, at a minimum: (1) the date, time, and magnitude of the earthquake; (2) the location and distance of the epicenter from the CCS project; (3) the results of the investigation into the link between the injection activity and the earthquake or pattern of seismicity; (4) any emergency and remedial actions taken; (5) a description of any investigations and tests conducted to assess the mechanical integrity of wells and other surface equipment, and a demonstration that the well and equipment were either not damaged by the earthquake or that mechanical integrity was restored prior to the re-initiation of injection; and (6) any identified changes necessary to the CCS project Testing and Monitoring Plan (CARB, 2018). There is no mention of reporting of seismic events to CARB anywhere in the seismicity mitigation plan.

Comment: Templeton et al. (2023) state that the seismicity mitigation plan should provide a clear description of mandatory and optional actions and procedures at each of the response levels. CTV repeatedly used the term *"if appropriate"* for initiation of injection well shutdown. The term appropriate is not defined and hence is ambiguous. Words like "*appropriate*" are vague and don't provide measurable performance criteria, per CEQA requirements. It is unclear precisely under what conditions initiation of shutdown would commence for yellow, orange and magenta operating states.

Comment: Of perhaps greater concern are naturally occurring seismic events at distance from the facility. In these cases, a seismic mitigation plan specified in terms of peak ground velocity or ground acceleration would be more useful in the DEIR and Class VI permit application.

Conclusions and Recommendations

There is interest in using depleted oil and gas reservoirs, such as the Carbon TerraVault I project for geological storage of CO_2 due to extensive preexisting geological characterization and infrastructure. Also, since depleted oil and gas fields have decreased pore pressure compared to initial conditions, it is plausible that the risk of induced seismicity in depleted oil and gas fields may be less than that associated with other storage configurations (e.g., saline aquifers) because increased pore pressure beyond initial conditions is one of the main causes of injection-induced seismic events.

However, well penetrations are widely recognized as a primary pathway for leakage during geologic storage of CO_2. There are an extraordinarily large number of wellbores (354) penetrating the primary confining layer (Reef Ridge Shale) at the Carbon TerraVault I project. Leakage through wellbores will be facilitated by the high pressure of storage (~4,000 psi) and storage occurring primarily as a separate phase supercritical fluid. All 354 wellbores will eventually be in direct contact with highly pressurized supercritical CO_2 – a highly corrosive medium.

Complicating matters further is the fact that that the Carbon TerraVault I project is located in an area of high natural seismicity. The probability of a natural seismic event capable of causing wellbore damage in the project area is quite high (~20% within 100 years). Given the large number of well penetrations, high

pressure during storage, storage primarily as a supercritical fluid, and natural seismicity, leakage through well penetrations is a major concern. The success or failure of geologic storage of CO_2 at the Carbon TerraVault I project will largely depend on minimizing leakage from well penetrations.

The importance of properly evaluating wellbores prior to plugging to determine the need for corrective action and evaluating wellbores that have been plugged sometime in the past cannot be stressed enough. Unfortunately, only a table identifying well penetrations was provided in the Class VI permit applications. No identification of well penetrations was provided in the Draft Environmental Impact Report. CTV claims that no wellbores require corrective action – a claim that must be viewed with considerable skepticism since wellbore integrity failure rates published from oil and gas sites in the literature range from 2 to 75%.

In one column of the table provided in the Class VI permit applications, annular isolation of wellbores within the upper confining later is subjectively described as "*adequate.*" No proof of adequacy of any wellbore beyond those used for injection was provided in the DEIR or Class VI permit applications. CTV should immediately submit all supporting information (drilling logs, well completion and plugging reports, casing and cementing records, records on internal and external mechanical integrity testing, cement bond/variable density logs, and wellbore diagrams) to the public record. Also, EPA should conduct an evaluation of each well penetration – something that the agency should have done but does not appear to have done so. Simply accepting CTV's claim of adequacy is unacceptable.

In the absence of a robust investigation of wellbore integrity at the Carbon TerraVault I project, neither the DEIR nor the Class VI permit applications should be approved.

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Attachment A
to Technical Comments of Dominic DiGiulio, PhD:
Qualifications and Experience

Dominic DiGiulio

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Background

I am a retired geoscientist from the U.S. Environmental Protection Agency. I have conducted research on: emissions of volatile organic compounds from abandoned wells, leakage of produced water, condensate, and drilling fluids from impoundments to groundwater, contamination of groundwater from hydraulic fracturing, subsurface methane and carbon dioxide migration (stray gas), intrusion of subsurface vapors into indoor air (vapor intrusion), gas flow-based subsurface remediation (soil vacuum extraction, bioventing), groundwater sampling methodology, soil-gas sampling methodology, gas permeability testing, and solute transport of contaminants in soil. I assisted in the development of EPA's original guidance on vapor intrusion and the EPA's Class VI Rule on geologic sequestration of carbon dioxide. I have served as an expert witness in litigation relevant to oil and gas development, testified before State oil and gas commissions on proposed regulation, and testified before Congress on the impact of oil and gas development on water resources. My consulting services have included reports on: stray methane gas migration, geological carbon storage in Louisiana, storage of natural gas liquids in solution mined caverns, proposed oil and gas regulations in Colorado, impact to groundwater resources from Class II disposal wells in Ohio, Idaho, and Florida, produced water transport in barges along the Ohio River, proposed EPA regulation on discharge of produced water to surface water, and Bureau of Land Management leases in Wyoming, Montana, and Colorado.

Education

B.S., Environmental Engineering, Temple University, Philadelphia, PA (1982)
M.S., Environmental Science, Drexel University, Philadelphia, PA (1988)
Ph.D., Soil, Water, and Environmental Science, University of Arizona, Tucson, AZ (2000)

Employment

Independent Consultant: Feb 2023 - present

Research Affiliate: University of Colorado, Boulder, CO: October 2020 - present. I conduct research on the impact of abandoned wells on air, surface water, and groundwater quality.

Senior Research Scientist: PSE Healthy Energy, Oakland, CA: Jan 2017 – Feb 2023. My research focused on evaluating the impact of oil and gas development on water resources and air quality. In addition to publishing findings of my research in peer-reviewed journals and reports, I provided testimony on oil and gas development rule-making, served as an expert witness in litigation against oil and gas corporations, and have testified before Congress on the impact of oil and gas development on water resources.

Research Associate: Stanford University, Stanford, CA: Apr 2014 – May 2019. I conducted research on the impact of oil and gas development to groundwater.

Environmental Engineer: U.S. Environmental Protection Agency, Office of Research and Development, Ada, OK: Sep 1988 – Mar 2014 (retired). Duties included providing regulatory oversight assistance to

EPA remedial project managers and conducting research related to subsurface gas flow and vapor transport. Research included: (1) Development of methods to improve the effectiveness of soil vapor extraction, bioventing, and air sparging subsurface remediation systems including lead authorship of EPA's primary technical resource document in these areas; (2) Co-development of analytical solutions and associated codes for estimation of gas permeability and gas flow in soil; (3) Development of analytical solutions to simulate combined solute and vapor transport in soil including lead authorship of the model *VFLUX;* (4) Development of field methods to improve active soil-gas sampling especially pertaining to leak and purge testing; (5) Development of forensic techniques (use of hydrocarbon degradation products and radon) and assistance in development of EPA guidance to evaluate vapor intrusion (migration of organic compounds from ground water to indoor air); (6) Development of ground water and soil gas monitoring strategies including assistance in development of EPA's Class VI rule on geologic sequestration of carbon dioxide; (7) Development of methods to evaluate impact to Underground Sources of Drinking Water (USDWs) under the Safe Drinking Water Act and stray gas migration due to hydraulic fracturing. Research activities included conducting seminars, workshops, and short courses to States.

Environmental Engineer (Remedial Project Manager: U.S. Environmental Protection Agency, Region III, Philadelphia, PA: Jun 1980 – Dec. 1981 and Sep 1982 – Jan 1988. Duties included: conducting investigations (e.g., remedial investigations, risk assessments, feasibility studies, sample collection) under the Comprehensive Environmental Response and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA), federal contractor oversight, preparation of consent orders and initiation of enforcement actions.

Military Service: U.S. Marine Corps: Active duty 1975-1978, Camp Pendleton, CA, Honorable Discharge in 1981.

Scientific Awards

5 EPA Bronze Medals: (1) Development of EPA Guidance Document on Soil Vacuum Extraction, (2) Technical Support to EPA's Program and Regional offices on Subsurface Gas Flow and Vapor Transport, (3) Development of EPA Guidance on Vapor Intrusion, (4) Research on Vapor Intrusion, (5) Development of Class VI Rule on Geologic Sequestration of Carbon Dioxide

3 EPA Honor Awards: (1) Development of a National Risk Management Research Laboratory Strategic Research Plan, (2) Development of a Protocol to Assess Vapor Intrusion; (3) Technical support at Leaking Underground Storage Tank Sites

3 EPA Scientific and Technological Achievement Awards: (1) Innovative Design of Soil Vacuum Extraction Systems, (2) Development of Analytical Model to Simulate Transient Flux of Volatile Organic Compounds in Soil to Ground Water and the Atmosphere, (3) Simulation of Geochemical Impacts to Ground Water from Leakage of Carbon Dioxide

Peer-Reviewed Journal Publications, Reports, and Book Chapters

Tisherman, R.; Rossi, R.J.; Shonkoff, S.B.C., DiGiulio, D.C. **2023**. Groundwater Uranium Contamination from Produced Water Disposal to Unlined Ponds in the San Joaquin Valley. *Science of the Total Environment*, Vol. 904, 15 December 2023, 166937

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DiGiulio D.C.; Shonkoff S.B.C. **2021**. Potential Impact to Groundwater Resources from Disposal of Produced Water into Unlined Produced Water Ponds in the San Joaquin Valley. In Assessment of Oil and Gas Water Cycle Reporting in California. In: An Assessment of Oil and Gas Water Cycle Reporting in California. Preliminary Evaluation of Data Collected Pursuant to California Senate Bill 1281, Phase II. Available at: https://www.psehealthyenergy.org/our-work/publications/archive/an-assessment-of-oil-and-gas-water-cycle-reporting-in-california/

Hill L.L., Czolowski E.D., DiGiulio D.C, Shonkoff S.B.C. **2019**. Temporal and spatial trends of conventional and unconventional oil and gas waste management in Pennsylvania, 1991–2017. *Science of the Total Environment* 674, 623-636.

DiGiulio D.C., Ruybal C.J., Hargrove K.D., Wilkin R.T. **2018**. Leak, Purge, and Gas Permeability Testing to Support Active Soil-Gas Sampling, EPA 600/R-18/225, U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, October 2018

Ruybal C.J.; Wilkin R.T.; Rue K.D., McCray J.E., DiGiulio, D.C. **2018**. A New Equilibrator Design for Rapid Detection of Methane in Groundwater during Purging. *Environmental Engineering Science* 35(9)

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Rossi, R.J.; DiGiulio, D.C. **2023**. Documenting Known Abandoned Wells in Proximity to Potential Carbon Storage Formations in Louisiana.

DiGiulio, D.C. **2023**. Evaluation of Stray Natural Gas in the Amber Norrid Domestic Water Well Near Abandoned Oil Wells in Hanover Township, Washington County, Pennsylvania. September 3, 2023

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DiGiulio, D.C. **2022.** Evaluation of Protection of Groundwater Resources in Environmental Impact Assessment (EIA) for Drilling Stratigraphic Wells in Kavango West and East Regions, Northern Namibia

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ATTACHMENT C

Accufacts Inc.
"Clear Knowledge in the Over Information Age"

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Redmond, WA 98052
Ph (425) 802-1200
kuprewicz@comcast.net

February 26, 2024

Attn: Earthjustice
Michelle Ghafar
50 California Street, Suite 500
San Francisco, CA 94111

Re: Observations concerning Kern County's Draft Environmental Impact Report ("DEIR") on the TerraVault I Carbon Capture and Storage Project ("Project").

A. Summary of DEIR.

The above referenced DEIR makes many statements that are confusing or misleading, lacking critical information to allow decision makers, including the public, to make an informed evaluation and decision about the proposed Project from this document. It appears that many of these statements relate to safety jurisdiction of various agencies, which based on my extensive experience, are confusing, if not misleading. It appears that the Project is getting ahead of badly needed safety regulatory efforts, either at the state or federal level before prudent safety regulations can be developed and implemented. Section 3 below identifies eight areas where the DEIR needs to be supplemented with important details before this Project is allowed to proceed. Lack of such detail has served to be a recurring problem across the U.S. as states and local governments wrestle with serious gaps in pipeline safety regulations for CO_2 pipelines as a result of an onslaught of multibillion dollar proposals incentivized by recent federal tax credits. A 2022 paper identifies at least eight serious deficiencies in current federal minimum pipeline safety regulations concerning liquid CO_2 pipelines summarized as follows:[1]

1. The definition of carbon dioxide needs to be updated.
2. Scientifically based regulation on impact areas for CO_2 pipeline ruptures needs to be promulgated.
3. Regulatory reference to industry recommended practices should be avoided.
4. Fracture propagation protection on CO_2 pipelines needs to be codified.
5. The use of odorant in CO_2 pipelines should be mandated.
6. Pipeline operations and maintenance manuals should require specific coordination with local emergency response personnel.
7. Maximum contaminant impurities for CO_2 pipelines should be specified.
8. Regulations for conversion of existing pipelines to CO_2 service should be developed.

[1] Richard B. Kuprewicz, President of Accufacts Inc., prepared for the Pipeline Safety Trust, "Accufacts' Perspectives on the State of Federal Carbon Dioxide Transmission Pipeline Safety Regulations as it Relates to Carbon Capture, Utilization, and Sequestration within the U.S.," March 23, 2022, pp. 12 &13.

B. The TerraVault 1 Carbon Capture and Storage Project DEIR - a simple synopsis.

The TerraVault 1 Project proposes to capture CO_2 from the existing Elk Hills oil field, produced by separating a portion of the pre-combustion field gas production into "high-purity" CO_2 streams at two existing or relocated cryogenic and fractionation natural gas plant facilities identified as "CGP-1." The term high purity is not defined in the DEIR, but is a critical parameter given that existing federal minimum pipeline safety jurisdiction currently establishes a CO_2 purity of more than 90% in a poorly worded definition of carbon dioxide.[2]

The high-purity CO_2 streams will then be transported from the two CGP-1 processing/treating locations by "Facility Pipelines" which will be newly constructed pipelines.[3] The DEIR also uses the term Injection Pipelines. The definition of both Facility Pipelines and Injection Pipelines needs to be clarified as well as their transition boundaries as these terms have specific meaning in the industry and affect regulatory safety jurisdictions, if any, of various federal and state agencies that might become involved.

The DEIR indicates that new pipelines of up to 16-inches in diameter, approximately 5.61 miles long for phase 1, and approximately 7.59 miles long for phase 2, will transport CO_2 to six injection wells at two sequestration reservoir sites within the site plan (to 26R Monterey Formation Reservoir at an approximate depth of 6,000 feet for phase 1's four injection well sites, and to A1-A2 Monterey Formation Reservoir, approximately 8,500 feet deep for phase 2's two injector well sites).[4]

C. Critically important and needed pipeline information is missing in the DEIR.

Important pipeline information is missing in the DEIR that will not permit decisionmakers to make an informed decision about this Project. For example, some of the many major shortcomings in the DEIR related to pipeline issues are:

1. The purity of the claimed "high-purity" CO_2 stream has not been provided.

The CO_2 purity sets a simple bar as to whether the Pipeline and Hazardous Materials Safety Administration, or PHMSA, the federal agency chartered with transportation pipeline safety regulations, or for that matter the California Office of the State Fire Marshal, or OSFM, the state agency chartered with intrastate liquid transportation pipeline safety oversight in California, has any pipeline safety jurisdiction under current transportation pipeline safety regulations. The DEIR needs to provide the minimum purity of the CO_2 stream for reinjection and how this minimum will be controlled/maintained and assured. If the CO_2 purity is not above 90 %, the pipeline facilities are not regulated as transportation pipelines under current federal pipeline safety regulations.

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[2] 49CFR§195.2 Definitions - *Carbon Dioxide*.
[3] DEIR, Volume 1, pp. 3-18 & 3-19.
[4] DEIR, Volume 1, pp. 3-21 & 3-22.

Since the CO_2 will be produced from the oil/gas field, the DEIR also needs to present how possible impurities in the CO_2 stream will be limited and controlled. This is especially important for water as water in CO_2 pipelines is not tolerated well in carbon steel pipeline systems. Water in such CO_2 systems can experience extremely unpredictable and high corrosion rates that can quickly result in pipeline rupture failure.

2. **The DEIR discussion of Facility Pipelines and Injection Pipelines is not clear.**

   Facility Pipelines and Injection Pipelines usually have special meaning/distinction within the industry and whether any pipeline safety agency has any jurisdiction. The DEIR is very confusing on this important issue, labeling for example Injection Pipelines under the heading Facility Pipelines in the figures' legends.[5] PHMSA, or for that matter the OSFM, may not have any jurisdiction on this Project or parts of this Project.

3. **The DEIR indicates that the Facility Pipelines will operate at pressures roughly 1,700 to 2,100 psig for "dense phase" transport.[6]**

   Psig, or pounds per square inch gauge, is a pressure measurement used in the industry. The pressure range for this system, while higher than conventional liquid transportation pipelines, is not unusual for dense phase CO_2 pipelines. Dense phase is a term used to mean either liquid **or** supercritical CO_2 phase for a liquid pipeline, and is not defined in either Federal or California pipeline safety regulations.[7] What phase a specific CO_2 liquid pipeline segment is in (liquid or supercritical) at the time of a pipeline rupture can have a significant impact on rupture release dynamics, the tonnage of pipeline inventory that will be vented even after mainline valves are closed, and associated attempts to model possible rupture impact zones and attempts at establishing realistic safety buffer zones.

4. **The DEIR does not provide important pipeline parameters.**

   At this stage of the Project, the pipeline operator should be able to provide the pipeline specifics such as: pipe grade, thickness, diameter, and maximum operating pressure, or MOP, a term defined in federal pipeline safety regulation having a specific meaning related to pipeline safety. As previously mentioned, the DEIR should also clearly delineate the general pipeline route, possible pipeline safety jurisdictional boundaries, and approximate location of main equipment such as pump/compressor stations. The lack of such basic information makes it difficult to determine a simple process flow scheme for the Project. This lack of such basic information also prevents decisionmakers from assessing impacts and to develop feasible mitigations for the Project. Not only does the DEIR lack such critical basic pipeline information, what information is supplied is also confusing. It appears the Project is being rushed and

[5] DEIR, Volume 1, p. 3-20, Figures 3-8 and 3-9, Location of Phase 1 Wells: 373-35R, 353X-35R, 345-36R, and 363-27R, and Location of the Phase 2 Wells: 357-7R and 355-7R, respectively.
[6] DEIR, Volume 1, p. 3-16.
[7] 49CFR§195 and California Code, Chapter 5.5. The Elder California Pipeline Safety Act of 1981.

missing basic information to permit independent evaluation and verification of the Project.

5. The location of compressor equipment is not well defined.

The DEIR states "Two new CO_2 compressor packages are proposed for installation at the facility. Compressors would be of the reciprocating type and driven by electric motors."[8] The general location and specific phase of the CO_2 feeding into such equipment is very important to the safe operation of the system and, more importantly, the compressors. One way to blow up a reciprocating compressor is to inadvertently introduce liquid into the compressor. I cannot determine from the limited and confusing information provided in the DEIR whether the location of the proposed compressors will be safely placed within the system to assure liquid CO_2 cannot be inadvertently introduced into the compressors.

6. The placement of mainline valves along the pipelines are not defined.

The DEIR states: "New valves would be installed based on regulatory and owner requirements."[9] As should become obvious from reading this report, such important valve determinations have not been clearly defined, so this DEIR citation is meaningless. Also, the DEIR does not identify whether mainline valves will be manually operated or remotely operated. Manually operated valves can take considerable time to reach and then close (especially for larger diameter pipelines such as a 16-inch mainline valve) increasing the tonnage of CO_2 released upon pipeline rupture.

As a point of reference, a 16-inch diameter CO_2 pipeline, depending on whether the CO_2 inventory is in a supercritical or liquid phase and its associated density, will release approximately 110 to 200 tons per mile of CO_2 upon a pipeline rupture once pipeline mainlines have been closed. What makes transportation pipelines unique, especially for CO_2, is the amount of tonnage undergoing phase change from cooling, that can be de-inventoried from a ruptured pipeline, releasing tons of CO_2 between mainline valves once such valves have been closed. The lack of timely closure of valves was a significant contributing factor for the Satartia, MS rupture CO_2 release as discussed later in this report.

7. The CO_2 temperature along the pipelines is not provided.

An important variable in the DEIR, approximate CO_2 temperature along the pipelines, dictates the CO_2, whether liquid or supercritical phase (which can change) along the pipelines as temperature changes at the expected pipeline operating pressure. This important temperature parameter is not mentioned nor discussed anywhere in the DEIR. What phase a segment of a pipeline is transporting CO_2 in can have serious significance on issues such as safety jurisdiction, design/operation, and pipeline rupture

[8] DEIR, Volume 1, p. 3-17.
[9] DEIR, Volume 1, p. 3-18.

release dynamics and safety buffer zones. For example, current federal minimum pipeline safety regulations do not regulate pipelines operating in liquid CO_2 phase. I have previously mentioned the importance of assuring that reciprocating compressors do not inadvertently receive liquid. Without understanding the initial phase CO_2 will most likely be in in a specific pipeline segment, attempts to establish safe buffer or impact zones are meaningless. Two temperature extreme boundary cases for CO_2 are usually necessary; a high temperature season and a low temperature season to assist in defining the range of CO_2 phases (liquid or supercritical), and associated release modeling/pipeline buffer safety margins for the operation.

8. The DEIR misses the importance of CO_2 phase.

The DEIR also misses the important differences associated with varying phases of CO_2 in a liquid pipeline operation that are not properly addressed in current pipeline safety regulations, leaving such pipelines basically unregulated in many critically important areas. While the DEIR attempts to address certain environmental impacts related to the Project, the real issue relates to pipeline safety and the possible impact to public safety. The DEIR is incomplete in this important area and needs to be supplemented with this missing information before this Project can move forward.

While not mentioned in the DEIR, at the expected pressures and temperatures of the proposed Project's pipelines, I would anticipate the Project's pipelines to be operated in either liquid CO_2 or supercritical CO_2 phases, with the phases changing somewhat with time depending on the temperature of the buried pipelines. Whether a pipeline segment is liquid or supercritical phase at the time of rupture affects the expected phase change occurring at the rupture site, the rate of release, the tonnage that will be released between closed valves, and expected buffer impact zones.

D. The California OSFM is limited in what pipeline safety regulations it can enforce for intrastate liquid carbon dioxide transportation pipelines.

Despite the best of recent intentions to enact improvements in carbon dioxide pipeline safety regulations within California, the California Legislature has failed to pass meaningful improvements in pipeline safety regulations as it applies to intrastate carbon dioxide pipelines. Without such new legislation, the California OSFM can only implement and enforce pipeline safety regulations for intrastate CO_2 liquid pipelines within the state as codified in federal minimum pipeline safety regulations (49CFR§195) intended for liquid transportation pipelines. Based on my extensive experience in California liquid pipeline operation and many pipeline investigations within the state, it is my understanding that the OSFM can only enforce federal pipeline safety regulations for CO_2 liquid pipelines codified in current federal regulations.

Federal regulations for carbon dioxide pipelines are currently woefully inadequate as discussed in more detail in my recently referenced March 23, 2022 CO_2 public paper. In addition, announcements by PHMSA to move forward with carbon dioxide safety regulations may miss many of the safety issues and concerns related to carbon dioxide liquid pipelines

which can take some time to properly address, given the highly unusual restrictive regulatory process imposed on PHMSA.[10]

E. The DEIR attempts to minimize the impact of the Satartia rupture on the public.

Some additional information might be helpful to add to the February 22, 2020 Satartia, MS 24-inch pipeline rupture discussion in the DEIR.[11] Depending on the density one assumes in the pipeline, the rupture released 3,000 to 5,000 tons of carbon dioxide after the mainline valves were eventually closed on the 24-inch pipeline, which took considerable time to isolate the ruptured segment**.** The CO_2 plume went beyond the Town of Satartia, crossing the Yazoo River, extending well over a mile from the pipeline release site which was basically downhill from the rupture releasing heavier than air CO_2. The DEIR fails to mention that the Town of Satartia was not identified as a high consequence area in the pipeline operator's integrity management program and the air dispersion model was unfit for the 24-inch pipeline. The high rain situations and steep terrain should not come as a surprise in this challenging location, and the wording in the DEIR appears to try to downplay that the rupture threat was a unique situation in that area of Mississippi. PHMSA's corrective action order requiring review of geohazard potential along the pipeline should dispel any illusion that breakaway landslide was an unusual threat. Despite the release of a PHMSA Advisory following the Satartia rupture, PHMSA knows that there have been pipeline regulations in effect for many decades that place the responsibility on the pipeline operator to monitor their pipeline right-of-way for signs of possible abnormal loading such as massive landslide potential (what is known in the industry as a breakaway landslide threat) that can easily result in pipeline rupture.[12]

F. Well Blowout prevention and Aliso Canyon similarities.

While not a specific pipeline associated matter, I have an ethical responsibility to note that the DEIR does not address the possibility of a CO_2 injection well blowout on any of the six proposed CO_2 injection wells. In late 2015, California was associated with an underground natural gas storage well blowout, the Aliso Canyon failure, that released well over 100,000 tons of natural gas which is normally lighter than air as compared to CO_2 which is heavier than air. The Aliso Canyon failure demonstrated to the public some of the risk of large high pressure underground storage reservoirs. I would advise that the Project incorporate some form of well blowout prevention design to prevent release of massive quantities of heavier than air CO_2 from the underground reservoirs should an injection well experience a blowout. The safety design should incorporate an approach with prudent independent safeties to assure that the installation will actually work and stop the release of CO_2 from the high-pressure reservoir if a well blowout occurs. Without getting into specific design issues, there are various ways to approach this possible threat, such as incorporating an automatic subservice safety valve as a blowout preventor on each injection well. The tonnage of CO_2 released from a well blowout

[10] "PHMSA Announces New Safety Measures to Protect Americans From Carbon Dioxide Pipeline Failures After Satartia, MS Leak," May 26, 2022 at PHMSA website: https://www.phmsa.dot.gov/news/phmsa-announces-new-safety-measures-protect-americans-carbon-dioxide-pipeline-failures.
[11] DEIR, Volume 1, pp. 4.9-8 & 4.9-9.
[12] PHMSA updated ADB-2022-01, "Pipeline Safety: Potential for Damage to Pipeline Facilities Caused by Earth Movement and Other Geological Hazards," June 2, 2022.

can easily exceed, by many orders of magnitude, the tonnage of CO_2 released from a pipeline rupture. As history has often demonstrated, well blowouts can release many thousands of tons from essentially an infinite supple of CO_2 in the reservoir, easily surpassing pipeline rupture releases.

G. Background/Experience.

Accufacts was asked to review the DEIR for the Project recently released in December 2023.[13] I have over fifty years of experience in the energy industry, including almost 25 years as president of Accufacts Inc. ("Accufacts"). Accufacts provides independent expert consulting services to assist decision makers in making informed decisions concerning pipelines. Pipeline safety expertise is provided in areas including, but not limited to; pipeline failure investigation, risk management, siting, construction, design, operation, maintenance, training, control room management including Supervisory Control and Data Acquisition ("SCADA") approaches, leak/rupture detection, integrity management, emergency response, and pipeline safety regulatory development and compliance. Much of my background is grounded in pipeline incident investigations following numerous pipeline rupture tragedies spanning several decades.

For the past two decades I have been involved as a representative of the public, which carries special obligations to avoid a conflict of interest, in advancing pipeline safety regulations at the federal and various state levels as demonstrated by my CV. For example, I played a significant role representing the public in developing integrity management federal pipeline safety regulations in the early 2000s for both liquid and gas transmission pipelines. These regulatory approaches emulated a safety process approach that I instituted and developed for the City of Bellingham, WA. This process, identified as the Safety Immediate Action Plan, or SIAP, identified steps that the pipeline operator was to complete following the Bellingham rupture tragedy of June 10, 1999, before that pipeline could be permitted to be returned to service.

H. Conclusion.

The DEIR is seriously incomplete and deficient in many areas as discussed above. These deficiencies need to be properly addressed before a DEIR can be deemed complete and sufficient for the Project to move forward. It is my understanding that the County can require that such critical information related to pipeline safety and CO_2 pipelines can be ordered to be provided, or supplemented, before this Project can be allowed to move forward.

Richard B. Kuprewicz, President, Accufacts Inc. *Richard B. Kuprewicz*

[13] Draft Environmental Impact Report – SCH# 2022030180 Volume 1, Chapters 1 through 12, CARBON TERRAVAULT I (KERN COUNTY) by California Resources Corporation (PP22405) at: https://psbweb.kerncounty.com/planning/pdfs/eirs/ctv1/CTV1_DEIR_Vol_1_Ch_1-12_upd.pdf, and Draft Environmental Impact Report – SCH# 2022030180 Volume 2, Appendices A-K, CARBON TERRAVAULT I (KERN COUNTY) by California Resources Corporation (PP22405) at: https://psbweb.kerncounty.com/planning/pdfs/eirs/ctv1/CTV1_DEIR_Vol2.pdf, December 2023.

Attachment A
to Technical Comments of Richard Kuprewicz:
Qualifications and Experience

Curriculum Vitae.

Richard B. Kuprewicz

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Redmond, WA 98052

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Profile:

As president of Accufacts Inc., I specialize in gas and liquid pipeline investigation, auditing, risk management, siting, construction, design, operation, maintenance, training, SCADA, leak detection, management review, emergency response, and regulatory development and compliance. I have consulted for various local, state and federal agencies, NGOs, the public, and pipeline industry members on pipeline regulation, operation and design, with particular emphasis on operation in unusually sensitive areas of high population density or environmental sensitivity.

Employment:

Accufacts Inc. **1999 – Present**

Pipeline regulatory advisor, incident investigator, and expert witness on all matters related to gas and liquid pipeline siting, design, operation, maintenance, risk analysis, and management.

Position: President
Duties:
> Full business responsibility
> Technical Expert

Alaska Anvil Inc. **1993 – 1999**

Engineering, procurement, and construction (EPC) oversight for various clients on oil production facilities, refining, and transportation pipeline design/operations in Alaska.

Position: Process Team Leader
Duties:
> Led process engineers group
> Review process designs
> Perform hazard analysis
> HAZOP Team leader
> Assure regulatory compliance in pipeline and process safety management

ARCO Transportation Alaska, Inc. **1991 - 1993**

Oversight of Trans Alaska Pipeline System (TAPS) and other Alaska pipeline assets for Arco after the Exxon Valdez event.

Position: Senior Technical Advisor
Duties:
> Access to all Alaska operations with partial Arco ownership
> Review, analysis of major Alaska pipeline projects

ARCO Transportation Co. **1989 – 1991**

Responsible for strategic planning, design, government interface, and construction of new gas pipeline projects, as well as gas pipeline acquisition/conversions.

Position: Manager Gas Pipeline Projects
Duties:
> Project management
> Oil pipeline conversion to gas transmission
> New distribution pipeline installation
> Full turnkey responsibility for new gas transmission pipeline, including FERC filing

Four Corners Pipeline Co. **1985 – 1989**

Managed operations of crude oil and product pipelines/terminals/berths/tank farms operating in western U.S., including regulatory compliance, emergency and spill response, and telecommunications and SCADA organizations supporting operations.

Position: Vice President and Manager of Operations
Duties:
> Full operational responsibility
> Major ship berth operations
> New acquisitions
> Several thousand miles of common carrier and private pipelines

Arco Product CQC Kiln **1985**

Operations manager of new plant acquisition, including major cogeneration power generation, with full profit center responsibility.

Position: Plant Manager
Duties:
> Team building of new facility that had been failing
> Plant design modifications and troubleshooting
> Setting expense and capital budgets, including key gas supply negotiations
> Modification of steam plant, power generation, and environmental controls

Arco Products Co. **1981 - 1985**

Operated Refined Product Blending, Storage and Handling Tank Farms, as well as Utility and Waste Water Treatment Operations for the third largest refinery on the west coast.

Position: Operations Manager of Process Services
Duties:
> Modernize refinery utilities and storage/blending operations
> Develop hydrocarbon product blends, including RFGs
> Modification of steam plants, power generation, and environmental controls
> Coordinate new major cogeneration installation, 400 MW plus

Arco Products Co. **1977 - 1981**

Coordinated short and long-range operational and capital planning, and major expansion for two west coast refineries.

Position: Manager of Refinery Planning and Evaluation
Duties:
> Establish monthly refinery volumetric plans
> Develop 5-year refinery long range plans
> Perform economic analysis for refinery enhancements
> Issue authorization for capital/expense major expenditures

Arco Products Co. **1973 - 1977**

Operating Supervisor and Process Engineer for various major refinery complexes.

Position: Operations Supervisor/Process Engineer
Duties:
> FCC Complex Supervisor
> Hydrocracker Complex Supervisor
> Process engineer throughout major integrated refinery improving process yield and energy efficiency

Qualifications:

Served for over fifteen years as a member representing the public on the federal Technical Hazardous Liquid Pipeline Safety Standards Committee (THLPSSC), a technical committee established by Congress to advise PHMSA on pipeline safety regulations.

Committee members are appointed by the Secretary of Transportation.

Served seven years, including position as its chairman, on the Washington State Citizens Committee on Pipeline Safety (CCOPS).

Positions are appointed by the governor of the state to advise federal, state, and local governments on regulatory matters related to pipeline safety, routing, construction, operation and maintenance.

Served on Executive subcommittee advising Congress and PHMSA on a report that culminated in new federal rules concerning Distribution Integrity Management Program (DIMP) gas distribution pipeline safety regulations.

As a representative of the public, advised the Office of Pipeline Safety on proposed new liquid and gas transmission pipeline integrity management rulemaking following the pipeline tragedies in Bellingham, Washington (1999) and Carlsbad, New Mexico (2000).

Member of Control Room Management committee assisting PHMSA on development of pipeline safety Control Room Management (CRM) regulations.

Certified and experienced HAZOP Team Leader associated with process safety management and application.

Education:

MBA (1976)	Pepperdine University, Los Angeles, CA
BS Chemical Engineering (1973)	University of California, Davis, CA
BS Chemistry (1973)	University of California, Davis, CA

Publications in the Public Domain:

1. "An Assessment of First Responder Readiness for Pipeline Emergencies in the State of Washington," prepared for the Office of the State Fire Marshall, by Hanson Engineers Inc., Elway Research Inc., and Accufacts Inc., and dated June 26, 2001.

2. "Preventing Pipeline Failures," prepared for the State of Washington Joint Legislative Audit and Review Committee ("JLARC"), by Richard B. Kuprewicz, President of Accufacts Inc., dated December 30, 2002.

3. "Pipelines - National Security and the Public's Right-to-Know," prepared for the Washington City and County Pipeline Safety Consortium, by Richard B. Kuprewicz, dated May 14, 2003.

4. "Preventing Pipeline Releases," prepared for the Washington City and County Pipeline Safety Consortium, by Richard B. Kuprewicz, dated July 22, 2003.

5. "Pipeline Integrity and Direct Assessment, A Layman's Perspective," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated November 18, 2004.

6. "Public Safety and FERC's LNG Spin, What Citizens Aren't Being Told," jointly authored by Richard B. Kuprewicz, President of Accufacts Inc., Clifford A. Goudey, Outreach Coordinator MIT Sea Grant College Program, and Carl M. Weimer, Executive Director Pipeline Safety Trust, dated May 14, 2005.

7. "A Simple Perspective on Excess Flow Valve Effectiveness in Gas Distribution System Service Lines," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated July 18, 2005.

8. "Observations on the Application of Smart Pigging on Transmission Pipelines," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated September 5, 2005.

9. "The Proposed Corrib Onshore System - An Independent Analysis," prepared for the Centre for Public Inquiry by Richard B. Kuprewicz, dated October 24, 2005.

10. "Observations on Sakhalin II Transmission Pipelines," prepared for The Wild Salmon Center by Richard B. Kuprewicz, dated February 24, 2006.

11. "Increasing MAOP on U.S. Gas Transmission Pipelines," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated March 31, 2006. This paper was also published in the June 26 and July 1, 2006 issues of the Oil & Gas Journal and in the December 2006 issue of the UK Global Pipeline Monthly magazines.

12. "An Independent Analysis of the Proposed Brunswick Pipeline Routes in Saint John, New Brunswick," prepared for the Friends of Rockwood Park, by Richard B. Kuprewicz, dated September 16, 2006.

13. "Commentary on the Risk Analysis for the Proposed Emera Brunswick Pipeline Through Saint John, NB," by Richard B. Kuprewicz, dated October 18, 2006.

14. "General Observations On the Myth of a Best International Pipeline Standard," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated March 31, 2007.

15. "Observations on Practical Leak Detection for Transmission Pipelines – An Experienced Perspective," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated August 30, 2007.

16. "Recommended Leak Detection Methods for the Keystone Pipeline in the Vicinity of the Fordville Aquifer," prepared for TransCanada Keystone L.P. by Richard B. Kuprewicz, President of Accufacts Inc., dated September 26, 2007.

17. "Increasing MOP on the Proposed Keystone XL 36-Inch Liquid Transmission Pipeline," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated February 6, 2009.

18. "Observations on Unified Command Drift River Fact Sheet No 1: Water Usage Options for the current Mt. Redoubt Volcano threat to the Drift River Oil Terminal," prepared for Cook Inletkeeper by Richard B. Kuprewicz, dated April 3, 2009.

19. “Observations on the Keystone XL Oil Pipeline DEIS,” prepared for Plains Justice by Richard B. Kuprewicz, dated April 10, 2010.

20. “PADD III & PADD II Refinery Options for Canadian Bitumen Oil and the Keystone XL Pipeline,” prepared for the Natural Resources Defense Council (NRDC), by Richard B. Kuprewicz, dated June 29, 2010.

21. “The State of Natural Gas Pipelines in Fort Worth,” prepared for the Fort Worth League of Neighborhoods by Richard B. Kuprewicz, President of Accufacts Inc., and Carl M. Weimer, Executive Director Pipeline Safety Trust, dated October, 2010.

22. “Accufacts’ Independent Observations on the Chevron No. 2 Crude Oil Pipeline,” prepared for the City of Salt Lake, Utah, by Richard B. Kuprewicz, dated January 30, 2011.

23. “Accufacts’ Independent Analysis of New Proposed School Sites and Risks Associated with a Nearby HVL Pipeline,” prepared for the Sylvania, Ohio School District, by Richard B. Kuprewicz, dated February 9, 2011.

24. “Accufacts’ Report Concerning Issues Related to the 36-inch Natural Gas Pipeline and the Application of Appleview, LLC Premises: 7009 and 7010 River Road, North Bergen, NJ,” prepared for the Galaxy Towers Condominium Association Inc., by Richard B. Kuprewicz, dated February 28, 2011.

25. “Prepared Testimony of Richard B. Kuprewicz Evaluating PG&E’s Pipeline Safety Enhancement Plan,” submitted on behalf of The Utility Reform Network (TURN), by Richard B. Kuprewicz, Accufacts Inc., dated January 31, 2012.

26. “Evaluation of the Valve Automation Component of PG&E’s Safety Enhancement Plan,” extracted from full testimony submitted on behalf of The Utility Reform Network (TURN), by Richard B.Kuprewicz, Accufacts Inc., dated January 31, 2012, Extracted Report issued February 20, 2012.

27. “Accufacts’ Perspective on Enbridge Filing to NEB for Modifications on Line 9 Reversal Phase I Project,” prepared for Equiterre Canada, by Richard B. Kuprewicz, Accufacts Inc., dated April 23, 2012.

28. “Accufacts’ Evaluation of Tennessee Gas Pipeline 300 Line Expansion Projects in PA & NJ,” prepared for the Delaware RiverKeeper Network, by Richard B. Kuprewicz, Accufacts Inc., dated June 27, 2012.

29. “Impact of an ONEOK NGL Pipeline Release in At-Risk Landslide and/or Sinkhole Karst Areas of Crook County, Wyoming,” prepared for landowners, by Richard B. Kuprewicz, Accufacts Inc., and submitted to Crook County Commissioners, dated July 16, 2012.

30. “Impact of Processing Dilbit on the Proposed NPDES Permit for the BP Cherry Point Washington Refinery,” prepared for the Puget Soundkeeper Alliance, by Richard B. Kuprewicz, Accufacts Inc., dated July 31, 2012.

31. “Analysis of SWG’s Proposed Accelerated EVPP and P70VSP Replacement Plans, Public Utilities Commission of Nevada Docket Nos. 12-02019 and 12-04005,” prepared for the State of Nevada Bureau of Consumer Protection, by Richard B. Kuprewicz, Accufacts Inc., dated August 17, 2012.

32. “Accufacts Inc. Most Probable Cause Findings of Three Oil Spills in Nigeria,” prepared for Bohler Advocaten, by Richard B. Kuprewicz, Accufacts Inc., dated September 3, 2012.

33. “Observations on Proposed 12-inch NGL ONEOK Pipeline Route in Crook County Sensitive or Unstable Land Areas,” prepared by Richard B. Kuprewicz, Accufacts Inc., dated September 13, 2012.

34. “Findings from Analysis of CEII Confidential Data Supplied to Accufacts Concerning the Millennium Pipeline Company L.L.C. Minisink Compressor Project Application to FERC, Docket No. CP11-515-000,” prepared by Richard B. Kuprewicz, Accufacts Inc., for Minisink Residents for Environmental Preservation and Safety (MREPS), dated November 25, 2012.

35. “Supplemental Observations from Analysis of CEII Confidential Data Supplied to Accufacts Concerning Tennessee Gas Pipeline’s Northeast Upgrade Project,” prepared by Richard B. Kuprewicz, Accufacts Inc., for Delaware RiverKeeper Network, dated December 19, 2012.

36. “Report on Pipeline Safety for Enbridge’s Line 9B Application to NEB,” prepared by Richard B. Kuprewicz, Accufacts Inc., for Equiterre, dated August 5, 2013.

37. “Accufacts’ Evaluation of Oil Spill Joint Investigation Visit Field Reporting Process for the Niger Delta Region of Nigeria,” prepared by Richard B. Kuprewicz for Amnesty International, September 30, 2013.

38. “Accufacts’ Expert Report on ExxonMobil Pipeline Company Silvertip Pipeline Rupture of July 1, 2011 into the Yellowstone River at the Laurel Crossing,” prepared by Richard B. Kuprewicz, November 25, 2013.

39. “Accufacts Inc. Evaluation of Transco’s 42-inch Skillman Loop submissions to FERC concerning the Princeton Ridge, NJ segment,” prepared by Richard B. Kuprewicz for the Princeton Ridge Coalition, dated June 26, 2014, and submitted to FERC Docket No. CP13-551.

40. Accufacts report “DTI Myersville Compressor Station and Dominion Cove Point Project Interlinks,” prepared by Richard B. Kuprewicz for Earthjustice, dated August 13, 2014, and submitted to FERC Docket No. CP13-113-000.

41. “Accufacts Inc. Report on EA Concerning the Princeton Ridge, NJ Segment of Transco’s Leidy Southeast Expansion Project,” prepared by Richard B. Kuprewicz for the Princeton Ridge Coalition, dated September 3, 2014, and submitted to FERC Docket No. CP13-551.

42. Accufacts’ “Evaluation of Actual Velocity Critical Issues Related to Transco’s Leidy Expansion Project,” prepared by Richard B. Kuprewicz for Delaware Riverkeeper Network, dated September 8, 2014, and submitted to FERC Docket No. CP13-551.

43. “Accufacts’ Report to Portland Water District on the Portland – Montreal Pipeline,” with Appendix, prepared by Richard B. Kuprewicz for the Portland, ME Water District, dated July 28, 1014.

44. “Accufacts Inc. Report on EA Concerning the Princeton Ridge, NJ Segment of Transco’s Leidy Southeast Expansion Project,” prepared by Richard B. Kuprewicz and submitted to FERC Docket No. CP13-551.

45. Review of Algonquin Gas Transmission LLC’s Algonquin Incremental Market (“AIM Project”), Impacting the Town of Cortlandt, NY, FERC Docket No. CP14-96-0000, Increasing System Capacity from 2.6 Billion Cubic Feet (Bcf/d) to 2.93 Bcf/d,” prepared by Richard B. Kuprewicz, and dated Nov. 3, 2014.

46. Accufacts’ Key Observations dated January 6, 2015 on Spectra’s Recent Responses to FERC Staff’s Data Request on the Algonquin Gas Transmission Proposal (aka “AIM Project”), FERC Docket No. CP 14-96-000) related to Accufacts’ Nov. 3, 2014 Report and prepared by Richard B. Kuprewicz.

47. Accufacts’ Report on Mariner East Project Affecting West Goshen Township, dated March 6, 2015, to Township Manager of West Goshen Township, PA, and prepared by Richard B. Kuprewicz.

48. Accufacts’ Report on Atmos Energy Corporation (“Atmos”) filing on the Proposed System Integrity Projects (“SIP”) to the Mississippi Public Service Commission (“MPSC”) under Docket No. 15-UN-049 (“Docket”), prepared by Richard B. Kuprewicz, dated June 12, 2015.

49. Accufacts’ Report to the Shwx’owhamel First Nations and the Peters Band (”First Nations”) on the Trans Mountain Expansion Project (“TMEP”) filing to the Canadian NEB, prepared by Richard B. Kuprewicz, dated April 24, 2015.

50. Accufacts Report Concerning Review of Siting of Transco New Compressor and Metering Station, and Possible New Jersey Intrastate Transmission Pipeline Within the Township of Chesterfield, NJ (“Township”), to the Township of Chesterfield, NJ, dated February 18, 2016.

51. Accufacts Report, “Accufacts Expert Analysis of Humberplex Developments Inc. v. TransCanada Pipelines Limited and Enbridge Gas Distribution Inc.; Application under Section 112 of the National Energy Board Act, R.S.C. 1985, c. N-7,” dated April 26, 2016, filed with the Canadian Nation Energy Board (NEB).

52. Accufacts Report, “ A Review, Analysis and Comments on Engineering Critical Assessments as proposed in

PHMSA's Proposed Rule on Safety of Gas Transmission and Gathering Pipelines," prepared for Pipeline Safety Trust by Richard B. Kuprewicz, dated May 16, 2016.

53. Accufacts' Report on Atmos Energy Corporation ("Atmos") filing to the Mississippi Public Utilities Staff, "Accufacts Review of Atmos Spending Proposal 2017 – 2021 (Docket N. 2015-UN-049)," prepared by Richard B. Kuprewicz, dated August 15, 2016.

54. Accufacts Report, "Accufacts Review of the U.S. Army Corps of Engineers (USACE) Environmental Assessment (EA) for the Dakota Access Pipeline ("DAPL")," prepared for Earthjustice by Richard B. Kuprewicz, dated October 28, 2016.

55. Accufacts' Report on Mariner East 2 Expansion Project Affecting West Goshen Township, dated January 6, 2017, to Township Manager of West Goshen Township, PA, and prepared by Richard B. Kuprewicz.

56. Accufacts Review of Puget Sound Energy's Energize Eastside Transmission project along Olympic Pipe Line's two petroleum pipelines crossing the City of Newcastle, for the City of Newcastle, WA, June 20, 2017.

57. Accufacts Review of the Draft Environmental Impact Statement for the Line 3 Pipeline Project Prepared for the Minnesota Department of Commerce, July 9, 2017, filed on behalf of Friends of the Headwaters, to Minnesota State Department of Commerce for Docket Nos. CN-14-916 & PPL-15-137.

58. Testimony of Richard B. Kuprewicz, president of Accufacts Inc., in the matter West Goshen Township and Concerned Citizens of West Goshen Township v. Sunoco Pipelines, L.P. before the Pennsylvania Public Utilities Commission, Docket No. C-2017-2589346, on July 18, 2017, on Behalf of West Goshen Township and Concerned Citizens of West Goshen Township.

59. Direct Testimony of Richard B. Kuprewicz, president of Accufacts Inc., on Behalf of Friends of the Headwaters regarding Enbridge Energy, Limited Partnership proposal to replace and reroute an existing Line 3 to the Minnesota Office of Administrative Hearings for the Minnesota Public Utilities Commission (MPUC PL-9/CN-14-916 and MPUC PL-9/PPL-15-137), September 11, 2017 and October 23, 2017.

60. Direct Testimony of Richard B. Kuprewicz On Behalf of The District of Columbia Government, before the Public Service Commission of the District of Columbia, in the matter of the merger of AltaGas Ltd. and WGL Holdings, Inc., Formal Case No. 1142, September 29, 2017.

61. Report to Mississippi Public Utilities Staff ("MPUS"), "Accufacts Review on Atmos Energy Corporation's Proposed Capital Budget for Fiscal Year 2018 related to System Integrity Program Spending (Docket N. 2015-UN-049)," prepared by Richard B. Kuprewicz, dated December 4, 2017.

62. Report to Hugh A. Donaghue, Esquire, Concord Township Solicitor, "Accufacts Comments on Adelphia Project Application to FERC (Docket No. CP18-46-000) as it might impact Concord Township," dated May 30, 2018.

63. Report to Mississippi Public Utilities Staff ("MPUS"), "Accufacts Review on Atmos Energy Corporation's Proposed Capital Budget for Fiscal Year 2019 related to System Integrity Program Spending (Docket N. 2015-UN-049)," prepared by Richard B. Kuprewicz, dated August 20, 2018.

64. Report to West Goshen Township Manager, PA, "Accufacts report on the repurposing of an existing 12-inch Sunoco pipeline segment to interconnect with the Mariner East 2 and Mariner East 2X crossing West Goshen Township," dated November 8, 2018.

65. Report to West Whiteland Township Manager, PA, "Accufacts Observations on Possible Pennsylvania State Pipeline Safety Regulations," prepared by Richard B. Kuprewicz, dated March 22, 2019.

66. Accufacts Public Comments on the Proposed Joint Settlement, BI&E v. Sunoco Pipeline L.P. ("SPLP"), Docket No. C-2018-3006534 ("Proposed Settlement"), submitted on August 15, 2019 to the Pennsylvania Public Utility Commission on the behalf of West Goshen Township as an intervener.

67. Report to West Whiteland Township Manager, Ms. Mimi Gleason, "Accufacts Perspective on Two Questions from West Whiteland's Board of Supervisors on Proposed Changes to ME 2 and ME 2X Construction/Operational Activities within West Whiteland," dated September 5, 2019."

68. Report to West Goshen Township Manager, Mr. Casey LaLonde, “Accufacts Report on the episode on the evening of 8-5-19 at the Mariner East Boot Road Pump Station (“Event”), Boot Road, West Goshen Township, PA,” dated September 16, 2019.

69. Provided direct testimony before the Arizona Corporation Commission, In the Matter of the Application of Southwest Gas Corporation for the Establishment of Just and Reasonable Rates and Charges Designed to Realize a Reasonable Rate of Return on Fair Value of the Properties of Southwest Gas Corporation Devoted to its Arizona Operations (Docket No. G-01551A-19-0055), testified on behalf of Utilities Division Arizona Corporation Commission, February 19, 2020.

70. Report to West Goshen Township Manager, Mr. Casey LaLonde, “Accufacts Report on the Mariner East 2X Pipeline Affecting West Goshen Township,” dated July 23, 2020.

71. Assisted the Commonwealth of Massachusetts, Office of the Attorney General in developing pipeline safety processes to be incorporated into the settlement agreement related to Columbia Gas’ sale of Assets to Eversource following the Merrimack Valley, Massachusetts overpressure event of September 13, 2018.

72. Report to Natural Resources Defense Council, Inc., “Accufacts’ Observations on the Use of Keystone XL Pipeline Pipe Exhibiting External Coating Deterioration Issues from Long Term Storage Exposure to the Elements,” October 1, 2020.

73. Report to Pennsylvania Public Utilities Commission (“PAPUC”), “Accufacts Comments on Proposed Pennsylvania Intrastate Liquid Pipeline Safety Regulations,” dated October 29, 2021, prepared for West Whiteland Township Board of Supervisors, West Whiteland Township, PA. Filed to PAPUC public web docket November 5, 2021 by West Whiteland Township under Reference Docket Number L-2019-3010267. Addresses suggested improvements in proposed pipeline safety rules for PA intrastate liquid transmission pipelines.

74. Submitted written testimony of Richard B. Kuprewicz on Behalf of Bay Mills Indian Community to ALJ Dennis Mack, dated December 14, 2021, in the matter of the Application of Enbridge Energy, Limited Partnership for Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, before the State of Michigan Public Service Commission, U-20763.

75. Public presentation to New York State Indian Point Nuclear Facility Decommissioning Oversight Board on Holtec removal activities in proximity to Enbridge three Natural Gas Transmission Pipelines, March 17, 2022.

76. Report to Pipeline Safety Trust and Bold Alliance, “Accufacts’ Perspectives on the State of Federal Carbon Dioxide Transmission Pipeline Safety Regulations as it Relates to Carbon Capture, Utilization, and Sequestration within the U.S.,” March 23, 2022.

77. Accufacts Inc., Public Presentation For the National Academies of Science Engineering Medicine and The Transportation Research Board, “To Committee on Criteria for Installing Automatic and Remote-Controlled Shutoff Valves on Existing Gas and Hazardous Liquid Transmission Pipelines,” 4/27/22.

78. Accufacts Inc, “6/13/22 Webinar to Illinois Emergency Responders, Healthcare Providers, & Local Officials on Responses to CO_2 Transmission Pipeline Releases,“ 6/13/22.

79. Accufacts Report for Pipeline Safety Trust, “Safety of Hydrogen Transportation by Gas Pipelines,” 11/28/22.

80. Completed a series of testimonies related to Enbridge’s Line 5 proposal to replace 2 – 20-inch diameter existing submerged pipelines currently lying across the bottom of the Straits of Mackinac with a 30-inch diameter grade X-70 pipeline, proposed to be installed in a 21-foot diameter concrete tunnel to be installed across the approximate 4 mile span of the Straits of Mackinac. Testified on Behalf of the Bay Mill Indian Community before the State of Michigan Public Service Commission, Docket U-20763, in opposition to this very poorly designed proposal/installation allowing for movement of the pipeline on rollers within the tunnel. Final testimony to the docket submitted May 19, 2023. This is the only pipeline proposal I am aware of in the world that would place a crude oil and liquid propane pipeline, especially a 30-inch diameter pipeline, within a tunnel.

81. Issued to Ms. Niroop Srivatsa, City Manager, “Accufacts Report for the City of Lafayette on the Status of the Tree Assessment Process with PG&E,” indicating most of the trees identified for removal by PG&E risk management

approach have nothing to do with gas pipeline safety, June 15, 2023.

82. Issued Direct Testimony to Illinois Commerce Commission (“ICC”) on the Navigator Heartland Greenway LLC Application for a Carbon Dioxide Transportation and Sequestration pipeline, under Docket 23-0161, on behalf of Citizens Against Heartland Pipeline (“CAHGP”), McDonough County, Christian County and Hancock County (the “Counties”) (jointly, “Citizen and County Intervenors” of “CCI”), raising serious questions as to PHMSA’s recent assertions of pipeline safety jurisdiction, and underscoring the ICC’s authority for pipeline siting jurisdiction of said pipeline proposal in the State of Illinois, filed June15, 2023.