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working through science, law and creative media to secure a future for all species, great or small, hovering on the brink of extinction.

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VIA ELECTRONIC MAIL AND FED EX

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RE: Center for Biological Diversity's and Sierra Club's Comments on the Draft Resource Management Plan Amendment and Environmental Impact Statement for Oil and Gas Leasing and Development within the Central Coast Field Office

Dear Mr. Murphy:

The Center for Biological Diversity ("Center") and Sierra Club write to submit the following comments on the Draft Resource Management Plan Amendment/Draft Environmental Impact Statement ("RMP"/"DEIS") for the Bureau of Land Management ("BLM") Central Coast Field Office. The Planning Area consists of about 6.8 million acres of public land which includes about 793,000 acres of Federal mineral estate managed by the Central Coast Field Office. Of these 793,000 acres of Federal mineral estate, 368,800 acres are deemed to be "high oil and gas occurrence potential areas."

Oil and gas exploration and development of the lands covered by the RMP likely involves highly controversial and severely harmful extraction methods, including horizontal drilling and hydraulic fracturing (or "fracking"). The extraction and burning of fossil fuels worsens the climate crisis; endangers water, air, wildlife, public health, and local communities; and further undermines the protection of our public lands. Because new fossil fuel leasing within the Planning Area will contribute to worsening the climate crisis, the vast majority of all *proven* fossil fuels must be kept in the ground to preserve any chance of averting catastrophic climate disruption. Opening up new areas to oil and gas exploration and unlocking new sources of greenhouse gas pollution would only fuel greater warming and contravenes FLPMA's mandate that BLM manage the public lands "without permanent impairment of the productivity of the land and the quality of the environment."[1] In addition, full compliance with the spirit and objectives of NEPA and other federal environmental laws and regulations requires BLM to avoid

[1] *See* 43 U.S.C. §§ 1701(a)(7), 1702(c), 1712(c)(1), 1732(a) (emphasis added); *see also id.* § 1732(b) (directing Secretary to take any action to "prevent unnecessary or undue degradation" of the public lands).

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local and regional impacts as well as contributing to climate change by ending all new leasing in the Planning Area and all other areas that it manages in order to limit the climate change effects of its actions.

The DEIS as prepared is unlawfully deficient. First, it takes an arbitrarily cabined view of the amount of development that could be foreseen. BLM is considering opening up 793,000 acres to oil and gas leasing. A "person of ordinary prudence" would take into account the possibility that more than one in four thousand of these acres would be subject to surface-disturbing oil and gas activity, but BLM excluded this foreseeable possibility from analysis. Second, the DEIS fails to analyze all reasonable alternatives raised in scoping, and to take a hard look at significant and foreseeable impacts to air, water, threatened and endangered species, induced seismicity, and public health and safety.

This comment letter focuses on BLM's failure to adequately analyze and disclose the direct, indirect, and cumulative impacts of fossil fuel leasing and development that would be authorized and made available by BLM in the DEIS, and correspondingly, the impact that such development will have on air, water, human health, and climate change. Adopting the proposed RMP would be dramatically out of step with the realities facing modern public lands management because it ignores current science and national policy on climate change. Therefore we request that BLM (1) reassess reasonably foreseeable development to include the potential for greater oil and gas development; (2) consider and analyze "no-leasing" and "no-fracking" alternatives that would bar new fossil fuel leases in the Central Coast Field Office Planning Area; (3) fully consider current scientific and economic information, especially regarding climate change; and (4) strengthen its "hard look" at impacts to air, water, induced seismicity and human health, including by conducting a Health Impact Assessment. and (3) BLM take a hard look at impacts to air, water, human health (which must include a detailed Health Impact Assessment), induced seismicity, wildlife, and sensitive species.

I. The DEIS Underestimates Activities Likely to Occur

BLM arbitrarily assumed for the purposes of the EIS that each alternative would result in no more than 37 exploratory and development wells on new Federal oil and gas leases, and no more than 206 acres of associated disturbance from well pads, roads, and other facilities over the 15- to 20-year period of analysis. BLM provided no explanation for these unreasonably low estimates, other than the conclusory statement that:

> Given the limited extent of area of federal mineral estate within the entire planning area, it is unlikely that more than a total of 37 exploratory and development wells will be drilled on federal oil and gas leases. Well stimulation technologies and enhanced oil recovery techniques are assumed to be used on any or all of these wells.

However, the "limited extent of area of federal mineral estate within the entire planning area" amounts to 793,000 acres, 368,800 acres of which are deemed to "high oil and gas occurrence potential areas."

A. BLM's Reasonably Foreseeable Development Scenario is Inadequate

BLM's Reasonably Foreseeable Development Scenario ("RFDS") for the Hollister Field Office ("HFO," now known as the Central Coast Field Office or CCFO) area[2] relies on unsupported assumptions to conclude that future oil and gas development will continue at levels consistent with historic development trends, and fails to take into account new relevant scientific information. As a result, the BLM's projection of 37 new wells and 206 acres of land disturbance drastically underestimates the potential future development of the area. Without a realistic evaluation of future oil and gas development, the DEIR improperly masks the extent of environmental impacts to air, climate, water, biological resources, and other areas. Accordingly, the RFDS must be revised to reflect possible future production growth from both conventional and unconventional oil and gas resources in order to ensure that potential environmental impacts are properly evaluated under NEPA.

As described in BLM Instructional Memorandum 2004-89, Policy for Reasonably Foreseeable Development (RFD) Scenario for Oil and Gas (IM 2004-89)[3], "The baseline RFD scenario provides the mechanism to analyze the effects that discretionary management decisions have on oil and gas activity. The RFD also provides basic information that is analyzed in the National Environmental Policy Act (NEPA) document under various alternatives."[4]

The RFDS underpins the entire NEPA analysis. It is therefore critical, as stated in IM 2004-89 and acknowledged in the RFDS, that it be "based on the best available information and data at the time of the study."[5]

B. The RFDS Relies on Unsupported Assumptions

BLM concludes in the RFDS that "leasing and exploration will continue at levels consistent with historic development. In other words, oil and gas leasing and exploration trends are not likely to increase or decrease. Rather, oil and gas activity within the HFO area over the next 15 to 20 years is likely to remain sporadic and primarily on non-federal lands. Furthermore, additions of new reserves are expected to continue the decline begun in 1990 in all management areas."[6] However, BLM provides no reason or evidence for why oil and gas activity within the CCFO are likely to continue at historic levels, especially since this assumption seems to ignore new technology that has been developed in recent years. BLM does not offer any substantive

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[2] U.S. Department of the Interior, Bureau of Land Management. 2016. Central Coast Field Office Draft Resource Management Plan Amendment and Draft Environmental Impact Statement for Oil and Gas Leasing and Development. Appendix B. Hollister Field Office Area – Reasonably Foreseeable Development Scenario for Oil and Gas. January 5 2017 ("BLM 2016, HFO RFDS"). [online] https://eplanning.blm.gov/epl-front-office/projects/lup/67003/94015/113329/Appendix_B_-_Reasonably_Foreseeable_Development_Scenario.pdf. Accessed March 28, 2017.

[3] U.S. Department of the Interior, Bureau of Land Management. 2004. Instruction Memorandum No. 2004-89, Policy for Reasonably Foreseeable Development (RFD) Scenario for Oil and Gas. January 16 2004 ("BLM 2004, IM NO. 2004-89"). [online] https://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction.html. Accessed March 28, 2017.

[4] *Id.* at 1-1.

[5] *Id.* at 1-3; BLM 2016, HFO RFDS at Ap.B-1.

[6] BLM 2016, HFO RFDS at Ap.B-15.

analysis to validate its conclusion, often relying on unsupported assumptions, and fails to fully analyze available information and data that may contradict this conclusion.

BLM states in the RFDS that it considered "three general categories of prospective target areas for oil production involving well stimulation in California, including within the HFO area. These targets include: (1) continued or increased oil production from discovered oil fields or similar undiscovered reservoirs; (2) organic-rich shales located deep in the basins within the oil window; and (3) oil-bearing shales in basins where little oil production has occurred."[7] However, BLM's analysis of these three general categories falls short, as discussed in greater detail below in subsections "c" and "d," and must be revised to take into account all available information and data and assess all reasonable development scenarios.

C. BLM Fails to Adequately Assess Continued or Increased Oil Production from Discovered Oil Fields or Similar Undiscovered Reservoirs

BLM failed to consider the possibility of production and/or reserve growth in discovered oil fields or similar undiscovered reservoirs, and how such growth would impact future drilling and production rates. In 2015, the United States Geological Survey (USGS) published a fact sheet entitled "Assessment of Remaining Recoverable Oil in Selected Major Oil Fields of the San Joaquin Basin, California" that estimated the "volumes of technically recoverable, conventional oil that could eventually be added to reserves in nine selected major oil fields in the San Joaquin Basin in central California."[8] One of the fields USGS assessed was the Coalinga Field, which is the second most productive oil field in the HFO/CCFO area.[9] USGS estimated that a mean volume of 705 million barrels of additional oil ("MMBO") is potentially recoverable from Coalinga. USGS concluded that much of the additional estimated oil production in the San Joaquin Basin could come from improved recovery in diatomite reservoirs of the Monterey Formation, which requires well stimulation. It also concluded that enhanced oil recovery ("EOR") methods – including those used at the Coalinga field – may also be used to increase production, stating that:

> Additional volumes of oil could come from continued application of thermal-recovery technologies to shallow reservoirs containing heavy oil, although the oil remaining in such reservoirs is more difficult to recover than in similar reservoirs already exploited. In a few reservoirs, particularly deep sandstone reservoirs containing relatively light oil such

[7] *Id.* at Ap.B-14.
[8] Tennyson, M.E. et al., Assessment of remaining recoverable oil in selected major oil fields of the San Joaquin Basin, California: U.S. Geological Survey Fact Sheet 2012–3050 (2012).
[9] BLM incorrectly states in the RFDS at Ap.B-9 that "[t]he Coalinga Field, located in western Fresno County, is the most productive field in the HFO area and is currently the eighth largest oil and gas field in California." According to production records from the California Division of Oil, Gas, and Geothermal Resources, in 2016, Coalinga produced approximately 6.4 million barrels of oil and 247 million cubic feet of natural gas, making it the 9th most productive oil field in the state and second most productive in the HFO. The most productive oil field in the HFO and 8th most productive in California is San Ardo, which in 2016 produced approximately 7.9 million barrels of oil and 1 billion cubic feet of natural gas.

> as sandstone reservoirs within the Monterey Formation at Elk Hills field, additional oil could be recovered with injection of carbon dioxide.[10]

Although USGS's analysis only examined future production from large oil fields, it also acknowledged that contributions from smaller fields could also be significant, stating that "[o]il reserves will also continue to be added in fields within the San Joaquin Basin that were not included in this analysis. Most such fields are smaller than the fields studied, and their additions to reserves will also be smaller, although they may be significant."

As noted above, BLM states that "additions of new reserves are expected to continue the decline begun in 1990 in all management areas" but does not describe in detail how reserve additions have declined during that time or how the USGS assessment described above may alter that decline. In its Independent Scientific Assessment of Well Stimulation in California[11], the California Council on Science and Technology found that,

> Growth of reserves in existing fields of the San Joaquin Basin has been the most important source of additional reserves in California in recent decades. The large remaining resource potential of these reasonably well understood oil accumulations suggests that additional development of the San Joaquin Basin oil fields is likely to continue to be an important source of reserve additions in California for years to come. In addition to the potential of the intensively developed large fields, some less developed smaller fields of the San Joaquin Basin also have significant potential as well.[12]

The 1995 USGS assessment of the Salinas Basin (the most recent available) notes that a significant part of the Salinas Basin has only been lightly explored, with the potential for many more discoveries, and some geologists believe that one or more very large fields (possibly comparable to San Ardo) may be present near the southern border of Monterey County.[13] The USGS concludes that it is much more likely that, if any additional fields are discovered, they will be very small. According to the USGS, San Ardo is estimated to contain 530-860 million barrels of oil; the median expected size of a new discovery is 2 million barrels of oil. Nevertheless, the exploration for and development of such fields would result in environmental impacts and those impacts must be assessed. BLM considers some types of surface disturbance associated with such a new discovery in Subsection 7 of the RFDS, but ultimately does not incorporate that

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[10] Tennyson, M.E. et al., Assessment of remaining recoverable oil in selected major oil fields of the San Joaquin Basin, California: U.S. Geological Survey Fact Sheet 2012–3050 (2012).

[11] California Council on Science and Technology. 2015. An Independent Scientific Assessment of Well Stimulation in California. Volume 1: Well Stimulation Technologies and their Past, Present, and Potential Future Use in California. Prepared by California Council on Science and Technology, Lawrence Berkeley National Laboratory. January ("CCST 2015"). [online]: http://www.ccst.us/ projects/hydraulic_fracturing_public/SB4.php. Accessed March 28, 2017.

[12] *Id.* at 211.

[13] Stanley, R. G., 1995, Central Coastal Province (2011) *with a section on* Cuyama Basin, by M.E. Tennyson, *in* Gautier, D. L., Dolton, G.L., Takahashi, K.I., and Varnes, K.L., ed., 1995 National assessment of United States oil and gas resources--Results, methodology, and supporting data: U.S. Geological Survey Digital Data Series DDS-30, Release 2, one CD-ROM.
Available at: *http://certmapper.cr.usgs.gov/data/noga95/prov11/text/prov11.pdf*

scenario in the RFDS on the basis that it is "extremely unlikely to occur."[14] However, BLM's previous analysis does not adequately demonstrate that this conclusion is correct. The CCST also found that, "Within the large area of the Central Coastal basins, the Salinas Basin, in particular, has significant potential for undiscovered conventional petroleum accumulations and for further development of heavy oil within the giant San Ardo field."[15]

BLM's assessment of potential increased production from conventional fields in the HFO/CCFO area, particularly within the San Joaquin and Salinas Basins, is inadequate and must be revised to reflect all available information and data.

D. BLM Fails to Adequately Assess Oil Production from Organic-Rich Shales Located Deep in the Basins within the Oil Window

While estimates of the size of the Monterey source rock play are highly uncertain, multiple independent experts conclude that the potential resource is significant. The CCST found that,

> Most known oil, and in all likelihood most yet-to-be discovered and developed oil as well, was generated through the thermal alteration of organic matter in the Monterey Formation. In short, the Monterey is a prolific petroleum source rock. Recent direct production of oil from source rocks (so-called shale oil) in other parts of the country have drawn attention to the possibility of producing oil directly from the Monterey source rocks as well. Although no such production has yet been demonstrated, the possibility exists for "source-rock system (shale oil) plays" in the deeper parts of a number of California basins, including the San Joaquin, Los Angeles, Ventura, Santa Maria, and Salinas basins. If these postulated resources exist and could be developed, their production would probably entail the widespread application of WST in hundreds or thousands of new wells.[16]

Specifically within the HFO/CCFO, CCST found that, "[t]he source rock intervals of the San Joaquin Basin are the most likely candidates for high-volume shale oil production,"[17] and "[t]he existence of the giant San Ardo oil field also demonstrates the presence of active and effective Monterey-equivalent petroleum source rocks deep in the basin. Therefore a source-rock system 'shale oil' play with significant recoverable resources is considered a real possibility in the Salinas Basin."[18]

The potential development of this resource is not adequately assessed in the RFDS. BLM simply assumes that the Monterey source rock play will not be developed within the time period considered in the RFDS, stating,

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[14] BLM 2016, HFO RFDS at Ap.B-28.
[15] CCST 2015 at 198.
[16] *Id.* at 251.
[17] *Id.*
[18] *Id.* at 198.

> Even if there are advances in science and technology that resolve some of the uncertainty associated with the Monterey Formation source rock, these advances are not likely to alter the RFDS for federal minerals in the planning area for the next 15 to 20 years due to the geology of the region. Therefore, all available scientific, industry, and government information indicates that absent currently unforeseen changes in oilfield technology, future oil and gas development within the HFO area will continue as it has over the last 10 or 20 years.[19]

No substantive assessment is provided to support this conclusion. Rather, this conclusion is simply repeated over and over with no further analysis. BLM states in Section 2.5, Future Oil and Gas Development, that "[g]iven the level of uncertainties regarding the distribution and abundance of oil retained in deep Monterey source rocks, or how successful production could occur, significant future production of this target is not expected. Even if some of the uncertainties are resolved, these advances are not likely to alter the RFDS for federal minerals in the Planning Area for the next 15 to 20 years due to the geology of the region (see Section 3, RFDS Assumptions)."[20]

However, Section 3 also does not include any discussion of the information or data that supports BLM's conclusion, but simply refers back to Section 2.5, "[a]s discussed in Section 2.5 (Future Oil and Gas Development), given the level of uncertainties regarding the Monterey Formation source rock, significant future production of this target is not expected (CCST, 2015, pp. 15 to 19)."[21]

BLM implies that it is not required to assess potential development of the Monterey source rock play by stating in the RFDS that, "[r]easonably foreseeable does not include scenarios that are merely speculative or only have a remote possibility of occurring."[22] However, IM 2004-89 contradicts this, including the statement that, "[t]he RFD projection ***can range from speculative estimates in unexplored frontier areas*** to estimates with higher levels of confidence in maturely developed producing areas,"[23] (emphasis added).

Moreover, the RFDS fails to include recent information and data that can help remove some of the uncertainties and help guide the assessment of potential development of the Monterey source rock play. In 2015, the USGS published a fact sheet entitled Assessment of Undiscovered Continuous Oil and Gas Resources in the Monterey Formation, San Joaquin Basin Province, California, 2015,[24] in which they concluded that,

> This USGS analysis, based on drilling results to date, concluded that some recoverable oil probably remains in the source rock, but success rates (proportion of drilled wells that produce at least 2,000 barrels) will be low, and the estimated ultimate recovery will be

[19] BLM 2016, HFO RFDS at Ap.B-16.
[20] *Id.* at Ap.B-14.
[21] *Id.* at Ap.B-15.
[22] *Id.* at Ap.B-1.
[23] BLM 2004, IM NO. 2004-89 at 1-3.
[24] Tennyson, M.E., et al., Assessment of undiscovered continuous oil and gas resources in the Monterey Formation, San Joaquin Basin Province, California, 2015: U.S. Geological Survey Fact Sheet 2015-3058 (2015).

> low for even successful wells (table 1). Wells will be relatively tightly spaced, as they are in producing Monterey reservoirs in conventional traps such as those at the Buena Vista and Lost Hills fields. Anticipated extraction methods are mostly vertical (rather than horizontal) wells, acid stimulation, and hydraulic fracturing.

USGS estimated that the calculated mean average drainage area of wells in the two assessment units considered would be 18 acres. In other words, on average, one well would be required every 18 acres to produce the Monterey reservoirs in the San Joaquin Basin province.

BLM should use this information and data on well spacing and anticipated extraction methods to revise the RFDS to include development scenarios for the more than 4,000 acres of federal mineral estate overlaying the Monterey Formation play in the HFO area.

In sum, and as described above, the RFDS must be revised to reflect possible future production growth from both conventional and unconventional oil and gas resources in order to ensure that potential environmental impacts are properly evaluated under NEPA.

BLM's drastic underestimate of the activities likely to occur as a result of the lease sale, and its limitation of the analysis to the impact of only 37 wells and 206 acres of surface disturbance, infected every aspect of BLM's analysis in the DEIS.[25] In particular, BLM minimized potential environmental impacts and failed to analyze the nature, intensity, and extent of the lease sale's actual effects, discussed in greater detail below.

II. The DEIS Is Not in Accordance with Local Laws and Regulations

The DEIS does not contain any meaningful discussion of local ordinances that prohibit land uses related to oil and gas development within HFO/CCFO jurisdiction. These include the following measures:

A. Measure J

On November 4, 2014, San Benito County voters passed a ballot initiative titled "Protect Our Water and Health: Ban Fracking Initiative," designated Measure J. Measure J amended the county general plan to protect local communities from the dangers of high-intensity petroleum operations. The new law states:

> The development, construction, installation, or use of any facility, appurtenance, or above-ground equipment, whether temporary or permanent, mobile or fixed, accessory or principal, in support of High-Intensity Petroleum Operation(s) is prohibited on all lands within the County's unincorporated area.[26]

[25] *See, e.g.*, DEIS at 4.6-2 (BLM estimated quantities of greenhouse gas emissions for the drilling of only 37 wells), and, *id.*, at 4.7- 3 ("groundwater is assumed to be used for all drilling and well stimulation activities for the maximum of 37 wells in the 2015 RFD Scenario.")

[26] San Benito General Plan, Land Use Policy 41 (2014).

The prohibition on land uses supporting High-Intensity Petroleum Operations applies to (1) Well Stimulation Treatments and/or (2) the operation of Enhanced Recovery Wells as defined in Measure J.[27] In addition, oil and gas development of any type is prohibited in all land designated for residential use.[28]

Aside from fleeting references noting Measure J's existence, the DEIS contains no analysis of the ordinance as it relates to BLM's oil and gas leasing.

B. Measure Z

On November 8, 2016, voters of Monterey County passed a ballot initiative titled, "Protect Our Water: Ban Fracking and Limit Risky Oil Operations Initiative," later named Measure Z for purposes of the ballot. Measure Z's land use restrictions, which apply to all unincorporated parts of the County, consisted of:

(1) A ban on land use in support of hydraulic fracturing and other forms of enhanced well stimulation treatments like acidizing;
(2) A ban on land use in support of wastewater injection and wastewater impoundment; and
(3) A ban on land use in support of drilling new oil and gas wells. [29]

The DEIS does not mention Measure Z and it is thus impossible to know how the BLM plans to address this local ordinance.

C. Santa Cruz Oil and Gas Ban

In 2014, the Santa Cruz County Board of Supervisors passed an ordinance imposing a permanent ban on fracking as well as all other oil and gas development.[30]

The DEIS acknowledges the need to consider local ordinances related to geotechnical studies, "safety elements," seismic safety provisions, construction regulations, soil and rock analyses, grading and erosion control, reporting and disclosure requirements, and more.[31] But critically, local laws that apply directly to oil and gas activity receive no discussion.

III. The BLM Fails to Demonstrate Conformity with the Clean Air Act

BLM asserts that it is not obliged to perform a full and complete "conformity determination" in the Central Coast draft RMP to comply with the Clean Air Act's requirement that federal actions conform to the applicable state implementation plan ("SIP"). DEIS at 4.5-6;

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[27] *Id.*
[28] *Id.*, Land Use Policy 42.
[29] Monterey County Elections, Ballot Measure: Full Text of Measure Z, Land Use sections 1.21, 1.22, and 1.23, available at http://www.montereycountyelections.us/a_measures_NOVEMBER_2016_EN_MZ.html (2016).
[30] Santa Cruz Board of Supervisors Resolution Amending the Santa Cruz County General Plan Regarding Prohibition on Oil and Gas Exploration and Development (May 20, 2014).
[31] DEIS at 3.3-4.

See also 42 U.S.C. § 7506. BLM's position is based on erroneous interpretations of the Clean Air Act and its underlying regulations, and unsubstantiated emissions estimates which indicate that BLM's proposed resource management plan will continue to fuel dangerous levels of ozone pollution in the region, jeopardizing public health.

Implementation of the Clean Air Act exemplifies cooperative governance between the states and the federal government. The Clean Air Act aims "to protect and enhance the quality of the Nation's air resources . . . ." 42 U.S.C. § 7401(b)(1). The Clean Air Act states that, "No department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity" that does not conform to an approved state air quality implementation plan. 42 U.S.C. § 7506(c)(1). "The assurance of conformity . . . shall be an affirmative responsibility of the head of such . . . agency." To ensure conformity, agency actions must not "cause or contribute to any new violation of any [air quality] standard" or "increase the frequency or severity of any existing violation of any standard in any area." *Id.* § 7506(c)(1)(B). This statute is very broadly applicable.

A SIP is a federally approved set of state regulations that are designed to prevent air quality deterioration and to restore clean air in areas that are out of attainment with federal standards. Conformity to a SIP as defined in the Clean Air Act, 42 U.S.C. § 7506(c)(1)(AB), means:

> (A) conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards; and
> (B) that such activities will not—
>
> > (i) cause or contribute to any new violation of any standard in any area;
> > (ii) increase the frequency or severity of any existing violation of any standard in any area; or
> > (iii) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The "assurance of conformity" to a SIP "shall be an affirmative responsibility" of a federal agency. 42 U.S.C. § 7506(c)(1). For Federal actions not related to transportation plans, "a conformity determination is required for each criteria pollutant or precursor where the total of direct and indirect emissions of the criteria pollutant or precursor in a nonattainment or maintenance area caused by a Federal action would equal or exceed. . . 10/25/50/100 [tons/year.]". 40 C.F.R. § 95.153(b).

There are certain limited exceptions to general conformity requirements under the Clean Air Act, such as when emissions from federal actions are below de minimis thresholds. Portions of federal actions that require a permit under the Clean Air Act's new source review program, as set forth under 42 U.S.C. §§ 7410(a)(2)(c) and 7503, are also not subject to general conformity requirements. See 40 C.F.R. § 93.150(d).

The purpose of general conformity is to "prevent the Federal Government from interfering with the States' abilities to comply with the CAA's requirements." *Dep't of Transp. v.*

Pub. Citizen, 541 U.S. 752, 758 (2004). An action "delays attainment only if its implementation *postpones* attainment beyond the date by which it would have been achieved without the project." *Nat. Res. Def. Council v. E.P.A.*, 661 F.3d 662, 665 (D.C. Cir. 2011).

Before action is taken, a federal agency must make a determination that the federal action conforms to "certain threshold emission rates set forth in § 93.153(b)." *Pub. Citizen,* 541 U.S. at 771. If the action's direct and indirect emissions will exceed *de minimis* levels, then the agency must demonstrate conformity. *Ctr. for Biological Diversity v. Bureau of Land Mgmt.*, 833 F.3d 1136, 1148 (9th Cir. 2016); *see also* 40 C.F.R § 93.153(b)(1) (defines *de minimis* emission rates). Because "[n]either the federal nor the state rule identify the form an agency must use when deciding whether a project necessitates a full-scale conformity determination," courts have found it sufficient for an agency to explain their conformity decision in a NEPA document. *California ex rel. Imperial Cty. Air Pollution Control Dist. v. U.S. Dep't of the Interior*, 767 F.3d 781, 799 (9th Cir. 2014). Thus, "[a]n agency need not prepare a stand-alone document explaining such a decision." *Id.* Likewise, the Federal Land Policy and Management Act (FLPMA) requires the Secretary of the Interior, in developing and revising land use plans, to "provide for compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standards or implementation plans." 43 U.S.C. § 1712(c)(8).

For purposes of conformity, direct emissions are those emissions that are "caused or initiated by the Federal action . . . occur at the same time and place as the action and are reasonably foreseeable." 40 C.F.R. § 93.152. Indirect emissions are defined "as being (1) caused by federal action but occurring at a different time or place as the action, (2) reasonably foreseeable, (3) practically controlled by the agency, and (4) under the continuing program responsibility of the agency." *California ex rel. Imperial Cty. Air Pollution Control Dist.*, 767 F.3d at 799; *see also* § 93.152. "[T]he EPA has made clear that for purposes of evaluating causation in the conformity review process, some sort of 'but for' causation is sufficient." *Pub. Citizen*, 541 U.S. at 772. To demonstrate causation, projected emission concentrations with and without the project are compared. *Nat. Res. Def. Council*, 661 F.3d at 665. If "the project's emissions would result in either a new or aggravated violation relative to the initial emissions trajectory," then the project does not conform. *Id*.

Ozone is a criteria pollutant under the federal Clean Air Act, 42 U.S.C. § 7408. The Clean Air Act establishes a National Ambient Air Quality Standard ("NAAQS") for each criteria pollutant that represents the maximum allowable concentration of each pollutant that can occur in the air and still protect public health. See 42 U.S.C. § 7409. In 2008, EPA published a final rule strengthening the ozone NAAQS by lowering the 8-hour standard to 0.075 ppm. 73 Fed. Reg. 16,436 (March 27, 2008). In response to evolving science and public health needs, in 2015 EPA again lowered the 2008 ozone NAAQS, setting a new, more stringent 8-hour limit of 0.070 ppm. 80 Fed. Reg. 65,292 (Oct. 26, 2015). According to EPA, the new limit was necessary "to provide requisite protection of public health and welfare, particularly for at-risk groups including children, older adults, people of all ages with lung diseases such as asthma, and people who are active outdoors, both for recreational and work purposes. It will also improve the health of trees, plants, and ecosystems." *Id*.

EPA's decision to strengthen the ozone standard was based on numerous human health studies conducted over the past decade documenting the adverse effects of ozone on public health. Ozone concentrations are measured on an hourly basis. 40 C.F.R. § 50.15. An exceedance of the ozone standard occurs if the average of eight consecutive hourly readings exceeds 0.075 ppm, which is the 2008 NAAQS for ozone. *Id*. A violation of the standard occurs when the "3-year average of the annual fourth-highest 8-hour" ozone concentrations exceeds 0.075 ppm. *Id*.

When the 3-year average for ozone levels for any given region falls below 0.075ppm, the region is considered to be in attainment with the ozone NAAQS. 42 U.S.C. § 7407(d)(1)(A)(ii). Conversely, when the 3-year ozone average is above 0.075 ppm, the region is considered a nonattainment area for ozone. 42 U.S.C. § 7407(d)(1)(A)(i). EPA will promulgate final area ozone designations for California based on the new 2015 ozone NAAQS by October 1, 2017.[32] The California Air Resources Board will then formally adopt the new designations, implementing the new 2015 ozone standard state-wide. Until the 2015 ozone designation process is complete, the 2008 0.075 ppm standard applies across all air districts in California

A 2011 interagency guidance memorandum of understanding, signed by the Department of Interior, outlines a commitment by the agency to undergo detailed analyses of air quality compliance, with a particular focus on non-attainment areas. The MOU establishes "a clearly defined, efficient approach to compliance with [NEPA] regarding air quality . . . in connection with oil and gas development on Federal lands."[33] The MOU "provides for early interagency consultation throughout the NEPA process; common procedures for determining what type of air quality analyses are appropriate and when air modeling is necessary; specific provisions for analyzing and discussing impacts to air quality and for mitigating such impacts; and a dispute resolution process to facilitate timely resolution of differences among agencies."[34] The goal of this process is to ensure that "[F]ederal oil and gas decisions do not cause or contribute to exceedances of the National Ambient Air Quality Standards (NAAQS)."[35] The MOU outlines recommended technical, quantitative procedures to follow, which include identifying the reasonably foreseeable number of oil and gas wells and conducting an emissions inventory of criteria pollutants. Further air quality modeling is required if certain criteria are met, based on the level of emissions impact and the geographic location of the action.[36] The MOU indicates that "[e]xisting reasonably foreseeable development scenarios can be used to identify the number of wells."[37]

In response to this interagency MOU, BLM implemented internal regulations in 2012 establishing a 10-step process for conducting a general conformity determination in compliance

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[32] California Air Resources Board, Federal Standard Area Designations (2017), available at https://www.arb.ca.gov/desig/feddesig.htm.

[33] Memorandum of Understanding Among the U.S. Department of Agriculture, U.S. Department of the Interior, and U.S. Environmental Protection Agency, regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act Process, Preamble (2011), available at: https://www.epa.gov/sites/production/files/2014-08/documents/air-quality-analyses-mou-2011.pdf.

[34] *Id*. at 4.

[35] *Id*. at 1, 2.

[36] *Id*. § V.E.1., pg. 9.

[37] *Id*.

with the Clean Air Act section 176(c).[38] The erroneous and unsubstantiated analysis at issue in the draft Central Coast RMP/EIS hinges on BLM's application of IM 2013-025 steps 4-6 which require BLM to:

> 4. Conduct an Air Quality impact analysis. This section should contain estimates of emissions that are caused by the project and located in the nonattainment or maintenance area. According to the EPA rules, the emissions estimates should include all reasonably foreseeable direct and indirect emissions from the proposed action.
> 5. Compare results to applicable SIP provisions and rules. Under this section, the project with its emission estimates and mitigations needs to be compared to the SIP to see if it complies with the provisions of the SIP, including the application of control measures required in the SIP and acquisition of all necessary air permits…
> 6. Write a Conclusion Statement. At this point, a statement needs to be made as to whether the project is in conformity (if not, the project cannot proceed), whether the emissions exceed the de minimus levels (40 CFR 93.153) and a formal determination is necessary, or it is below de minimus levels and no further analysis would be necessary. This statement should also include the mechanism through which any required mitigation will be established and enforced (i.e., in the Record of Decision, the Conditions of Approval (COAs) on an Application for Permit to Drill (APD), etc.).

BLM essentially skipped step 4 in the Central Coast RMP/DEIS. BLM's so-called "air quality impacts analysis" consists of a few emissions estimates reported in Tables 4.5-1 and 4.5-2 for development and long-term production, operations and maintenance of the 37 wells estimated in the RFD scenario for this planning area. DEIS at 4.5-4, 4.5-5. BLM cites *no* source or reference for the calculations of these emissions estimates, yet quickly and conveniently concludes that all potential emission thresholds fall within "de minimis" levels, releasing the agency from obligations to conduct a full General Conformity Determination for this RMP. DEIS at 4.5-6. De minimis levels under EPA's General Conformity regulations are as follows (40 CFR 93.153(b)):

(1) For purposes of paragraph (b) of this section the following rates apply in nonattainment areas (NAA's):

	Tons/year
Ozone (VOC's or NOX):	
Serious NAA's	50
Severe NAA's	25
Extreme NAA's	10
Other ozone NAA's outside an ozone transport region	100
Other ozone NAA's inside an ozone transport region:	
VOC	50
NOX	100

[38] United States Department of the Interior, Bureau of Land Management, Instruction Memorandum No. 2013-025, *Guidance for Conducting Air Quality General Conformity Determinations* (December 4, 2012) *found at* https://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2013/IM_2013-025.html.

Carbon Monoxide: All maintenance areas	100
SO2 or NO2: All NAA's	100
PM10:	
Moderate NAA's	100
Serious NAA's	70
PM2.5 (direct emissions, SO2, NOX, VOC, and Ammonia):	
Moderate NAA's	100
Serious NAA's	70
Pb: All NAA's	25

(2) For purposes of paragraph (b) of this section the following rates apply in maintenance areas:

	Tons/year
Ozone (NOX), SO2 or NO2:	
All maintenance areas	100
Ozone (VOC's)	
Maintenance areas inside an ozone transport region	50
Maintenance areas outside an ozone transport region	100
Carbon monoxide: All maintenance areas	100
PM10: All maintenance areas	100
PM2.5 (direct emissions, SO2, NOX, VOC, and Ammonia)	100
All maintenance areas	100
Pb: All maintenance areas	25

In the draft Central Coast RMP/EIS, the NOx emissions estimate of 8.4 tons per year falls just below the de minimis threshold of 10 tons per year established by the California Air Resources Board for the San Joaquin Valley Air Basin which is currently classified as "extreme" non-attainment for ozone. DEIS at 4.5-5. NOx and VOCs are pre-cursors that form ground-level ozone, therefore the agency must demonstrate that additional emissions of either NOx or VOCs meet the NAAQS. BLM fails to cite *any* authority or resource in calculating these potential emissions, thereby failing its affirmative duty to demonstrate to the public that health-protective air quality standards will be met with approval of increased oil and gas development in the planning area.

The need for BLM to ensure conformity is underscored by the fact that California is failing to bring the San Joaquin Valley ozone "extreme" nonattainment area into attainment with the 2008 0.075 ppm ozone NAAQS. Given the inability of the current San Joaquin ozone air quality plan to ensure attainment with the ozone NAAQS, as required by the Clean Air Act, it appears clear that the BLM's decision will not only cause or contribute to violations of the NAAQS, but increase their severity and frequency. Not to speak of the more stringent 0.070 ppm ozone standard adopted by EPA in 2015. The San Joaquin Air Resources Control Board acknowledges that meeting the new more stringent ozone NAAQS means "NOx emissions reductions in the Valley must be reduced by an additional 90% in order to attain the latest federal ozone and PM2.5 standards that now encroach on natural background levels. This air quality challenge is unmatched by any other region in the nation."[39] A conformity determination is

[39] San Joaquin Valley Air Pollution Control District, *2016 Plan for the 2008 8-Hour Ozone Standard*, at ES-5 (June 16, 2016) *found* at http://www.valleyair.org/Air_Quality_Plans/Ozone-Plan-2016.htm.

especially necessary in this case. BLM must prove to the public that their estimated emission calculations are accurate, justified and enforceable. BLM fails to provide any information to support their air emissions estimates in this RMP, which also puts them in direct conflict with requirements under NEPA.

NEPA regulations repeatedly emphasize the need for effective and accurate public notice and involvement. NEPA procedures must ensure "environmental information is available to public officials and citizens before decisions are made and before actions are taken." 40 C.F.R. § 1500.1(b). NEPA regulations make it crystal clear that "[T]he information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA." *Id.* Accordingly, "agencies shall to the fullest extent possible…encourage and facilitate public involvement in decisions." *Id.* § 1500.2(d) (emphasis added).

NEPA's implementing regulations require that the agency "shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions," and shall ensure the scientific accuracy and integrity of environmental analysis. *Id.* § 1502.24. The agency must disclose if information is incomplete or unavailable and explain "the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts." *Id.* § 1502.22(b)(1). The agency must also directly and explicitly respond to dissenting scientific opinion. *Id.* § 1502.9(b).

Courts interpret these regulations as requiring a high level of accuracy in the information provided to the public, and the burden falls on the agency to meet this high standard. "[W]ith respect to public involvement, the way in which the information is provided is less important than that a sufficient amount of environmental information – *as much as practicable* – be provided so that a member of the public can weigh in on the significant decision that the agency will make in preparing the EIS. *WildEarth Guardians v. Mont. Snowmobile Ass'n*, 790 F.3d 920, 926 (9th Cir. 2015) (quoting *Native Ecosystems Council v. U.S. Forest Serv.*, 418 F.3d 953, 964 (9th Cir. 2005) (citing 40 C.F.R. § 1500.1(b)("To take the required 'hard look' at a proposed project's effects, an agency may not rely on incorrect assumptions or data in an EIS. It surely follows that the data the Forest Service provides to the public to substantiate its analysis and conclusions must also be accurate. If the wolverine habitat prediction map does not accurately depict the big game winter range, and the Forest Service ultimately worked from a different, accurate map, then it is the accurate map that must be disclosed to the public.")(internal quotations omitted).

It is the agency's duty to provide clear, consistent and accurate information so that the public is fully informed of the scope of the agency action. BLM utterly failed to meet this fundamental pillar of NEPA review.

In addition to NEPA information accuracy requirements, courts also interpret EPA CAA General Conformity regulations to include the latest, most accurate information. In *Border Power Plant Working Group v. DOE,* the Court clarified the legal standard for general conformity determinations, stating that a Federal action's conformity determination must rely "on the most recent estimates of emissions," (42 U.S.C. § 7506(c)(1)) and that the EPA requires

"the latest and most accurate emission estimation techniques available . . . (2) such as actual stack test data from stationary sources which are part of the conformity analysis." 467 F. Supp. 2d 1040, 1054 (S.D. Cal. 2006) (quoting 40 C.F.R. § 51.859(b)(2)). BLM offered absolutely no analysis as the basis for the potential emissions listed in Tables 4.5-1 and 4.5-2 and proceeds to exempt itself from a full conformity determination based on said non-existent analysis. BLM's failure to meet both NEPA information accuracy and CAA conformity requirements are clear in this draft RMP.

Additionally, BLM is not clear whether the air emissions estimates reflect direct or indirect air emissions or both. Direct emissions alone are not the basis for a requirement to perform a conformity determination. A general conformity determination is required if indirect emissions would also exceed 10 tons per year of target pollutants in extreme non-attainment areas. 40 CFR § 93.153(b)(1). Indirect emissions are defined as those:

> (1) That are caused or initiated by the Federal action and originate in the same nonattainment or maintenance area but occur at a different time or place as the action;
> (2) That are reasonably foreseeable;
> (3) That the agency can practically control; and
> (4) For which the agency has continuing program responsibility.

40 C.F.R. § 93.152.

BLM can practically control those emissions in a number of ways including, but not limited to, by choosing not to lease certain areas or by including stipulations that require limits on emissions or emitting practices. The agency has continuing program responsibility for those emissions, both through subsequent permit actions and ongoing inspection and enforcement oversight. BLM provides no emissions inventory or analysis of potential direct and indirect emissions based on oil and gas industry standards for development, operations and ongoing maintenance. Again, BLM fails to document or provide sources for their potential emissions tables, in violation of CAA general conformity requirements.

Mitigation measures outlined in the draft RMP EIS are vague and inadequate to address the principle sources of ozone emissions from future oil and gas operations, discussed in great detail below. DEIS 4.5-7-10. BLM asserts that it will analyze additional mitigation measures at the project development stage. DEIS 4.5-7. BLM's attempt to "kick the can down the road" runs afoul of the 9th circuit decision in *Conner v. Burford*. The court held that the "government's inability to fully ascertain the precise extent of the effects of mineral leasing [in an EIS]…is not, however, a justification for failing to estimate what those effects might be before irrevocably committing to the activity." *Conner v. Burford*, 836 F.2d 1521 at 1531 (9th Cir. 1988). Indeed, the court specifically denounced BLM's "approve now and ask questions later" approach as blatantly incompatible with the purpose and spirit of NEPA. *Id.*

Finally, BLM's estimate of the number of new wells expected is unsupported. The potential for far greater expansion and intensification of oil and gas activity has been studied and documented, as discussed above. The artificially low number of expected wells projected in the

DEIS also improperly reduces the air emission impacts. Each should be reevaluated in light of the studies provided.

IV. The DEIS Violates the National Environmental Policy Act ("NEPA")

The National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 *et seq*., and its implementing regulations, promulgated by the Council on Environmental Quality ("CEQ"), 40 C.F.R. §§ 1500.1 *et seq*., is our "basic national charter for the protection of the environment" achieving its purpose through "action forcing procedures. . . requir[ing] that agencies take a hard look at environmental consequences." 40 C.F.R. § 1500.1; *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989) (citations omitted). This includes the consideration of best available information and data, as well as disclosure of any inconsistencies with federal policies and plans.

Recognizing that "each person should enjoy a healthful environment," NEPA ensures that the federal government uses all practicable means to "assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings," and to "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences," among other policies. 43 U.S.C. § 4331(b).

NEPA regulations explain, in 40 C.F.R. §1500.1(c), that:

> Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork – even excellent paperwork – but to foster excellent action. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.

Thus, while "NEPA itself does not mandate particular results, but simply prescribes the necessary process," *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989), agency adherence to NEPA's action-forcing statutory and regulatory mandates helps federal agencies ensure that they are adhering to NEPA's noble purpose and policies. *See* 42 U.S.C. §§ 4321, 4331.

A. BLM Has a Legal Obligation to Consider All Reasonable Alternatives

NEPA requires federal agencies to pause before committing resources to a project and consider the likely environmental impacts of the preferred course of action as well as reasonable alternatives. *See* 42 U.S.C. § 4331(b) (congressional declaration of national environmental policy); *U.S. Dep't of Transp. v. Public Citizen*, 541 U.S. 752, 756–57 (2004). NEPA's regulations require BLM to "rigorously explore and objectively evaluate all reasonable alternatives" to the proposed action in comparative form, so as to provide a "clear basis for choice among the options" open to the agency. 40 C.F.R. § 1502.14. The agency should address all reasonable alternatives to the proposed action. *See Colorado Envtl. Coal. v. Salazar*, 875 F. Supp. 2d 1233, 1245 (D. Colo. 2012). An alternative is "reasonable" if it falls within the agency's statutory mandate, and meets at least a part of the agency's purpose and need.

Westlands Water Dist. v. U.S. Dep't of the Interior, 376 F.3d 853, 868 (9th Cir. 2004); *Idaho Conservation League v. Mumma*, 956 F.2d 1508, 1520 (9th Cir. 1992).

BLM received 734 comments from the public in scoping.[40] A majority of the comments that expressed opinions on what future management direction the BLM should take regarding allowing hydraulic fracturing on public lands urged BLM to ban such extraction methods and to consider a "no leasing" alternative. Despite the public's demands for serious consideration of these alternatives, the DEIS declined to analyze in detail any such alternatives that would (1) ban the use of well stimulation technologies on Federal mineral estate, (2) close all lands except existing leases, and (3) close all lands to oil and gas leasing,[41] on the grounds that a ban or moratorium would not satisfy the BLM's multiple-use responsibilities under the FLPMA.[42] However, FLPMA does not mandate that every use be accommodated on every piece of land; rather, "multiple use" requires management of the public lands and their numerous natural resources so that they can be used for economic, recreational, and scientific purposes *without the infliction of permanent damage*." *Public Lands Council v. Babbitt*, 167 F.3d 1287, 1290 (10th Cir. 1999) (citing 43 U.S.C. § 1702 (c)) (emphasis added). BLM's obligation to manage for multiple use does not mean that development *must* be allowed on a particular piece of public lands. *New Mexico ex rel. Richardson*, 565 F.3d at 710. Development is a *possible* use, which BLM must weigh against other possible uses—including conservation to protect environmental values, which are best assessed through the NEPA process. *Id*. Thus, an alternative that closes the proposed public lands to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration. *Id*.

BLM further claimed that while has the authority to deny individual permits, it does not have authority to deny all future well stimulation technologies. BLM does not provide any legal of factual basis for this claim, however. Courts have interpreted BLM's authority under the Mineral Leasing Act ("MLA") as discretionary and not as an absolute mandate to lease. In fact, the Ninth Circuit held that the MLA "allows the Secretary to lease such lands, but does not require him to do so . . . [T]he Secretary has discretion to refuse to issue any lease at all on a given tract" and affirmed the district court's holding that the agencies failed to give the no action alternative meaningful consideration and thereby violated NEPA. *Bob Marshall All. v. Hodel*, 852 F.2d 1223, 1229-30 (9th Cir. 1988) (internal citations omitted).

BLM's rejection of the no-fracking and no-leasing alternatives in this RMP is unsubstantiated and relies on a very narrow and outdated interpretation of BLM's leasing and planning authority, particularly in an EIS development context. Because BLM is conducting an EIS review for this RMP, the requirement for analyzing or dismissing these alternatives is heightened. *See W. Watersheds Project v. Bureau of Land Mgmt.*, 721 F.3d 1264, 1274-75 (10th Cir. 2013) ("Regulations require both documents to incorporate a range of reasonable alternatives, but the depth of discussion and analysis required is different depending on whether the document is an EIS or an EA. For example, section 40 C.F.R. §1502.14 provides that an EIS

[40] DEIS, Appendix E Scoping Report at 2-1.
[41] DEIS at 2-20.
[42] DEIS at 2-23.

should '[r]igorously explore . . . all reasonable alternatives,' and '[d]evote substantial treatment to each alternative' with 'detail.' *Id*. at (a)-(b).")

Thus BLM was required to "rigorously" explore all "reasonable" alternatives, and therefore to devote "substantial treatment" to the no-fracking and no-leasing alternatives. The reasonableness of the alternatives considered is measured against two guideposts. First, when considering agency actions taken pursuant to a statute, an alternative is reasonable only if it falls within the agency's statutory mandate. *Westlands,* 376 F.3d at 866. Second, reasonableness is judged with reference to an agency's objectives for a particular project.[43] *See Colo. Envt'l Coalition v. Dombeck*, 185 F.3d 1162, 1174–75 (10th Cir. 1999); *Simmons v. U.S. Army Corps of Eng'rs*, 120 F.3d 664, 668–69 (7th Cir. 1997); *Idaho Conservation League v. Mumma,* 956 F.2d 1508, 1520 (9th Cir. 1992). The no-fracking and no-leasing alternatives are both reasonable alternatives because they meet both of these tests.

Under the first test, the BLM has explicit legal authority under NEPA, as well as under FLPMA and MLA, to adopt no-leasing or no-fracking alternatives as necessary to respond to the threats posed by climate change. BLM has broad discretion in determining when, how, and if fossil fuel resources are made available for leasing. The MLA states: "All lands subject to disposition under this Act which are known or believed to contain oil or gas deposits *may* be leased by the Secretary." 30 US.C. § 226(a) (emphasis added); *see also Udall v. Tallman*, 30 U.S. 1, 4 (1965) (MLA "left the Secretary discretion to refuse to issue any lease at all on a given tract"); *Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975) ("The permissive word 'may' in Section 226(a) allows the Secretary to lease such lands, but does not require him to do so."). Although the MLA states that, for oil and gas, "[l]ease sales shall be held for each State where eligible lands are available at least quarterly," quarterly leasing is *not required* if no lands are "eligible" and "available" due to factors including withdrawal from the operation of the MLA under FLPMA, allocation decisions under an applicable land management plan, need for additional environmental review, or exercise of Secretarial discretion. 30 U.S.C. § 226(b)(1)(A); *see also* 43 C.F.R. § 3120.1-1; U.S. Bureau of Land Management, Oil and Gas Leasing Reform, Instruction Memorandum No. 2010-117 ("Eligible lands include those identified in 43 C.F.R. § 3120.1-1 as being available for leasing (BLM Manual 3120, Competitive Leases). They are considered available for leasing when all statutory requirements have been met, including compliance with the NEPA, appropriate reviews have been conducted, and *lands have been allocated for leasing in the RMP* (BLM Handbook H-3101-1, Issuance of Leases).") (emphasis added). Thus, a decision to allocate an area as ineligible for leasing through the planning process is contemplated by BLM's regulations, contradicting any perceived requirement that BLM must lease the area.

The Secretary of the Interior also has authority under FLPMA to "withdraw" an area of federal land from oil and gas leasing to "maintain . . . public values" or for a "particular public purpose." FLPMA defines a withdrawal as:

[43] While an agency may restrict its analysis to alternatives that suit the "basic policy objectives" of a planning action, *Seattle Audubon Soc'y v. Moseley,* 80 F.3d 1401, 1404 (9th Cir. 1996), it may do so only as long as "the statements of purpose and need drafted to guide the environmental review process ... are not unreasonably narrow," *Dombeck*, 185 F.3d at 1175.

> withholding an area of Federal land from settlement, sale, location, or entry, under some or all of the general land laws, for the purpose of limiting activities under those laws in order to maintain other public values in the area or reserving the area for a particular public purpose or program . . .

43 U.S.C. § 1702(j). FLPMA further provides that Congress declares that it is the policy of the United States that "the public lands [shall] be managed in a manner that will protect the quality of … air and atmospheric … values." 43 U.S.C. § 1701(a)(8).

Furthermore, as stated previously, under FLPMA's "multiple use and sustained yield" management directive, *id.* § 1701(a)(7), the federal government must manage public lands and resources in a manner that "takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land[,]" *id.* § 1702(3). Further, "[i]n managing the public lands the Secretary shall … take any action necessary to prevent unnecessary or undue degradation of the lands." *Id.* § 1732(b).

Under these authorities, BLM is required not only to evaluate the impacts of federal oil and gas leasing to public lands, water, and wildlife resources, but to avoid harm to those resources whenever possible. Accordingly, the MLA and FLPMA provide BLM the legal authority to either decide not to lease particular lands, or to withdraw large tracts from leasing.[44]

As to the second test, both of the no-fracking and no-leasing alternatives meet BLM's objectives for the RMP. As set out in Section 1.1 of the DEIS, Purpose and Need for Amending the 2007 Hollister Resource Management Plan, BLM states:

> Through the RMPA, the BLM will identify which lands are open or closed to oil and gas leasing and which stipulations would be applied on oil and gas exploration and development activities *in order to protect environmental resources*.[45]

Thus alternatives that prohibit or strictly limit new fossil fuel leasing meet the proposed action's purpose and need. Banning the use of well stimulation technologies on Federal mineral estate and barring new leases to achieve national, regional and local greenhouse gas reduction goals would constitute protection of environmental resources for the Planning Area. A desired

[44] Even if BLM concludes that the agency lacks authority to bar new oil and gas leasing throughout the planning area, it should still consider such an alternative because it is otherwise reasonable. Federal courts hold that agencies have the duty to consider reasonable alternatives that are outside the jurisdiction of the agency or that require a change of law to implement. *See* 40 C.F.R. § 1502.14(c) (an EIS "shall" "[i]nclude reasonable alternatives not within the jurisdiction of the lead agency"); Council on Environmental Quality, Executive Office of the President, Publication of Memorandum to Agencies Containing Answers to 40 Most Asked Questions on NEPA Regulations, 46 Fed. Reg. 18,026–01 at 18,027 (1981) ("An alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable. A potential conflict with local or federal law does not necessarily render an alternative unreasonable"); *Muckleshoot Indian Tribe v. U.S. Forest Serv.*, 177 F.3d 800, 814 (9th Cir. 1999) (setting aside EIS for failure to address alternative requiring Congressional action).

[45] DEIS at 1-3 (emphasis added).

outcome for a reasonable alternative could be reducing the Planning Area's contribution to climate pollution. It would establish that certain uses—oil and gas production—would be allowable only on current leases, and it would enable BLM to achieve a desired outcome of reducing the chance of catastrophic climate change and increasing the chance for the U.S. to reach its greenhouse gas reduction goals set by the Paris Agreement. As discussed above, such management direction would adhere to the law and BLM's multiple use mandate. As such, a no or limited fossil fuel leasing alternative would meet the purpose and need for the RMP.

The DEIS's contemplated range of alternatives fails to satisfy its statutory obligation under FLPMA, as well as the purpose and need of the RMP. All of the DEIS alternatives propose to leave available extensive lands for fossil fuel leasing and development. Although acreage may reflect subtle differences between alternatives, there is virtually no change in the foreseeable range of oil and gas leasing and development, or in greenhouse gas emission rates across alternatives. Any difference in BLM's range of alternatives is mere window-dressing for an RMP aimed at leaving all foreseeable fossil fuel resources fully available to exploitation. In effect, the agency's alternatives analysis becomes little more than an exercise of form over substance. Not only is further consideration of no-leasing and no-fracking alternatives necessary in light of new information, science, and national policy related to climate change, but this information underscores the unreasonableness of the DEIS's alternatives. This is particularly true of BLM's preferred Alternative C, which leaves 368,800 acres open to oil and gas leasing, and commits the Planning Area to potentially several million tons of greenhouse gas emissions, every year, for the foreseeable future. This type of status quo approach to federal lands management is unhinged from current reality and the demands of the time.

BLM failed in its basic obligation to consider all reasonable alternatives, including alternatives that would significantly reduce planning area greenhouse gas emissions, and in particular an alternative that considers not leasing public lands for fossil fuel development. 40 C.F.R. § 1502.14.

B. BLM Failed to Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Fossil Fuel Development on Resource Values in the Planning Area

NEPA also imposes "action forcing procedures … requir[ing] that agencies take a *hard look* at environmental consequences." *Methow Valley*, 490 U.S. at 350 (citations omitted) (emphasis added). As discussed in greater detail below, the DEIS failed to take a hard look at several foreseeable and significant environmental consequences, including impacts to water resources, air quality, climate change, induced seismicity, human health and safety, and endangered, threatened, or other special status species.

These "environmental consequences" may be direct, indirect, or cumulative. 40 C.F.R. §§ 1502.16, 1508.7, 1508.8. A cumulative impact – particularly important here – is defined as:

> [T]he impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes

such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 C.F.R. § 1508.7.

It is general practice to evaluate the impacts of several related projects with cumulative impacts proposed or reasonably foreseeable in the same geographic region in a single, comprehensive, analysis.[46] The DEIS failed to include alternatives based on a cumulative impacts assessment. For example, the DEIS fails to consider the cumulative impact of oil and gas leases when aggregated with the environmental harm resulting from other types of land use, particularly those authorized by BLM leasing. Grazing activities in the CCFO/HFO jurisdiction already have a considerable impact on upland and riparian habitats and species. Failing to evaluate these impacts together with oil and gas leasing renders the DEIS cumulative impact analysis deficient.

We discuss below the several foreseeable and significant environmental impacts that the DEIS should have but failed to consider, including impacts to water resources, air quality, climate change, induced seismicity, human health and safety, and endangered, threatened, or other special status species.

V. BLM Failed to Take a Hard Look at Certain Impacts to Air Quality

Fugitive emissions can occur at every stage of extraction and production, often leading to high volumes of gas being released into the air. Oil and gas operations emit large amounts and a wide array of toxic air pollutants,[47] also referred to as Hazardous Air Pollutants, which are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.[48] Air pollutants emitted by unconventional oil and gas production include toxic BTEX compounds (benzene, toluene, ethylbenzene, and xylene); volatile organic compounds (VOCs) such as methylene chloride; nitrogen oxides (NOx); particulate matter (including diesel exhaust); alkanes (methane, ethane, propane); formaldehyde; hydrogen sulfide; silica; acid mists; sulfuric oxide; and radon gas.[49] These toxic air contaminants and smog-forming chemicals (such as VOCs, NOx, methane and ethane) threaten local communities and regional air quality.

The reporting requirements recently implemented by the California South Coast Air Quality Management District ("SCAQMD") have shown that at least 44 chemicals known to be

[46] *See Kleppe v. Sierra Club*, 427 U.S. 390, 410 (1976) ("when several proposals for . . . actions that will have cumulative or synergistic environmental impact upon a region are pending concurrently before an agency, their environmental consequences must be considered together.")
[47] Sierra Club et al. comments on New Source Performance Standards: Oil and Natural Gas Sector; Review and Proposed Rule for Subpart OOOO (Nov. 30, 2011) ("Sierra Club Comments") at 13.
[48] See "About Hazardous Air Pollutants" at U.S. Environmental Protection Agency, Hazardous Air Pollutants, https://www.epa.gov/haps (accessed Jan 5, 2017)
[49] McKenzie, Lisa M. et al., Human Health Risk Assessment of Air Emissions From Development of Unconventional Natural Gas Resources, 424 Science of the Total Environment 79 (2012) ("McKenzie 2012); Shonkoff, Seth B.C. et al., Environmental Public Health Dimensions of Shale and Tight Gas Development, 122 Environmental Health Perspectives 787 (2014) ("Shonkoff 2014").

air toxics have been used in fracking and other types of oil and gas operations in California.[50] Through the implementation of these new reporting requirements, it is now known that operators have been using several types of air toxics, including crystalline silica, methanol, hydrochloric acid, hydrofluoric acid, 2-butoxyethanol, ethyl glycol monobutyl ether, xylene, amorphous silica fume, aluminum oxide, acrylic polymer, acetophenone, and ethylbenzene. Many of these chemicals also appear on the U.S. EPA's list of hazardous air pollutants.[51] EPA has also identified six "criteria" air pollutants that must be regulated under the National Ambient Air Quality Standards (NAAQS) due to their potential to cause primary and secondary health effects. As detailed below, concentrations of many of these pollutants—ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead—have been shown to increase in regions where unconventional oil and gas recovery techniques are permitted.

VOCs, from car and truck engines as well as the drilling and completion stages of oil and gas production, make up about 3.5 percent of the gases emitted by oil or gas operations.[52] The VOCs emitted include the BTEX compounds – benzene, toluene, ethyl benzene, and xylene – which are listed as Hazardous Air Pollutants.[53] There is substantial evidence showing the grave harm from these pollutants.[54] Recent studies and reports confirm the pervasive and extensive amount of VOCs emitted by unconventional oil and gas extraction.[55] For example, a study covering sites near oil and gas wells in five different states including Colorado, Wyoming, Ohio, Pennsylvania, and Arkansas, found that concentrations of eight toxic volatile chemicals, including benzene, formaldehyde and hydrogen sulfide, exceeded federal health and safety standards, at times by several orders of magnitude.[56] Another study determined that vehicle traffic and engine exhaust were likely the sources of intermittently high dust and benzene concentrations observed near well pads.[57] Recent studies have found that oil and gas operations are likely responsible for elevated levels of hydrocarbons such as benzene downwind of the

[50] Center for Biological Diversity, Air Toxics One Year Report (June 2014) at 1.
[51] U.S. Environmental Protection Agency, The Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants, Technology Transfer Network Air Toxics Web Site, available at http://www.epa.gov/ttnatw01/orig189.html (accessed July 29, 2015).
[52] Brown, Heather, Memorandum to Bruce Moore, U.S.EPA/OAQPS/SPPD re Composition of Natural Gas for use in the Oil and Natural Gas Sector Rulemaking, July 28, 2011 ("Brown Memo") at 3.
[53] 42 U.S.C. § 7412(b).
[54] Colborn, T. et al., Natural Gas Operations from a Public Health Perspective, 17 Human and Ecological Risk Assessment 1039 (2011) ("Colborn 2011"); McKenzie 2012.
[55] McCawley, Michael., Air, Noise, and Light Monitoring Plan for Assessing Environmental Impacts of Horizontal Gas Well Drilling Operations (ETD-10 Project), West Virginia University School of Public Health, Morgantown, WV (2013) ("McCawley 2013"), available at http://www.dep.wv.gov/oil-and-gas/Horizontal-Permits/legislativestudies/Documents/WVU%20Final%20Air%20Noise%20Light%20Protocol.pdf; Center for Biological Diversity, Dirty Dozen: The 12 Most Commonly Used Air Toxics in Unconventional Oil Development in the Los Angeles Basin (Sept. 2013).
[56] Macey, Gregg P. et al., Air Concentrations of Volatile Compounds Near Oil and Gas Production: A Community-Based Exploratory Study, 13 Environmental Health 82 (2014) at 1.
[57] McCawley 2013.

Denver-Julesburg Fossil Fuel Basin, north of Denver.[58] Another study found that oil and gas operations in this area emit approximately 55percent of the VOCs in northeastern Colorado. [59]

VOCs, NOx, methane, and ethane are potent ground-level (tropospheric) ozone precursors that are emitted by oil and gas drilling and fracking operations. Ozone can result in serious health conditions, including heart and lung disease and mortality.[60] Exposure to elevated levels of ozone is estimated to be cause ~10,000 premature deaths per year in the United States.[61] VOCs can form ground-level (tropospheric) ozone when combined with nitrogen oxides ("NO_X") from compressor engines, turbines, other engines used in drilling, and flaring,[62] in the presence of sunlight. This reaction can diminish visibility and air quality and harm vegetation. Many regions around the country with substantial oil and gas operations are now suffering from extreme ozone levels due to heavy emissions of these pollutants.[63] A recent study of ozone pollution in the Uintah Basin of northeastern Utah, a rural area that experiences hazardous tropospheric ozone concentrations, found that oil and gas operations were responsible for 98 to 99 percent of VOCs and 57 to 61 percent of NO_X emitted from sources within the Basin considered in the study's inventory.[64]

Ground-level ozone can also be caused by methane, which is leaked and vented at various stages of unconventional oil and gas development, as it interacts with nitrogen oxides and sunlight.[65] In addition to its role as a potent greenhouse gas, methane's effect on ozone concentrations can be substantial. One paper modeled reductions in various anthropogenic ozone precursor emissions and found that "[r]educing anthropogenic CH_4 emissions by 50% nearly halves the incidence of U.S. high-O_3 events . . . ."[66]

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[58] Pétron, G. et al., Hydrocarbon Emissions Characterization in the Colorado Front Range – A Pilot Study, 117 J. Geophysical Research D04304 (2012) at 8, 13 ("Pétron 2012).

[59] Gilman, Jessica B. et al., Source Signature of Volatile Organic Compounds from Oil and Natural Gas Operations in Northeastern Colorado, 47 Environmental Science & Technology 1297 (2013) at 1297, 1303 ("Gilman 2013").

[60] U.S. Environmental Protection Agency, Integrated Science Assessment (ISA) for Ozone (O3) and Related Photochemical Oxidants (2013).

[61] Caiazzo, Fabio et al., Air Pollution and Early Deaths in the United States. Part I: Quantifying the Impact of Major Sectors in 2005, 79 Atmospheric Environment 198 (2013).

[62] *See, e.g.*, U.S. Environmental Protection Agency, Oil and Gas Sector: Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution: Background Technical Support Document for Proposed Standards at 3-6 (July 2011); Armendariz, Al, Emissions for Natural Gas Production in the Barnett Shale Area and Opportunities for Cost-Effective Improvements (2009) ("Armendariz 2009") at 24.

[63] Armendariz 2009 at 1, 3, 25-26; Koch, Wendy, *Wyoming's Smog Exceeds Los Angeles' Due to Gas Drilling*, USA Today (May 9, 2011); Craft, Elena, Environmental Defense Fund, Do Shale Gas Activities Play a Role in Rising Ozone Levels? (2012); Colorado Dept. of Public Health and Environment, Conservation Commission, Colorado Weekly and Monthly Oil and Gas Statistics (July 6, 2012) at 12.

[64] Lyman, Seth & Howard Shorthill, Final Report: 2012 Uintah Basin Winter Ozone & Air Quality Study, Utah Department of Environmental Quality (2013) ("Lyman 2013"); *see also* Gilman 2013.

[65] Fiore, Arlene et al., Linking Ozone Pollution and Climate Change: The Case for Controlling Methane, 29 Geophys. Res Letters 19 (2002) ("Fiore 2002"); U.S. Environmental Protection Agency, Oil and Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews Proposed Rule, 76 Fed. Reg 52,738 (Aug 23, 2011).

[66] Fiore 2002; *see also* Martin, Randal et al., Final Report: Uinta Basin Winter Ozone and Air Quality Study Dec 2010 - March 2011 (2011) at 7.

Ethane is also a potent precursor of ground-based ozone pollution as it breaks down and reacts with sunlight to create smog, as well as being a greenhouse gas. Ethane emissions have risen steeply in recent years due to U.S. oil and gas production. A recent study documented that ethane emissions in the Northern Hemisphere increased by about 400,000 tons annually between 2009 and 2014, with the majority coming from North American oil and gas activity, reversing a decades-long decline in ethane emissions.[67] Shockingly, about 60 percent of the drop in ethane levels that occurred over the past 40 years has already been made up in the past five years. At this rate, U.S. ethane levels are expected to hit 1970s levels in about three years. About two percent of global ethane emissions originate from the Bakken Shale oil and gas field alone, which emits 250,000 tons of ethane per year.[68] Because global ethane levels were decreasing until 2009, the U.S. shale gas boom is thought to be responsible for the global increase in levels since 2010.

Oil and gas operations can also emit hydrogen sulfide. The hydrogen sulfide is contained in the natural gas and makes that gas "sour."[69] Hydrogen sulfide may be emitted during all stages of operation, including exploration, extraction, treatment and storage, transportation, and refining. Long-term exposure to hydrogen sulfide is linked to respiratory infections, eye, nose, and throat irritation, breathlessness, nausea, dizziness, confusion, and headaches.[70]

The oil and gas industry is also a major source of particulate matter. The heavy equipment regularly used in the industry burns diesel fuel, generating fine particulate matter[71] that is especially harmful.[72] Vehicles traveling on unpaved roads also kick up fugitive dust, which is particulate matter.[73] Further, both NO_X and VOCs, which as discussed above are heavily emitted by the oil and gas industry, are also particulate matter precursors.[74] Some of the health effects associated with particulate matter exposure are "premature mortality, increased hospital admissions and development of chronic respiratory disease."[75]

Fracking results in additional air pollution that can create a severe threat to human health. One analysis found that 37 percent of the chemicals found at fracked gas wells were volatile, and that of those volatile chemicals, 81 percent can harm the brain and nervous system, 71 percent

[67] Helmig, Detlev et al,, Reversal of Global Atmospheric Ethane and Propane Trends Largely Due to US Oil and Natural Gas Production. 9 Nature Geoscience 490 (2016).
[68] Kort, Eric A. et al., Fugitive Emissions From the Bakken Shale Illustrate Role of Shale Production in Global Ethane Shift. 43 Geophysical Research Letters 4617 (2016).
[69] Sierra Club Comments.
[70] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Report to Congress on Hydrogen Sulfide Air Emissions Associated with the Extraction of Oil and Natural Gas (EPA-453/R-93-045) at i (Oct. 1993) ("USEPA 1993").
[71] Earthworks, Sources of Oil and Gas Pollution (2011).
[72] Bay Area Air Quality Management District, Particulate Matter Overview, Particulate Matter and Human Health (2012).
[73] U.S. Environmental Protection Agency, Regulatory Impact Analysis for the Proposed Revisions to the National Ambient Air Quality Standards for Particulate Matter (June 2012), http://www.epa.gov/ttnecas1/regdata/RIAs/PMRIACombinedFile_Bookmarked.pdfat 2-2, ("EPA RIA")
[74] EPA RIA at 2-2.
[75] U.S. Environmental Protection Agency, National Ambient Air Quality Standards for Particulate Matter Proposed Rule, 77 Fed. Reg. 38,890, 38,893 (June 29, 2012).

can harm the cardiovascular system and blood, and 66 percent can harm the kidneys.[76] The SCAQMD has identified three areas of dangerous and unregulated air emissions from fracking: (1) the mixing of the fracking chemicals; (2) the use of the silica, or sand, as a proppant, which causes the deadly disease silicosis; and (3) the storage of fracking fluid once it comes back to the surface.[77] Preparation of the fluids used for well completion often involves onsite mixing of gravel or proppants with fluid, a process which potentially results in major amounts of particulate matter emissions.[78] Further, these proppants often include silica sand, which increases the risk of lung disease and silicosis when inhaled.[79] Finally, as flowback returns to the surface and is deposited in pits or tanks that are open to the atmosphere, there is the potential for organic compounds and toxic air pollutants to be emitted, which are harmful to human health as described above.[80]

The EIS should study the potential for oil and gas operations sites in the planning area to emit such air toxics and any other pollutants that may pose a risk to human health, paying particular attention to the impacts of air pollution on environmental justice communities that already bear the burden of disproportionately high levels of air pollution.

The EIS should rely on the most up-to-date information regarding the contribution of oil and gas operations to air pollution levels. Numerous studies demonstrate that state and federal emissions inventories significantly underestimate the levels of hazardous air pollution coming from oil and gas drilling and fracking operations. For example, aerial surveys of more than 8,000 oil and gas wells in seven US regions found that well pads emit considerably more methane and VOCs that captured by existing inventories.[81] Recent studies in Weld County, Colorado, show that existing emissions inventories likely underestimate the contribution of oil and gas operations to VOC levels by at least a factor of two, and that benzene emissions are underestimated by four to nine times[82] These studies suggest that the health risk assessments conducted using these inventories are inaccurate and underestimate exposures and health risks.[83] Similarly, the assessment of fracking in California by the California Council on Science and Technology found that current inventory methods underestimate methane and VOC emissions from oil and gas operations.[84]

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[76] Colborn 2011 at 8.
[77] South Coast Air Quality Management District, Draft Staff Report on Proposed Rule 1148.2 - Notification and Reporting Requirements for Oil and Gas Wells and Chemical Suppliers (January 2013).at 15 ("SCAQMD Draft Staff Report PR1148-2").
[78] *Id.*
[79] South Coast Air Quality Management District, Response to Questions re Air Quality Risks of Hydraulic Fracturing in California, Submission to Joint Senate Hearing (2013) at 3.
[80] SCAQMD Draft Staff Report PR1148-2 at 15.
[81] Lyon, David R. et al., Aerial Surveys of Elevated Hydrocarbon Emissions From Oil and Gas Production Sites, 50 Environmental Science & Technology 4877 (2016).
[82]Pétron 2012 at 1, 18 (noting state and federal inventories likely underestimate hydrocarbon emissions from oil and gas operations by as much as factor of two); Pétron, Gabrielle et al., A New Look at Methane and Non-Methane Hydrocarbon Emissions from Oil and Natural Gas Operations in the Colorado Denver-Julesburg Basin, 119 J. Geophysical Research: Atmospheres 6836 at 6836 ("Pétron 2014")..
[83] Pétron 2014.
[84] Brandt, Adam et al., Air quality impacts from well stimulation. In California Council on Science and Technology, *An Independent Assessment of Well Stimulation in California,* Volume 2, Chapter 3 (2015) ("CCST 2015").

1. California

Experimental studies of air quality in California indicate that current inventory methods underestimate methane and VOC emissions from oil and gas operations.[85] One recent analysis found that NOx emissions from oil and gas operations in Kern County are significantly underestimated.[86] Numerous studies also indicate that methane emissions in California may be underestimated by 30 to 80 percent by the state greenhouse gas inventory.[87] In the Los Angeles Basin, fossil fuel sources are the primary source of methane emissions, estimated to contribute 56 to 70 percent of total methane, with leakage from natural gas infrastructure and local oil and gas operations being the most important contributors.[88] One recent state-wide study estimated that methane emissions from the oil and gas production sector were 3 to 7 times higher than reflected in the state inventory.[89]

An independent analysis by the California Council on Science and Technology (CCST) determined that fracking in California occurs disproportionally in areas already suffering from serious air quality problems. The two largest oil and gas-producing regions in California are in the San Joaquin and South Coast air basins which are classified as "extreme" nonattainment areas for ozone.[90] According to an analysis by the CCST, in the San Joaquin Valley, oil and gas facilities "emit significant air toxics," including 30 percent of sulfur oxides, 70 percent of hydrogen sulfide, and 8 percent of anthropogenic VOCs, which in turn react with nitrogen oxides (NOx) to create ozone.[91] Another study estimated that 22 percent of VOCs in the San Joaquin Valley came from petroleum operations, which was higher than the state inventory.[92] In Kern County, oil and gas production is the dominant sources of hydrogen sulfide (96 percent) and a major contributor to emissions of benzene (9 percent), formaldehyde (26 percent), hexane (11 percent), and xylene (14 percent).[93]

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[85] CCST 2015.

[86] Sahu, Ranajit, On the Underestimation of NOx Emissions from Oil Well Drilling Activities in Kern County, CA (2015).

[87] Hopkins, Francesca M. et al., Spatial Patterns and Source Attribution of Urban Methane in the Los Angeles Basin, 121 J. Geophysical Research: Atmospheres 249 (2016) ("Hopkins 2016"); Jeong, Seongeun et al., Estimating Methane Emissions in California's Urban and Rural Regions Using Multitower Observations, 121 J. Geophysical Research: Atmospheres 13031 (2016).

[88] Wennberg, Paul O. et al., On the Sources of Methane to the Los Angeles Atmosphere, 46 Environmental Science & Technology 9282; Peischl, Jeff et al., Quantifying sources of methane using light alkanes in the Los Angeles basin, California, 118 J. Geophysical Research Atmospheres 1 (2013); Hopkins 2016.

[89] Jeong, Seongeun et al., Spatially Explicit Methane Emissions from Petroleum Production and the Natural Gas System in California, 48 Environmental Science & Technology 5982 (2014).

[90] Long, Jane C.S. et al., Introduction, In California Council on Science and Technology, *An Independent Assessment of Well Stimulation in California,* Volume 2, Chapter 1 (2015) ("Long CCST 2015") at 44; See also Center for Biological Diversity Map of Nonattainment Areas in the Central Coast Field Office Planning Area (2017), attached as Exhibit A.

[91] Long CCST 2015 at 42.

[92] Gentner, Drew et al., Emissions of Organic Carbon and Methane from Petroleum and Dairy Operations in California's San Joaquin Valley, 14 Atmospheric Chemistry and Physics 4955 (2014).

[93] Shonkoff, Seth & Donald Gautier, A Case Study of the Petroleum Geological Potential and Potential Public Health Risks Associated with Hydraulic Fracturing and Oil and Gas Development in The Los Angeles Basin, In California Council on Science and Technology, *An Independent Assessment of Well Stimulation in California,* Volume 3, Chapter 4 (2015).at 268.

The CCST analysis highlights that while many toxic air pollutants are being used in well stimulation, there are significant information gaps on how much of these chemicals escape into the air, how far they travel, and how big the risk of exposure to those living nearby. Air contaminants known to be emitted during the well-stimulation-enabled oil and gas development in California include toxic BTEX compounds, formaldehyde, hydrogen sulfide, particulate matter, nitrogen oxides, sulfur dioxide, polycyclic aromatic, aliphatic, and aromatic hydrocarbons, and volatile organic compounds.[94] Although many air contaminants used in well stimulation are hazardous to human health, there are no studies of air quality impacts of well stimulation in California,[95] including how much of these chemicals escape into the air.[96] What is known is that people living close to oil and gas production have higher potential exposure to toxic air emissions and higher risk of associated health harms.[97]

More fundamentally, there are significant data gaps regarding what chemicals are used in oil and gas extraction. State disclosure requirements only cover hydraulic fracturing and other types of well stimulation. There are no disclosure requirements for drilling, well completion, well maintenance, enhanced oil recovery, and other processes.[98] As a result, there is little information regarding what kinds of chemicals are being used, and what risks they pose to public health and safety and the environment. Still others are protected under claims of trade secrecy.[99] Even for chemicals that have been identified, many have little to no publicly available information regarding their toxicity. [100]

What little information we have regarding chemicals used in these processes reveals that many pose a threat to health and the environment. A recent survey found that, of the chemicals that could be identified, 46 were potential chemicals of concern.[101] Of the 173 different chemical additives used in the oil and gas development process, over a third could not be identified.[102]

2. Sources of Air Emissions

Harmful air pollutants are emitted during every stage of oil and gas development, including drilling, completion, well stimulation, production, and disposal, as well as from

[94] Long CCST 2015 at 410.
[95] *Id*. at 250.
[96] *Id*. at 183, 250, 409.
[97] *Id*. at 44.
[98] Shonkoff, Seth et al., Preliminary Hazard Assessment of Chemical Additives Used in Oil and Gas Fields that Reuse Their Produced Water for Agricultural Irrigation in The San Joaquin Valley of California, PSE Healthy Energy (2016), ("Shonkoff 2016")
[99] Shonkoff 2016 at 7 (finding 38 percent of chemicals withheld from disclosure to California Regional Water Quality Control Board investigation.
[100] *Id.* at 13.
[101] *Id*.
[102] *Id*.

transportation of water, sand, chemicals, and to and from the well pad.[103] The well stimulation stage can emit diesel exhaust, VOCs, particulate matter, ozone precursors, silica, and acid mists.[104] Drilling and casing the wellbore require substantial power from large equipment. The engines used typically run on diesel fuel, which emits particularly harmful types of air pollutants when burned. Similarly, high-powered pump engines are used in the fracturing and completion phase. This too can amount in large volumes of air pollution. Flaring, venting, and fugitive emissions of gas are also a potential source of air emissions. Gas flaring and venting can occur in both oil and gas recovery processes when underground gas rises to the surface and is not captured as part of production. Emissions from flaring typically include carbon monoxide, nitrogen oxides, benzene, formaldehyde and xylene, but levels of these smog-forming compounds are seldom measured directly.[105]

Fugitive emissions can occur at every stage of extraction and production, often leading to high volumes of gas being released into the air. Methane emissions from oil and gas production is as much as 270 percent greater than previously estimated by calculation.[106] Recent studies show that emissions from pneumatic valves (which control routine operations at the well pad by venting methane during normal operation) and fugitive emissions are higher than EPA estimates.[107]

Fracking can pollute air hundreds of miles from the well pad. For example, ethane pollution in Baltimore, Maryland and Washington, D.C, has been attributed to the rapidly increasing natural gas production in the upwind, neighboring states of Pennsylvania and West Virginia.[108]

Evaporation from pits can also contribute to air pollution. Pits that store drilling waste, produced water, and other waste fluid may be exposed to the open air. Chemicals mixed with the wastewater—including the additives used to make fracking fluids, as well as volatile hydrocarbons, such as benzene and toluene, brought to the surface with the waste—can escape into the air through evaporation. Some pits are equipped with pumps that spray effluents into the air to hasten the evaporation process. For example, evaporation from fracking waste pits in western Colorado was found to have added tons of toxic chemicals to the air, increasing air

[103] McCawley, Michael, Abstract: Air Contaminants Associated with Potential Respiratory Effects from Unconventional Resource Development Activities, 36 Seminars in Respiratory and Critical Care Medicine 379 (2015); Shonkoff 2014.
[104] *Id.*
[105] Physicians for Social Responsibility and Concerned Health Professionals of NY, Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking, Fourth Edition, November 17, 2016 ("PSR 2016").
[106] Miller, S. M. et al. Anthropogenic Emissions of Methane in the United States, Proc. Natl. Acad. Sci. Early Edition, DOI: 10.1073/pnas.1314392110 (2013).
[107] Allen, David et al., Measurements of Methane Emissions at Natural Gas Production Sites in The United States, 110 PNAS 17768 (2013) ("Allen 2013"); Harriss, Robert et al., Using Multi-Scale Measurements to Improve Methane Emission Estimates from Oil and Gas Operations in the Barnett Shale Region, Texas, 49 Environ. Sci. Technol. 7524 (2015) ("Harriss 2015").
[108] Vinciguerra,Timothy et al, Regional Air Quality Impacts of Hydraulic Fracturing and Shale Natural Gas Activities: Evidence From Ambient VOC Observations. 110 Atmospheric Environment 144 (2015).

pollution in Utah.[109] In Texas, toxic air emissions from fracking waste pits are unmonitored and unregulated.[110] In Califonria, unlined disposal pits for drilling and fracking waste are documented sources of contamination.[111] Even where waste fluid is stored in so-called "closed loop" storage tanks, fugitive emissions can escape from tanks.

As mentioned above, increased truck traffic will lead to more air emissions. Trucks capable of transporting large volumes of chemicals and waste fluid typically use large engines that run on diesel fuel. Air pollutants from truck engines will be emitted not only at the well site, but also along truck routes to and from the site.

The EIS must provide an adequate analysis and disclosure of the effects the lease sale could have on air quality, including the impacts that would result from fracking. The EAs cannot postpone the discussion of air pollution and climate change impacts until site-specific plans are proposed. Because BLM must analyze impacts at "the earliest practicable time," and no benefit would be gained from postponing the analysis, BLM must discuss these cumulative impacts before the lease sale.

3. Impact of Increased Air Pollution

The potential harms resulting from increased exposure to the dangerous air pollutants from unconventional oil and gas development are serious and wide ranging. A growing body of scientific research has documented adverse public health impacts from unconventional oil and gas development, including studies showing air pollutants at levels associated with reproductive and developmental harms and the increased risk of morbidity and mortality.[112] A comprehensive review of the risks and harms of fracking to public health came to several key findings related to air pollution: (1) "drilling and fracking emissions contribute to toxic air pollution and smog (ground-level ozone) at levels known to have health impacts," (2)"public health problems associated with drilling and fracking, including reproductive impacts and occupational health and safety problems, are increasingly well documented"; and (3)"fracking infrastructure poses serious potential exposure risks to those living near it."

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[109] Maffy, Brian , *Utah grapples with toxic water from oil and gas industry*, The Salt Lake Tribune, August 28, 2014, available at http://archive.sltrib.com/story.php?ref=/sltrib/news/58298470-78/danish-flats-ponds-company.html.csp; The company responsible for the waste pits was found to have operated without a permit, underreported emissions and provided erroneous data to regulators.

[110] Hasemyer, David & Zahra Hirji, Open pits offer cheap dispsal for fracking sludge, but health worries mount, Center for Public Integrity (2014)

[111] Stringfellow, William T. et al., Impacts of Well Stimulation on Water Resources, In California Council on Science and Technology, *An Independent Assessment of Well Stimulation in California,* Volume 2, Chapter 2 (2015) ("Stringfellow CCST 2015") at 110-113.

[112] Hays, Jake & Seth B.C. Shonkoff , Towards an Understanding of the Environmental and Public Health Impacts of Unconventional Natural Gas Development: A Categorical Assessment of the Peer-Reviewed Scientific Literature, 11 PLoS ONE e0154164 (2016); Shonkoff 2014; Webb, Ellen et al., Developmental and reproductive effects of chemicals associated with unconventional oil and natural gas operations, 29 Rev Environ Health 307 (2014); McKenzie 2012; Clean Air Task Force, Fossil Fumes: A Public Health Analysis of Toxic Air Pollution From the Oil and Gas Industry, June 2016, available at http://www.catf.us/resources/publications/files/FossilFumes.pdf.

Air toxics and hazardous air pollutants, by definition, can result in harm to human health and safety. Understanding the full extent of the health effects of exposure is still far from being complete, but already there are numerous studies that have found these chemicals to have serious health consequences for humans exposed to even minimal amounts. The negative effects of criteria pollutants are well documented and are summarized by the U.S. EPA's website:

> *Nitrogen oxides* (NOx) react with ammonia, moisture, and other compounds to form small particles. These small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death. NO_x and volatile organic compounds react in the presence of heat and sunlight to form ozone.
>
> *Particulate matter* (PM) - especially fine particles - contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including: premature death in people with heart or lung disease, increased mortality, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.[113]
>
> *Sulfur Dioxide* (SO_2) – has been shown to cause an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms.[114] Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.[115]
>
> *Carbon Monoxide* (CO) can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death.[116] Exposure to CO can reduce the oxygen-carrying capacity of the blood. People with several types of heart disease already have a reduced capacity for pumping oxygenated blood to the heart, which can cause them to experience myocardial ischemia (reduced oxygen to the heart), often accompanied by chest pain (angina), when exercising or under increased stress.[117] For these people, short-term CO exposure further affects their body's already compromised ability to respond to the increased oxygen demands of exercise or exertion.[118]

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[113] U.S. Environmental Protection Agency, Particulate Matter, (PM) http://www.epa.gov/airquality/particlepollution/health.html (accessed July 30, 2015); Ostro, Bart et al., Long-term Exposure to Constituents of Fine Particulate Air Pollution and Mortality: Results from the California Teachers Study, 118 Environmental Health Perspectives 3 (2010).
[114] U.S. Environmental Protection Agency, Sulfur Dioxide http://www.epa.gov/airquality/sulfurdioxide/health.html, available at (accessed July 29, 2015).
[115] *Id.*
[116] U.S. Environmental Protection Agency, Carbon Monoxide, available at http://www.epa.gov/airquality/carbonmonoxide/health.html (accessed July 29, 2015).
[117] *Id.*
[118] *Id.*

> *Ozone* (O_3) can trigger or worsen asthma and other respiratory ailments.[119] Ground level ozone can have harmful effects on sensitive vegetation and ecosystems. Ozone may also lead to loss of species diversity and changes to habitat quality, water cycles, and nutrient cycles.

The range of illnesses that can result from the wide array of air pollutants from fracking were summarized in a study by Dr. Theo Colburn, which charts which chemicals have been shown to be linked to certain illnesses.[120] This study analyzed air samples taken during drilling operations near natural gas wells and residential areas in Garfield County, and detected 57 chemicals between July 2010 and October 2011, including 44 with reported health effects.[121] For example:

> Thirty-five chemicals were found to affect the brain/nervous system, 33 the liver/metabolism, and 30 the endocrine system, which includes reproductive and developmental effects. The categories with the next highest numbers of effects were the immune system (28), cardiovascular/blood (27), and the sensory and respiratory systems (25 each). Eight chemicals had health effects in all 12 categories. There were also several chemicals for which no health effect data could be found.[122]

The study found extremely high levels of methylene chloride, which may be used as cleaning solvents to remove waxy paraffin that is commonly deposited by raw natural gas in the region. These deposits solidify at ambient temperatures and build up on equipment.[123] While none of the detected chemicals exceeded governmental safety thresholds of exposure, the study noted that such thresholds are typically based on "exposure of a grown man encountering relatively high concentrations of a chemical over a brief time period, for example, during occupational exposure."[124] Consequently, such thresholds may not apply to individuals experiencing "chronic, sporadic, low-level exposure," including sensitive populations such as children, the elderly, and pregnant women.[125] For example, the study detected polycyclic aromatic hydrocarbon (PAH) levels that could be of "clinical significance," as recent studies have linked low levels of exposure to lower mental development in children who were prenatally exposed.[126] In addition, government safety standards do not take into account "the kinds of effects found from low-level exposure to endocrine disrupting chemicals…, which can be particularly harmful during prenatal development and childhood.[127]

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[119] U.S. Environmental Protection Agency, Ground Level Ozone, available at http://www.epa.gov/airquality/ozonepollution/health.html (accessed July 29, 2015).
[120] Colborn 2011; Colborn, Theo et al., An Exploratory Study of Air Quality Near Natural Gas Operations, 20 Human and Ecological Risk Assessment: An International Journal 1 (2012) ("Colborn 2012"); *see* note 120 & accompanying text below.
[121] Colborn 2012 at pp. 21-22 (pages refer to page numbers in attached manuscript and not journal pages).
[122] Colborn 2012 at 11.
[123] *Id*. at 10.
[124] *Id*. at 11-12.
[125] *Id*. at. 12.
[126] *Id*. at 10-11.
[127] *Id*. at 12.

Adverse health impacts documented among residents living near drilling and fracking operations include reproductive harms, increased asthma attacks, increased rates of hospitalization, ambulance runs, emergency room visits, self-reported respiratory problems and rashes, motor vehicle fatalities, trauma, and drug abuse. A recent review concluded:

> By several measures, evidence for fracking-related health problems is emerging across the United States. In Pennsylvania, as the number of gas wells increase in a community, so do rates of hospitalization. Drilling and fracking operations are correlated with elevated motor vehicle fatalities (Texas), asthma (Pennsylvania), self-reported skin and respiratory problems (southwestern Pennsylvania), ambulance runs and emergency room visits (North Dakota), infant deaths (Utah), birth defects (Colorado), high risk pregnancies (Pennsylvania), premature birth (Pennsylvania), and low birthweight (multiple states). Benzene levels in ambient air surrounding drilling and fracking operations are sufficient to elevate risks for future cancers in both workers and nearby residents, according to studies. Animal studies show that two dozen chemicals commonly used in fracking operations are endocrine disruptors that can variously disrupt organ systems, lower sperm counts, and cause reproductive harm at levels to which people can be realistically exposed.[128]

A rigorous study by Johns Hopkins University, which examined 35,000 medical records of people with asthma in Pennsylvania, found that people who live near a higher number of, or larger, active gas wells were 1.5 to 4 times more likely to suffer from asthma attacks than those living farther away, with the closest groups having the highest risk.[129] Increased asthma risks occurred during all phases of well development. A recent Yale University study identified numerous fracking chemicals that are known, probable, or possible human carcinogens (20 air pollutants) and/or are linked to increased risk for leukemia and lymphoma (11 air pollutants), including benzene, 1,3-butadiene, cadmium, diesel exhaust, and polycyclic aromatic hydrocarbons.[130]

Numerous studies suggest that higher maternal exposure to fracking and drilling can increase the incidence of high-risk pregnancies, premature births, low-birthweight babies, and birth defects. A study of 9,384 pregnant women in Pennsylvania found that women who live near active drilling and fracking sites had a 40 percent increased risk for having premature birth and a 30 percent increased risk for having high-risk pregnancies.[131] Another study found that pregnant women who had greater exposure to gas wells (measured in terms of proximity and density of wells) had a much higher risk of having low-birthweight babies; the researchers identified air

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[128] PSR 2016 at 93.

[129] Rasmussen, Sara G. et al., Association Between Unconventional Natural Gas Development in the Marcellus Shale and Asthma Exacerbations, 176 JAMA Internal Medicine 1334 (2016).

[130] Elliott, Elise G. et al., A Systematic Evaluation of Chemicals in Hydraulic-Fracturing Fluids and Wastewater for Reproductive and Developmental Toxicity, 27 Journal of Exposure Science and Environmental Epidemiology 90 (2016).

[131] Casey, Joan A., Unconventional Natural Gas Development and Birth Outcomes in Pennsylvania, USA, 27 Epidemiology 163 (2016).

pollution as the likely route of exposure.[132] In rural Colorado, mothers with greater exposure to natural gas wells were associated with a higher risk of having babies with congenital heart defects and possibly neural tube defects.[133]

Other studies have found that residents living closer to drilling and fracking operations had higher hospitalization rates[134] and reported more health symptoms, including upper respiratory problems and rashes.[135]

Workers suffer high risks from toxic exposure and accidents.[136] As summarized by a recent review:

> Drilling and fracking jobs are among the most dangerous jobs in the nation with a fatality rate that is five times the national average and shows no sign of abating. Occupational hazards include head injuries, traffic accidents, blunt trauma, burns, inhalation of hydrocarbon vapors, toxic chemical exposures, heat exhaustion, dehydration, and sleep deprivation. An investigation of occupational exposures found high levels of benzene in the urine of wellpad workers, especially those in close proximity to flowback fluid coming up from wells following fracturing activities. Exposure to silica dust, which is definitively linked to silicosis and lung cancer, was singled out by the National Institute for Occupational Safety and Health as a particular threat to workers in fracking operations where silica sand is used. At the same time, research shows that many gas field workers, despite these serious occupational hazards, are uninsured or underinsured and lack access to basic medical care.[137]

Methods of collecting and analyzing emissions data often underestimate health risks by failing to adequately measure the intensity, frequency, and duration of community exposure to toxic chemicals from fracking and drilling; failing to examine the effects of chemical mixtures; and failing to consider vulnerable populations.[138] Of high concern, numerous studies highlight that health assessments drilling and fracking emissions often fail to consider impact on

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[132] Stacy, Shaina L. et al., Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania. 10 PLoS ONE e0126425 (2015).

[133] McKenzie, Lisa M., Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado, 122 Environmental Health Perspectives 412 (2014).

[134] Jemielita, Thomas et al., Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates. 10 PLoS ONE e0131093 (2015).

[135] Rabinowitz, Peter M. et al., Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania, 123 Environmental Health Perspectives 21 (2015).

[136] Esswein, Eric J. et al., Occupational Exposures to Respirable Crystalline Silica During Hydraulic Fracturing, 10 Journal of Occupational and Environmental Hygiene 347 (2013); Esswein, Eric et al., Evaluation of Some Potential Chemical Exposure Risks during Flowback Operations in Unconventional Oil and Gas Extraction: Preliminary Results, 11 Journal of Occupational and Environmental Hygiene D174 (2013); Harrison, Robert J. et al., Sudden Deaths Among Oil and Gas Extraction Workers Resulting from Oxygen Deficiency and Inhalation of Hydrocarbon Gases and Vapors — United States, January 2010–March 2015, 65 Morb Mortal Wkly Rep 6 (2016); PSR 2016.

[137] PSR 2016 at 80

[138] Brown, David et al., Understanding Exposure From Natural Gas Drilling Puts Current Air Standards to the Test. 29 Reviews on Environmental Health 277 (2014).

vulnerable populations including environmental justice communities[139] and children.[140] For example, a recent analysis of oil and gas development in California found that 14 percent of the state's population (5.4 million people) live within a mile of at least one oil and gas well. More than a third of these people (1.8 million) also live in areas most burdened by environmental pollution.[141]

The DEIS should incorporate a literature review of the harmful effects of each of these chemicals known to be used in fracking and other types of oil and gas operations. Without knowing the effects of each chemical, the DEIS cannot accurately project the true impact of unconventional or conventional oil and gas extraction.

VI. BLM Failed to Take a Hard Look at Climate Change Impacts

The DEIS contains a highly generalized discussion of climate change, in its description of "current conditions and trends" citing to the 2009 Biennial Report of the California Climate Action Team, and in its discussion of greenhouse gas emissions. However, the DEIS's analysis of direct and indirect greenhouse gas emissions (GHGs) resulting from new oil and gas development and the proposed mitigation measures are wholly inadequate.

A. BLM Failed to Provide Any Evidence or Basis for its Greenhouse Gas Emission Estimates

The DEIS failed to provide any of the sources, calculations and rationale for the development phase GHG emissions estimates presented in Table 4.6-1 and the production phase GHG emissions estimates presented in Table 4.6-2, making it impossible for the public to evaluate these estimates. The DEIS also failed to provide any sources, calculations, or explanation for the 317,718 barrels of crude oil anticipated to be produced annually.[142] BLM must provide transparency and show its work.

Furthermore, scientific studies indicate that fugitive emissions can occur at every stage of production, often leading to high volumes of greenhouse gases being released into the air. For example, a recent state-wide study estimated that methane emissions from the oil and gas production in California are 3 to 7 times higher than reflected in the state inventory.[143] The production phase GHG estimate in Table 4.6-2 apparently includes GHGs from vents and fugitive emissions, but these emissions are not specified in the table or text. BLM must provide

[139] NRDC [Natural Resources Defense Council], Drilling in California: Who's At Risk?, October 2014 ("NRDC 2014"); Clough, Emily & Derek Bell, Just Fracking: A Distributive Environmental Justice Analysis of Unconventional Gas Development in Pennsylvania, USA, 11 Environmental Research Letters 025001 (2016); McKenzie, Lisa M. et al., Population Size, Growth, and Environmental Justice Near Oil and Gas Wells in Colorado, 50 Environmental Science & Technology 11471 (2016).
[140] Webb, Ellen et al., Potential Hazards of Air Pollutant Emissions From Unconventional Oil and Natural Gas Operations on The Respiratory Health of Children And Infants. 31 Reviews on Environmental Health 225 (2016).
[141] NRDC 2014.
[142] DEIS at 4.6-3.
[143] Jeong, Seongeun et al., Spatially Explicit Methane Emissions from Petroleum Production and the Natural Gas System in California, 48 Environmental Science & Technology 5982 (2014).

an actual estimate, backed by a science-based rationale, for GHGs coming from venting and fugitive emissions since these can be substantial.

B. BLM's Inaccurate Estimates for Greenhouse Gas Emissions are a Result of its Arbitrary Assumptions in its Reasonably Foreseeable Development Scenario

As we explained above, BLM's underestimate of the activities likely to occur as a result of the lease sale, and its limitation of the analysis to the impact of only 37 wells and 206 acres of surface disturbance, infected every aspect of BLM's analysis in the DEIS, including its estimates for greenhouse gas emissions. BLM arbitrarily assumed that future oil and gas development will continue at levels consistent with historic development trends but failed to provide any evidence to support its assumption. The RFDS and BLM's estimates of greenhouse gas emissions must be revised to reflect possible future production growth from both conventional and unconventional oil and gas resources.

Furthermore, the estimates for indirect GHG emissions under "full buildout of the RFD Scenario" (presented in Table 4.6-3) are unrealistically low because they do not account for the higher climate impact of the heavy, carbon-intensive crude oil that is most likely to be produced from the project. The DEIS states in Appendix B that most of the projected well development is expected to occur in the Coalinga, San Ardo, Lynch Canyon, and Jacalitos fields,[144] with the vast majority of oil likely to come from two fields—Coalinga and San Ardo—following recent patterns.[145]

According to California Air Resources Board data, the San Ardo and Coalinga oil fields supply among the heaviest and most climate-damaging crude oil produced in, or imported into, the state. Carbon intensity measures the GHG emissions associated with all stages of production, including exploration, well development, extraction and transport. The carbon intensity for the production of crude oil in the San Ardo oil field (28.82 gCO_2e/MJ) is more than two and a half times the average carbon intensity for crudes used in California (11.19 gCO_2e/MJ).[146] The carbon intensity for crude produced from the Coalinga oil field (25.36 gCO_2e/MJ) is more than twice the state average.[147]

A recent comprehensive analysis of California crude oil highlights that California's oil resources are heterogeneous in their GHG impacts, with some California crudes as high-emitting as Canadian tar sands oil.[148] The study calculated total emissions of crude oils from oil fields in California by summing production, refining, and combustion emissions. This analysis flagged the crude oil from the San Ardo and Coalinga oil fields as "high GHG" crudes. The study

[144] DEIS at Appendix B-16.
[145] DEIS at Table 4 at Appendix B-4.
[146] From the California Air Resources Board, Calculation of 2015 Crude Average Carbon Intensity Value, released June 2016, at https://www.arb.ca.gov/fuels/lcfs/crude-oil/2015_crude_average_ci_value_final.pdf
[147] *Id.*
[148] Gordon, D. & S. Wojcicki, Need to Know: The Case for Oil Transparency in California. March 15, 2017. Carnegie Endowment for International Peace (2017), http://carnegieendowment.org/2017/03/15/need-to-know-case-for-oil-transparency-in-california-pub-68166 ("Gordon 2017")

calculated total emissions for San Ardo crude at 760 $kgCO_2e$/bbl, and 700 $kgCO_2e$/bbl for Coalinga crude, which are among the highest emitting crudes in the state.[149]

Based on these estimates, the GHG emissions associated with 318,718 bbl per year produced by 37 wells in the full buildout of the RFG scenario[150] would be 242,226 $mtCO_2e$ per year based on producing San Ardo oil and 223,103 $mtCO_2e$ per year based on producing Coalinga oil.[151] These GHG emissions are significantly higher than estimated by the DEIS in Tables 4.6-1, 4.6-2, and 4.6-3, which estimate combined development, production, and end use emissions at 160,146 $mtCO_2e$ per year.

C. The DEIS Arbitrarily Underestimates the Impact of Methane Emissions

The DEIS uses the incorrect global warming potential (GWP) for methane which substantially underestimates its climate impact. The DEIS states that it uses a GWP for methane of 25 over a 100-year time period.[152] However the 2013 IPCC Fifth Assessment Report clearly establishes a GWP of 36 for fossil fuel sources of methane over a 100-year time period.[153] Importantly, the GWP of methane over a 20-year period is 87,[154] meaning that methane is 87 times stronger in trapping heat than CO_2 over a 20 year period, which is a particularly relevant time frame for meeting California's GHG goals and avoiding crossing dangerous climate tipping points. According to the IPCC Fifth Assessment Report, the GWP for N_20 is 268 over 20 years and 298 over 100 years.[155]

In light of serious controversy and uncertainties regarding GHG pollution from oil and gas development, it is critical that BLM's quantitative assessment account for methane's long-term (100-year) global warming impact and, also, methane's short-term (20-year) warming impact using the latest peer-reviewed science to ensure that potentially significant impacts are not underestimated or ignored. See 40 C.F.R. § 1508.27(a) (requiring consideration of "[b]oth short- and long-term effects"). BLM has significantly underestimated the near-term benefits of keeping methane emissions out of the atmosphere. 40 C.F.R. §§ 1502.16(e), (f); id. at 1508.27. These estimates are essential given the noted importance of near term action to ameliorate climate change – near term action that scientists say should focus, *inter alia*, on preventing the emission of short-lived but potent GHGs like methane while, at the same time, stemming the ongoing increase in the concentration of carbon dioxide.[156]

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[149] Gordon 2017.
[150] DEIS at 4.6-3.
[151] For San Ardo, 318,718 bbl/year*760 $kgCO_2e$/bbl*0.001 $mtCO_2e/kgCO_2$ = 242,226 $mtCO_2e$ per year.
For Coalinga, 318,718 bbl/year*700 $kgCO_2e$/bbl*0.001 $mtCO_2e/kgCO_2$ = 223,103 $mtCO_2e$ per year.
[152] DEIS at 3.61.
[153] Myhre, G., D. Shindell et al., Ch. 8: Anthropogenic and Natural Radiative Forcing, in Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change IPCC, Stocker, T.F. et al., eds. Cambridge University Press, Cambridge UK and New York USA (2013) at Table 8.7.
[154] *Id.*
[155] *Id.*
[156] *See, e.g.*, Scripps Institution of Oceanography, Limiting Global Warming: Variety of Efforts Needed Ranging from 'Herculean' to the Readily Actionable, Scientists Say, Science Daily (May 4, 2010), available at: http://www.sciencedaily.com/releases/2010/05/100503161328.htm; *see also*, Ramanathan, V. et. al., The Copenhagen Accord for Limiting Global Warming: Criteria, Constraints, and Available Avenues (Feb. 2010).

In addition, the DEIS does not discuss the impact of the March 28, 2017 Executive Order that directs the Secretary of Interior to review BLM's final rule entitled "Waste Prevention, Production Subject to Royalties, and Resource Conservation" (the "methane waste rule")[157] and conform the rule with newly created executive policies. [158] If the rule is rescinded, methane emissions could be far greater than the volume emitted with the rule in place. The BLM's itself estimates an emissions reduction of 175,000 to 180,000 tons of methane per year under the rule.[159] Given the potential change in law, the BLM's analysis should include methane emissions that will result if the methane waste rule is not in place when BLM intends to lease its land or when actual drilling and production occurs.

The DEIS's assertion that the GHG emissions and associated direct and indirect impacts "would be minor"[160] is therefore unfounded.

D. BLM Must Limit Greenhouse Gas Emissions by Keeping Federal Fossil Fuels in the Ground

The urgent need to prevent the worst impacts of climate change means that the world in general – and California in particular – cannot afford to invest in new fossil fuel development and infrastructure that locks in carbon intensive oil production for years into the future.

A robust body of scientific research has established that most fossil fuels must be kept in the ground to avoid the worst dangers of climate change. The severe impacts of global warming from the 1°C warming that the planet has already experienced highlight the urgency for stronger climate action to avoid truly catastrophic dangers to people and planet. Human-caused climate change is already causing widespread damage from intensifying global food and water insecurity, the increasing frequency of heat waves and other extreme weather events, flooding of coastal regions by sea level rise and increasing storm surge, the rapid loss of Arctic sea ice and Antarctic ice shelves, increasing species extinction risk, and the worldwide collapse of coral reefs.[161] The Third National Climate Assessment makes clear that "reduc[ing] the risks of some of the worst impacts of climate change" will require "aggressive and sustained greenhouse gas emission reductions" over the course of this century.[162]

The United States has committed to the climate change target of holding the long-term global average temperature "to well below 2°C above pre-industrial levels and to pursue efforts

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[157] U.S. Bureau of Land Management, Final Rule: Waste Prevention, Production Subject to Royalties, and Resource Conservation, 81 Fed. Reg. 83008 (November 18, 2016).
[158] The White House, Presidential Executive Order on Promoting Energy Independence and Economic Growth (March. 28, 2017), available at https://www.whitehouse.gov/the-press-office/2017/03/28/presidential-executive-order-promoting-energy-independence-and-economi-1
[159] 81 Fed. Reg. 83069.
[160] DEIS at 4.6-4.
[161] Melillo, Jerry M., "Climate Change Impacts in the United States: The Third National Climate Assessment," Terese (T.C.) Richmond, and Gary W. Yohe, Eds., U.S. Global Change Research Program, (2014).
[162] Melillo, Jerry M., at 13, 14, and 649.

to limit the temperature increase to 1.5°C above pre-industrial levels"[163] under the Paris Agreement.[164] The United States signed the Paris Agreement on April 22, 2016 as a legally binding instrument through executive agreement,[165] and the treaty entered into force on November 4, 2016. The Paris Agreement codifies the international consensus that climate change is an "urgent threat" of global concern.[166] The Agreement also requires a "well below 2°C" climate target because 2°C of warming is no longer considered a safe guardrail for avoiding catastrophic climate impacts and runaway climate change.[167]

Immediate and aggressive greenhouse gas emissions reductions are necessary to keep warming well below 2°C rise above pre-industrial levels. The IPCC Fifth Assessment Report and other expert assessments have established global carbon budgets, or the total amount of carbon that can be burned while maintaining some probability of staying below a given temperature target. According to the IPCC, total cumulative anthropogenic emissions of CO_2 must remain below about 1,000 gigatonnes ($GtCO_2$) from 2011 onward for a 66 percent probability of limiting warming to 2°C above pre-industrial levels, and to 400 $GtCO_2$ from 2011 onward for a 66 percent probability of limiting warming to 1.5°C.[168] These carbon budgets have been reduced to 850 $GtCO_2$ and 240 $GtCO_2$, respectively, from 2015 onward.[169] Given that global CO_2 emissions in 2015 alone totaled 36 $GtCO_2$,[170] humanity is rapidly consuming the remaining carbon budget.

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[163] *See* United Nations Framework Convention on Climate Change, Conference of the Parties, Nov. 30-Dec. 11, 2015, Adoption of the Paris Agreement Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015), http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf ("Paris Agreement").

[164] On December 12, 2015, 197 nation-state and supra-national organization parties meeting in Paris at the 2015 United Nations Framework Convention on Climate Change Conference of the Parties consented to the Paris Agreement committing its parties to take action so as to avoid dangerous climate change.

[164] *See* United Nations Treaty Collection, Chapter XXVII, 7.d Paris Agreement, List of Signatories (2015); U.S. Department of State, Background Briefing on the Paris Climate Agreement (Dec. 12, 2015). Although not every provision in the Paris Agreement is legally binding or enforceable, the U.S. and all parties are committed to perform the treaty commitments in good faith under the international legal principle of *pacta sunt servanda* ("agreements must be kept"). Vienna Convention on the Law of Treaties, Art. 26.

[165] *Id*.

[166] *See* Paris Agreement, at Recitals.

[167] *See* the comprehensive scientific review under the United Nations Framework Convention on Climate Change (UNFCCC) of the global impacts of 1.5°C versus 2°C warming: U.N. Subsidiary Body for Scientific and Technological Advice, "Report on the Structured Expert Dialogue on the 2013-2015 review," FCCC/SB/2015/1NF.1 (2015), http://unfccc.int/resource/docs/2015/sb/eng/inf01.pdf; Schleussner, Carl-Friedrich. et al., Differential climate impacts for policy-relevant limits to global warming: the case of 1.5C and 2C, 7 Earth Systems Dynamics 327 (2016).

[168] IPCC, "2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; Summary for Policymakers (2013), at 25; IPCC, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, R.K. Pachauri and L.A. Meyer (eds.) (2014), at 63-64 and Table 2.2.

[169] Rogelj, Joeri et al., Differences between carbon budget estimates unraveled, 6 Nature Climate Change 245 (2016), at Table 2.

[170] *See* Le Quéré, Corrine et al., Global Carbon Budget 2016, 8 Earth Syst. Sci. Data 605 (2016), www.globalcarbonproject.org/carbonbudget/16/data.htm.

According to a large body of scientific research, the vast majority of global and US fossil fuels must stay in the ground in order to hold temperature rise to well below 2°C.[171] Studies estimate that 68 to 80 percent of global fossil fuel reserves must not be extracted and burned to limit temperature rise to 2°C based on a 1,000 $GtCO_2$ carbon budget.[172] For a 50 percent chance of limiting temperature rise to 1.5°C, 85 percent of known fossil fuel reserves must stay in the ground.[173] Effectively, fossil fuel emissions must be phased out globally within the next few decades.[174]

A 2016 analysis found that potential carbon emissions from developed reserves in currently operating oil and gas fields and mines would lead to global temperature rise beyond 2°C.[175] Excluding coal, currently operating oil and gas fields alone would take the world beyond 1.5°C.[176] To stay well below 2°C, the clear implication is that no new fossil fuel extraction or transportation infrastructure should be built, and governments should grant no new permits for new fossil fuel extraction and infrastructure.[177] Moreover, some fields and mines, primarily in rich countries, must closed before fully exploiting their resources. The analysis concludes that, because "existing fossil fuel reserves considerably exceed both the 2°C and 1.5°C carbon budgets[, i]t follows that exploration for new fossil fuel reserves is at best a waste of money and at worst very dangerous."[178]

According to a U.S. focused analysis,[179] the United States alone has enough recoverable fossil fuels, split about evenly between federal and non-federal resources, that if extracted and

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[171] The IPCC estimates that global fossil fuel reserves exceed the remaining carbon budget for staying below 2°C by 4 to 7 times, while fossil fuel resources exceed the carbon budget for 2°C by 31 to 50 times. *See* Bruckner, Thomas et al., Ch. 7: 2014: Energy Systems, in Climate Change 2014: Mitigation of Climate Change, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014), http://ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter7.pdf, at Table 7.2.

[172] To limit temperature rise to 2°C based on a 1,000 $GtCO_2$ carbon budget from 2011 onward, studies indicate variously that 80 percent (Carbon Tracker Initiative, Unburnable Carbon – Are the world's financial markets carrying a carbon bubble? (2013) ("Carbon Tracker Initiative 2013"), http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf;), 76 percent (Raupach, Michael et al., "Sharing a quota on cumulative carbon emissions," 4 Nature Climate Change 873 ("Raupach 2014"), and 68 percent (Oil Change International, The Sky's Limit: Why the Paris Climate Goals Require A Managed Decline of Fossil Fuel Production, (September 2016) ("Oil Change International 2016")) of global fossil fuel reserves must stay in the ground. *See* Carbon Tracker Initiative 2013; Raupach 2014; Oil Change International 2016.

[173] Oil Change International 2016 at 6.

[174] Joeri Rogelj et al. (2015) estimated that a reasonable likelihood of limiting warming to 1.5° or 2°C requires global CO_2 emissions to be phased out by mid-century and likely as early as 2040-2045. *See* Rogelj, Joeri et al., Energy system transformations for limiting end-of-century warming to below 1.5°C, 5 Nature Climate Change 519 (2015). Climate Action Tracker indicated that the United States must phase out fossil fuel CO_2 emissions even earlier—between 2025 and 2040—for a reasonable chance of staying below 2ºC. *See, e.g*. Climate Action Tracker, "USA" (last updated 25 January 2017), http://climateactiontracker.org/countries/usa

[175] Oil Change International 2016 at 5.

[176] *Id.*, at 5.

[177] *Id*.

[178] *Id.*, at 17.

[179] Ecoshift Consulting, et al., The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels, Prepared for Center for Biological Diversity & Friends of the Earth (2015). http://www.ecoshiftconsulting.com/wpcontent/uploads/Potential-Greenhouse-Gas-Emissions-U-S-Federal-Fossil-Fuels.pdf

burned, would exceed the global carbon budget for a 1.5°C limit, and would consume nearly the entire global budget for a 2°C limit.[180] Specifically, the analysis found:

- Potential greenhouse gas emissions of federal fossil fuels (leased and unleased) if developed would release up to 492 gigatons (Gt) of carbon dioxide equivalent pollution (CO_2e), representing 46 percent to 50 percent of potential emissions from all remaining U.S. fossil fuels.
- Of that amount, up to 450 Gt CO_2e have not yet been leased to private industry for extraction;
- Releasing those 450 Gt CO_2e (the equivalent annual pollution of more than 118,000 coal-fired power plants) would be greater than any proposed U.S. share of global carbon limits that would keep emissions well below 2°C.[181]

Fracking has also opened up vast resources that otherwise would not be available, increasing the potential for future greenhouse gas emissions.

The long-lived GHG emissions and fossil fuel infrastructure that would result from this project will contribute to undermining national and state climate commitments and increase climate change impacts, at a time when there is urgent need to keep most fossil fuels in the ground.

E. The DEIS Fails to Address Whether the Alternatives Considered Are Consistent with State and National Climate Plans, Policies, Regulations, or Goals

NEPA regulations require agencies to account for conflicts with existing laws and requirements imposed for the protection of the environment when engaging in environmental analysis.[182] For example, BLM must disclose whether each of the proposed plan alternatives would interfere with efforts to meet federal and international greenhouse gas emission reduction targets.[183] As explained by the CEQ in its Final Climate Guidance, federal agencies evaluating the climate impacts of their decisions should "discuss relevant approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to

[180] *Id.*, at 4.
[181] For the United States, Raupach et al. (2014) provided a mid-range estimate of the U.S. carbon quota of 158 $GtCO_2$ for a 50 percent chance of staying below 2°C, using a "blended" scenario of sharing principles for allocating the global carbon budget among countries. This study estimated US fossil fuel reserves at 716 $GtCO_2$, of which coal comprises the vast majority, indicating that most fossil fuel reserves in the US must remain unburned to meet a well below 2°C carbon budget. Raupach 2014 at Supplementary Figure 7.
[182] *See* 40 C.F.R. § 1506.2(d) (EISs must discuss inconsistencies with state law); 40 C.F.R. § 1508.27(b)(10) (when examining whether actions are "significant" within the meaning of NEPA, agencies must consider whether the action "threatens a violation of Federal, State, or local law or *requirements imposed for the protection of the environment*.").
[183] *See* 40 C.F.R. § 1506.2(d); 40 C.F.R. § 1508.27(b)(10).

make clear whether a proposed project's GHG emissions are consistent with such plans or laws."[184]

The DEIS arbitrarily concludes that the GHG emissions from oil and gas development "would not be likely to conflict with any applicable plan, policy, regulation, or goals adopted for the purpose of reducing GHG emissions."[185] However, the proposed RMP is inconsistent not only with United States' climate commitments under the Paris Agreement (discussed above in Section VI (D)) but also with California's mandates for rapid statewide GHG emissions reductions, as well as the Clean Power Plan.

The Governor's Executive Order B-30-15 and Senate Bill 32 establish a mid-term greenhouse gas emissions reduction target for California of 40 percent below 1990 levels by 2030. Executive Order S-3-05 calls for the state to reduce emissions levels by 80 percent below 1990 levels by 2050. These targets require increasingly steep reductions in emissions over the next three decades. Yet the science shows this is precisely the time period during which the carbon emitted from new oil and gas development will increase atmospheric CO2 levels. At a time when we need to reduce emissions dramatically in the short term and keep them down, this project would contribute to undermining California's climate goals.

Furthermore continued leasing and development of federal fossil fuel resources commits the world to extremely dangerous warming well beyond the 2°C threshold. As one study put it, "the disparity between what resources and reserves exist and what can be emitted while avoiding a temperature rise greater than the agreed 2°C limit is therefore stark."[186] In short, *any* new leasing of federal fossil fuel resources is inconsistent with a carbon budget that would seek to avoid catastrophic climate change.

The DEIS asserts that:

> California's regulatory setting, including reporting of GHG and the Cap-and-Trade Program (Section 3.6.2, Regulatory Framework), provides oversight and management of GHG directly emitted during development and production and indirectly emitted by end users of the petroleum products. The GHG emissions and the associated direct and indirect impacts would be minor.[187]

The DEIS further assumes that reporting requirements and "controlling GHG through permit conditions or participation by the operators in mandatory programs for GHG management" will prevent all potential disruption of the statewide emissions reduction goals set by the Global Warming Solutions Act of 2006 (AB 32) and subsequent programs.[188] However, BLM provides no scientific evidence, data, or analyses showing that compliance with Cap-and-

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[184] Council on Environmental Quality, Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews, 81 Fed Reg 51866 (Aug 5, 2016).
[185] DEIS at 4.6-4.
[186] McGlade at 188.
[187] DEIS at 4.6-4.
[188] *Id*. at 4.6-5.

Trade Program provisions or reporting requirements would guarantee that California's overall GHG emissions remain consistent with statewide-targeted levels.

Suppliers of transportation fuels and the end-use of oil and gas as a transportation fuel in California would need to comply with California's Low Carbon Fuel Standard (LCFS). Under this program, transportation fuel suppliers must demonstrate that the mix of fuels they provide meet the carbon intensity standards of the LCFS, where the carbon intensity is a measure of the GHG emissions associated with the various production, distribution, and use steps in the "life-cycle" of the fuel. This ensures that downstream use of oil and gas as a transportation fuel would meet the LCFS. Additionally, fuel suppliers, including refiners, pipeline companies and railroads, generally bear the compliance obligation in the Cap-and-Trade Program for the GHG from end-use of the petroleum products for fuel users not otherwise covered. This means that the combustion emissions of the fuel delivered to all end-users are covered in the Cap-and-Trade Program."

F. The DEIS's Proposed Mitigation Measures Are Inadequate

The only required mitigation for GHG emissions and resulting climate change impacts is the Best Management Practices and Standard Operating Procedures for Air Quality, which is inadequate to mitigate the substantial GHG emissions that would be emitted over the lifetime of this project and the harms that would result from these emissions.

VII. BLM Failed to Take an Adequately Hard Look at Impacts to Human Health

In addition to climate change effects, oil and gas leasing and fracking entail significant public health risks that should compel BLM to consider a ban on these practices. Although the DEIS identifies a few example mitigation measures that "could be implemented to lessen the degree of potential adverse public safety impacts,"[189] it fails to take a hard look, despite the public's concerns as stated in scoping, at the potential threats that oil and gas leasing poses to human health and safety, such as carcinogenic, developmental, reproductive, and endocrine disruption effects.

Ample scientific evidence indicates that well development and well stimulation activities have been linked to an array of adverse human health effects, including carcinogenic, developmental, reproductive, and endocrine disruption effects. The DEIS does not consider how close development could potentially take place to schools, residences, and businesses. Just as troubling, is how much is *unknown* about the chemicals used in well stimulation activities.[190] The potential human health dangers and the precautionary principle should further compel BLM to consider not allowing further development of oil and gas minerals in the areas for lease. In comparing the no-leasing and no-fracking alternatives to leasing and continued unconventional well development scenarios, BLM should include a health impact assessment, or equivalent, of

[189] DEIS at 4.4-22.

[190] *See, e.g.* U.S. Environmental Protection Agency, Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources, External Review Draft at 5-73, 10-7 (June 2015) available at http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=523539 ("EPA 2015").

the aggregate impact that unconventional extraction techniques, including fracking, will have on human health and nearby communities.

Due to the heavy and frequent use of chemicals, proximity to fracked wells is associated with higher rates of cancer, birth defects, poor infant health, and acute health effects for nearby residents who must endure long-term exposure:

- In one study, residents living within one-half mile of a fracked well were significantly more likely to develop cancer than those who live more than one-half mile away, with exposure to benzene being the most significant risk.[191]

- Another study found that pregnant women living within 10 miles of a fracked well were more likely to bear children with congenital heart defects and possibly neural tube defects.[192] A separate study independently found the same pattern; infants born near fracked gas wells had more health problems than infants born near sites that had not yet conducted fracking.[193, 194] Further studies have raised substantial questions regarding air pollution from Uinta Basin drilling for example and its public health effects on stillborns.[195]

- A study analyzed Pennsylvania birth records from 2004 to 2011 to assess the health of infants born within a 2.5-kilometer radius of natural-gas fracking sites. They found that proximity to fracking increased the likelihood of low birth weight by more than half, from about 5.6 percent to more than 9 percent.[196] The chances of a low Apgar score, a summary measure of the health of newborn children, roughly doubled, to more than 5 percent.[197] Another recent Pennsylvania study found a correlation between proximity to unconventional gas drilling and higher incidence of lower birth weight and small-for-gestational-age babies.[198]

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[191] McKenzie, L. et al., Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources, 424 Science of the Total Environment 79 (2012) ("McKenzie 2012").
[192] McKenzie, L. et al., Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado, Advance Publication Environmental Health Perspectives (Jan. 28, 2014), http://dx.doi.org/10.1289/ehp.1306722 ("McKenzie 2014").
[193] Hill, Elaine L., Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania, Cornell University (2012).
[194] Whitehouse, Mark, Study Shows Fracking is Bad for Babies, Bloomberg View, Jan. 4, 2014, *available at* http://www.bloombergview.com/articles/2014-01-04/study-shows-fracking-is-bad-for-babies.
[195] *See* Siddika N et al., Prenatal ambient air pollution exposure and the risk of stillbirth: systematic review and meta-analysis of the empirical evidence, Occup Environ Med. (May 24, 2016) doi: 10.1136/oemed-2015-103086; *see also* Knox, Annie, "At Vernal forum, questions about air pollution, pregnancies, research," Salt Lake Tribune (April 19, 2015); Solotaroff, Paul, What's Killing the Babies of Vernal, Utah? Rolling Stone Magazine (June 22, 2015), http://www.rollingstone.com/culture/features/fracking-whats-killing-the-babies-of-vernal-utah-20150622
[196] *Id*., citing Janet Currie of Princeton University, Katherine Meckel of Columbia University, and John Deutch and Michael Greenstone of the Massachusetts Institute of Technology.
[197] *Id.*
[198] Stacy, Shaina L. et al., Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania, 10 PLoS ONE 6: e0126425, doi:10.1371/journal.pone.0126425 (2015), *available at* http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0126425.

- A recent study found increased rates of cardiology-patient hospitalizations in zip codes with greater number of unconventional oil and gas wells and higher well density in Pennsylvania.[199] The results suggested that if a zip code went from having zero wells to well density greater than 0.79 wells/km^2, the number of cardiology-patient hospitalizations per 100 people (or "cardiology inpatient prevalence rate") in that zip code would increase by 27%. If a zip code went from having zero wells to a well density of 0.17 to 0.79 wells/km^2, a 14% increase in cardiology inpatient prevalence rates would be expected. Further, higher rates of neurology-patient hospitalizations were correlated with zip codes with higher well density.

- Recently published reports indicate that people living in proximity to fracked gas wells commonly report skin rashes and irritation, nausea or vomiting, headache, dizziness, eye irritation and throat irritation.[200]

- In Texas, a jury awarded nearly $3 million to a family who lived near a well that was hydraulically fractured.[201] The family complained that they experienced migraines, rashes, dizziness, nausea and chronic nosebleeds. Medical tests showed one of the plaintiffs had more than 20 toxic chemicals in her bloodstream.[202] Air samples around their home also showed the presence of BTEX — benzene, toluene, ethylbenzene and xylene —colorless but toxic chemicals typically found in petroleum products.[203]

Chemicals used for fracking also put nearby residents at risk of endocrine disruption effects. A study that sampled water near active wells and known spill sites in Garfield County Colorado found alarming levels of estrogenic, antiestrogenic, androgenic, and antiandrogenic activities, indicating that endocrine system disrupting chemicals (EDC) threaten to contaminate surface and groundwater sources for nearby residents.[204] The study concluded:

> [M]ost water samples from sites with known drilling-related incidents in a drilling-dense region of Colorado exhibited more estrogenic, antiestrogenic, and/or antiandrogenic activities than the water samples collected from reference sites[,] and 12 chemicals used in drilling operations exhibited similar activities. Taken together, the following support an association between natural gas drilling

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[199] Jemielital, T. et al., Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates. 10 PLoS ONE 7: e0131093 (2015), *available at* http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0131093.

[200] Rabinowitz, P.M. et al., Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania. Environmental Health Perspectives Advance Publication (2014); Bamberger, Michelle and R.E. Oswald, Impacts of Gas Drilling on Human and Animal Health, 22 New Solutions 51 (2012); Steinzor, N. et al., Gas Patch Roulette: How Shale Development Risks Public Health in Pennsylvania, Earthworks Gas & Oil Accountability Project (2012).

[201] *Parr v. Aruba Petroleum, Inc*., Case No. 11-01650-E (Dallas Cty., filed Sept.13, 2013).

[202] Deam, Jenny, Jury Awards Texas family Nearly $3 million in Fracking Case, Los Angeles Times (Apr. 3, 2014) http://www.latimes.com/nation/la-na-fracking-lawsuit-20140424-story.html.

[203] *Id*.

[204] Kassotis, Christopher D. et al., Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region, 155 Endocrinology 3:897 (2014), http://press.endocrine.org/doi/full/10.1210/en.2013-1697.

> operations and EDC activity in surface and ground water: [1] hormonal activities in Garfield County spill sites and the Colorado River are higher than those in reference sites in Garfield County and in Missouri, [2] selected drilling chemicals displayed activities similar to those measured in water samples collected from a drilling-dense region, [3] several of these chemicals and similar compounds were detected by other researchers at our sample collection sites, and [4] known spills of natural gas fluids occurred at these spill sites.

The study also noted a linkage between EDCs and "negative health outcomes in laboratory animals, wildlife, and humans":

> Despite an understanding of adverse health outcomes associated with exposure to EDCs, research on the potential health implications of exposure to chemicals used in hydraulic fracturing is lacking. Bamberger and Oswald (26) analyzed the health consequences associated with exposure to chemicals used in natural gas operations and found respiratory, gastrointestinal, dermatologic, neurologic, immunologic, endocrine, reproductive, and other negative health outcomes in humans, pets, livestock, and wildlife species.
>
> Of note, site 4 in the current study was used as a small-scale ranch before the produced water spill in 2004. This use had to be discontinued because the animals no longer produced live offspring, perhaps because of the high antiestrogenic activity observed at this site. There is evidence that hydraulic fracturing fluids are associated with negative health outcomes, and there is a critical need to quickly and thoroughly evaluate the overall human and environmental health impact of this process. It should be noted that although this study focused on only estrogen and androgen receptors, there is a need for evaluation of other hormone receptor activities to provide a more complete endocrine-disrupting profile associated with natural gas drilling.[205]

Operational accidents also pose a significant threat to public health. For example in August 2008, Newsweek reported that an employee of an energy-services company got caught in a fracking fluid spill and was taken to the emergency room, complaining of nausea and headaches.[206] The fracking fluid was so toxic that it ended up harming not only the worker, but also the emergency room nurse who treated him. Several days later, after she began vomiting and retaining fluid, her skin turned yellow and she was diagnosed with chemical poisoning.[207]

Harmful chemicals are also found in the flowback fluid after well stimulation events. Flowback fluid is a key component of oil-industry wastewater from stimulated wells. A survey of chemical analyses of flowback fluid dating back to April 2014 in California revealed that concentrations of benzene, a known carcinogen, were detected at levels over 1,500 times the

[205] *Id*., p. 905.
[206] Wiseman, Hannah, Untested Waters: the Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation, 115 Fordham Envtl. Law Rev. 138 (2009).
[207] *Id*.

federal limits for drinking water.[208] Of the 329 available tests that measured for benzene, the chemical was detected at levels in excess of federal limits in 320 tests (97 percent).[209] On average, benzene levels were around 700 times the federal limit for drinking water.[210]Among other carcinogenic or otherwise dangerous chemicals found in flowback fluid from fracked wells are toluene and chromium-6.[211] These hazardous substances were detected in excess of federal limits for drinking water in over one hundred tests. This dangerous fluid is commonly disposed of in injection wells, which often feed into aquifers, including some that could be used for drinking water and irrigation.

Acidizing presents similarly alarming risks to public health and safety. In acidizing operations, large volumes of hydrochloric and hydrofluoric acid are transported to the site and injected underground. These chemicals are highly dangerous due to their corrosive properties and ability to trigger tissue corrosion and damage to sensory organs through contact.

While many risks are known, much more is unknown about the hundreds of chemicals used in fracking. The identity and effects of many of these additives is unknown, due to operators' claims of confidential business information. But, as the EPA recognizes, chemical identities are "necessary to understand their chemical, physical, and toxicological properties, which determine how they might move through the environment to drinking water resources and any resulting effects."[212] Compounds in mixtures can have synergistic or antagonistic effects, but again, it is impossible to know these effects without full disclosure.[213] The lack of this information also precludes effective remediation: "Knowing their identities would also help inform what chemicals to test for in the event of suspected drinking water impacts and, in the case of wastewater, may help predict whether current treatment systems are effective at removing them."[214]

Even where chemical identities are known, chemical safety data may be limited. In EPA's study of the hazards of fracking chemicals to drinking water, EPA found that "[o]ral reference values and oral slope factors meeting the criteria used in this assessment were not available for the majority of chemicals used in hydraulic fracturing fluids [87%], representing a significant data gap for hazard identification."[215] Without this data, EPA could not adequately

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[208] California Department of Conservation Division of Oil, Gas, & Geothermal Resources, California Well Stimulation Public Disclosure Report, *available at* http://www.conservation.ca.gov/dog/Pages/WellStimulationTreatmentDisclosure.aspx. The highest concentration was 7,700 parts per billion (ppb) for a well with API number 03052587. The US EPA's maximum contaminant level for benzene is 5 ppb.

[209] *Id*.

[210] *Id*., *see also* Cart, J., High Levels of Benzene Found in Fracking Wastewater, Los Angeles Times (Feb. 11, 2015), http://www.latimes.com/local/california/la-me-fracking-20150211-story.html#page=1.

[211] *Id*.; *see also* Center for Biological Diversity, Cancer-causing Chemicals Found in Fracking Flowback from California Oil Wells (2015), *available at* http://www.biologicaldiversity.org/news/press_releases/2015/fracking-02-11-2015.html.

[212] EPA 2015 at 10-18.

[213] Souther, Sara et al, Biotic Impacts of Energy Development from Shale: Research Priorities and Knowledge Gaps, 12 Front Ecol Environ 6: 334 (2014).

[214] EPA 2015 at 10-18.

[215] *Id*. at 10-7, 9-7.

assess potential impacts on drinking water resources and human health.[216] Further, of 1,076 hydraulic fracturing fluid chemicals identified by the EPA, 623 did not have estimated physiochemical properties reported in EPA's toxics database, although this information is "essential to predicting how and where it will travel in the environment."[217] The data gaps are actually much larger, because EPA excluded 35% of fracking chemicals reported to FracFocus from its analysis because it could not assign them standardized chemical names.[218]

The DEIS fails to incorporate a literature review of the harmful effects of each of the chemicals known to be used in fracking and other unconventional oil and gas extraction methods. Without knowing the effects of each chemical, the DEIS cannot accurately project the true impact of unconventional oil and gas extraction.

The DEIS also fails to study the human health and safety impacts of noise pollution, light pollution, and traffic accidents resulting from oil and gas development. A recent study found that automobile and truck accident rates in counties in Pennsylvania with heavy unconventional oil and gas extraction activity were between 15 and 65 percent higher than accident rates in counties without unconventional oil and gas extraction activities.[219] Rates of traffic fatalities and major injuries may be higher in areas with heavy drilling activity than areas without.[220]

1. BLM Must Conduct a Health Impact Assessment.

NEPA requires that the BLM employ at least the same level of effort to analyze human health impacts as it does to promote industry's interest in development when preparing the RFD and associated analyses regarding projected drilling levels. BLM did not conduct a health impact assessment, or equivalent analysis, and, as a result, the DEIS does not satisfy NEPA and its implementing regulations.

A health impact assessment ("HIA") or equivalent analysis would fulfill the regulations governing NEPA, to examine human health impacts "to the fullest extent possible." A HIA would be forward-looking and attempt to identify all of the potential direct, indirect, and cumulative links between a proposed activity and the health and well-being of affected communities, and to develop mitigation measures to minimize harms and maximize benefits. The DEIS does not include this type of analysis of human health impacts.

The U.S. EPA has posted on its website an excellent document on the utility of an HIA as part of the NEPA analysis of federal agencies where public health impacts are at issue.[221] HIA "provides a systematic process and methodology to anticipate and proactively address the

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[216] *Id*. at 9-37-38.
[217] *Id*. at 5-73.
[218] *Id*. at 9-38.
[219] Graham, J., Irving et al., Increased Traffic Accident Rates Associated with Shale Gas Drilling in Pennsylvania. 74 Accident Analysis and Prevention 203 (2015).
[220] *Id.*
[221] *See* U.S. Environmental Protection Agency, Human Impact Partners, Frequently Asked Questions About Integrating Health Impact Assessment into Environmental Impact Statement (2015), available at: http://www.epa.gov/region9/nepa/PortsHIA/pdfs/FAQIntegratingHIA-EIA.pdf.

potential health consequences of a program or policy in order to maximize the potential benefits and minimize adverse outcomes."[222] Steps in the HIA process include:

1. Screening: Determines whether an HIA is necessary, and whether it is likely to be useful.
2. Scoping: Establish the population to which the HIA applies, the scope of health problems to be analyzed, the HIA team, methods to be used in the assessment, and data sources.
3. Assessment: describe the baseline health status and determinants of health in the population and assess likely impacts through a literature review and qualitative or quantitative analysis.
4. Decision and recommendations to minimize adverse impacts and maximize benefits.
5. Monitoring and reassessment plan: select a set of outcomes likely to be sensitive/accurate indicators of the changes predicted, such as health outcomes and develop a plan to monitor and then reassess if needed.

The BLM did not conduct these steps, and did not analyze the impacts to the population within the planning area, considering how many people might be exposed to health impacts, analyze where development would take place relative to water sources or residences, or assess the likely impacts to the actual population in the area, including particularly vulnerable populations. It also omitted significant potential impacts. For example, the DEIS did not include any potential impacts from the illness caused by the stress and mental anguish associated with living near intensive oil and gas development.

According to the U.S. Centers for Disease Control, "HIA can be used to evaluate objectively the potential health effects of a project or policy before it is built or implemented. It can provide recommendations to increase positive health outcomes and minimize adverse health outcomes. A major benefit of the HIA process is that it brings public health issues to the attention of persons who make decisions about areas that fall outside of traditional public health arenas, such as transportation or land use."[223]

VIII. BLM Failed to Take a Hard Look at Impacts to Water Resources

BLM has not adequately evaluated potential impacts to groundwater and surface water.[224] The EIS must be revised to account for impacts from Enhanced Oil Recovery (EOR) operations and development of additional conventional and unconventional resources. Additional mitigation measures must also be adopted to address potential impacts to groundwater and surface water.

A. BLM Has Not Analyzed the Impacts of EOR Operations

[222] *See* Wernham, Aaron, Inupiat Health and Proposed Alaskan Oil Development: Results of the First Integrated Health Impact Assessment/Environmental Impact Statement for Proposed Oil Development on Alaska's North Slope, 4 EcoHealth 500, doi: 10.1007/s10393-007-0132-2 (2007).
[223] Centers for Disease Control, Health Impact Assessment, available at: http://www.cdc.gov/healthyplaces/hia.htm .
[224] See Center for Biological Diversity Map of Lakes and Rivers in Central Coast Field Office Planning Area (2017), attached as Exhibit C.

As acknowledged in the Reasonably Foreseeable Development Scenario, EOR is critical to oil production within the HFO:

> EOR is the main recovery method used within the HFO area. About 85 percent of the production from the Coalinga Field is from thermal recovery projects (DOGGR, 2010, p. 43). EOR techniques are utilized in all of the most productive oil and gas fields within the HFO area, which are discussed in Section 1 and listed as follow (DOGGR, 2010, pp. 177 to 191):
>
> - Coalinga Oil and Gas Field with Coalinga East Extension Oil and Gas Field (steam flood, cyclic steam, and water flood);
> - San Ardo Oil and Gas Field (steam flood, cyclic steam, water flood, and air injection);
> - Lynch Canyon Oil and Gas Field (cyclic steam);
> - Jacalitos Oil and Gas Field (cyclic steam and water flood);
> - Kettleman North Dome Oil and Gas Field (water flood); and
> - Sargent-Hollister Oil and Gas Field (cyclic steam).
>
> Therefore, similar to well stimulation technologies discussed above, it is estimated that EOR techniques (i.e., cyclic steam and steam flood) and secondary recovery techniques (water flood) may be used on any or all wells under this RFDS.[225]

The EOR techniques used in the HFO require large volumes of water. As shown below in Table 1, according to DOGGR's Report of California Oil and Gas Production Statistics, in 2015 more than 100 million barrels (4 billion gallons) of water and/or steam were injected for EOR into four fields in the HFO.[226] The source of the fluids was not disclosed in DOGGR's report but data reported to fulfill the requirements of Senate Bill 1281 indicate that the injected fluid consists of produced water from oil and gas wells and oil field water source wells.[227] BLM is obligated to analyze how such water use may impact ground and surface water quantity and quality and develop mitigation measures to reduce any impacts.

Table 1. 2015 volume of steam and water injected into fields in the HFO that currently or in the past utilize EOR. Source: DOGGR

STEAM & WATER INJECTION BY FIELD (BBL) - 2015				
Field	Cyclic Steam	Steam Flood	Water Flood	Total

[225] U.S. Bureau of Land Management. 2016. Central Coast Field Office Draft Resource Management Plan Amendment and Draft Environmental Impact Statement for Oil and Gas Leasing and Development. Appendix B. Hollister Field Office Area – Reasonably Foreseeable Development Scenario for Oil and Gas at Ap.B-26. January 5 2017. Available at https://eplanning.blm.gov/epl-front-office/projects/lup/67003/94015/113329/Appendix_B_-_Reasonably_Foreseeable_Development_Scenario.pdf (accessed March 28, 2017).

[226] California Department of Conservation, Division of Oil, Gas, and Geothermal Resources. 2015. 2015 Report of California Oil And Gas Production Statistics. Sacramento. Available at ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2015/PR03_2015.pdf

[227] California Department of Conservation, Division of Oil, Gas, and Geothermal Resources. 2016. "SB 1281 Data and Reports." 2015 Fourth Quarter Data Files. Available at ftp://ftp.consrv.ca.gov/pub/oil/SB1281/2015/2015%20Q4/Data%20Files

Coalinga & Coalinga East Extension	4,996,254	32,871,256	11,182,994	49,050,504
San Ardo	3,447,155	43,551,844	3,761,455	50,760,454
Lynch Canyon	414,952	872,548	0	1,287,500
Jacalitos	0	0	252,677	252,677
Kettleman North Dome	0	0	0	0
Sargent/Hollister	0	0	0	0
Total	8,858,361	77,295,648	15,197,126	**101,351,135**

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B. BLM Has Not Adequately Analyzed the Water Quantity Impacts of New Development

As described in Section I(A) - (D), BLM's Reasonably Foreseeable Development Scenario (or "RFDS") does not adequately reflect possible future production growth from both conventional and unconventional oil and gas resources. Given that the anticipated environmental consequences described in the EIS are based in large part on the RFDS, BLM's analysis of impacts is inherently flawed. The potential environmental impacts to groundwater and surface water must be revised to take into account the possibility of production growth on BLM-administered leases.

BLM provides end members for a range of total water use by assuming that all 37 wells anticipated to be drilled under the RFD scenario will be either:

1) Conventional vertical wells with well stimulation treatments involving one to three stages; or,
2) Water-intensive horizontal wells with well stimulation treatments involving up to 20 stages.

As noted in our comments on the RFDS, BLM may be significantly underestimating the number of new conventional and unconventional wells that may be drilled. BLM assumes that the high water-use end member would be based on the use of long horizontal wells with multi-stage horizontal fracturing. However, recent data and information from the USGS indicate that if the Monterey source rock play is developed, the anticipated extraction method would be mostly vertical, rather than horizontal, wells.[228] In addition, USGS anticipates that these wells would be tightly spaced with, on average, one well every 18 acres. Although the use of vertical rather than horizontal wells may decrease the per well water needs, the large number of wells that would be required to develop the Monterey could result in significant water use, which in turn may result in significant impacts to water quantity and quality. For example, if the 28,200 acres of federal mineral estate just within active oil and gas fields was developed on 18 acre spacing, that would result in the drilling of more than 1,500 additional wells. Using BLM's minimum estimate of water use of 0.79 – 1.17 acre feet (AF) per well, more than 1,500 well operations would require an estimated 1,238 – 1,833 AF (403,400,000 – 597,280,000 gallons) of water.

[228] Tennyson, M.E., et al., Assessment of undiscovered continuous oil and gas resources in the Monterey Formation, San Joaquin Basin Province, California, 2015: U.S. Geological Survey Fact Sheet 2015-3058 (2015).

BLM's current estimated maximum water use is 1,110 AF of water. BLM summarily dismisses any potential impacts that may result from this upper-end estimate of water use, stating that, "[c]ompared to the resources present in any of the groundwater basins, this small amount would not likely result in any discernable impact." BLM does not state what the current and future water supply and demand in these groundwater basins is and offers no analysis to support this conclusion. Moreover, as stated by the U.S. Environmental Protection Agency[229] and the CCST[230], and acknowledge by BLM in the EIS, impacts from water use are likely to be local and site-specific. As such, simply stating that the total available groundwater resources in a region are large compared to estimated water use is completely insufficient to assess potential impacts and necessary mitigation. BLM also claims, with no support, that because the impacts would be site-specific, they cannot be quantified at this time. BLM can and must develop reasonable scenarios for potential water use based on the location of existing oil fields and areas with high potential for oil and gas development, the location of federal minerals, and current and future water supply and demand in those areas. Based on that assessment, BLM must identify potential impacts and any necessary mitigation measures.

It is especially imperative that BLM conduct an adequate analysis of water quantity impacts, given recent droughts and concerns about water use. A study published in 2016 quantified water volumes used and produced by conventional oil production and hydraulic fracturing in California, and showed that despite a 25% decrease in conventional oil production from 1999 to 2012, total water use increased by 30% and freshwater use increased by 46% due to increased freshwater-intensive tertiary oil production.[231]

In sum, BLM must revise the RFDS to reflect potential future growth in both conventional and unconventional production and reassess potential impacts to water resources and necessary mitigation based on the updated RFDS. The assessment of impacts and mitigation must consider local, site-specific conditions, given that this is the scale at which impacts are expected to occur.

C. BLM Has Not Adequately Analyzed Potential Impacts to Water Quality or Necessary Mitigation Measures

BLM identifies numerous potential pathways by which water quality may be impacted including:

- Surface spills and leaks during the transport of chemicals, during pre-stimulation chemical mixing, or during well stimulation treatment;
- Accidental surface releases of flowback and produced water associated with storage and disposal;

[229] U.S. Environmental Protection Agency, Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States (Final Report), EPA/600/R-16/236F, (2016)
[230] California Council on Science and Technology, An Independent Scientific Assessment of Well Stimulation in California, Volume II: Potential Environmental Impacts of Hydraulic Fracturing and Acid Stimulations (July 2015).
[231] Tiedeman, K., et al., Recent Trends in Water Use and Production for California Oil Production. Environ. Sci. Technol., 2016, 50 (14), pp 7904–7912, DOI: 10.1021/acs.est.6b01240 (May 13, 2016).

- Disposal of flowback and/or produced water in unlined pits;
- Reuse of produced water for irrigated agriculture;
- Fracture created by well stimulation that may connect to a higher permeable zone or to existing faults or abandoned wells; and,
- Migration of well stimulation fluids in the well or well annuli between the casing and the formation or through abandoned wells.

BLM concludes that, "[c]ollectively, the DOGGR regulations, mitigation measures provided in the Final EIR, and the BLM final rule serve to reduce potential impacts to the quantity or quality of usable groundwater," and does not propose any additional mitigation measures. However these regulations and mitigation measures do not adequately address the threats identified above and therefore this mitigation strategy is inadequate.

In addition, the effects of fracking may be worse in California. The US EPA's study on hydraulic fracturing also identified six factors that increase the risk to water resources. All six risk factors apply to hydraulic fracturing in California[232]:

1. Water withdrawals for hydraulic fracturing in times or areas of low water availability, particularly in areas with limited or declining groundwater resources:

2. Spills during the handling of hydraulic fracturing fluids and chemicals or produced water that result in large volumes or high concentrations of chemicals reaching groundwater resources:

3. Injection of hydraulic fracturing fluids into wells with inadequate mechanical integrity, allowing gases or liquids to move to groundwater resources:

4. Injection of hydraulic fracturing fluids directly into groundwater resources:

5. Discharge of inadequately treated hydraulic fracturing wastewater to surface water:

6. Disposal or storage of hydraulic fracturing wastewater in unlined pits resulting in contamination of groundwater resources:

Among the most commonly cited environmental impacts of oil and gas production are degradation of soils and water caused by releases of hydrocarbons and co-produced brine, known as "produced water."[233] The critical importance of properly mitigating the risk of spills and leaks is demonstrated by the many tens of studies describing the environmental impacts of

[232] U.S. Environmental Protection Agency, Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States (Final Report), EPA/600/R-16/236F, (2016)
[233] Kharaka, Y. K., & Dorsey, N. S., Environmental issues of petroleum exploration and production: Introduction. 12 Environmental Geosciences 2 (2005)

hydrocarbon and produced water releases.[234] A multi-year, interdisciplinary study of hydrocarbon and produced water releases at an oil production site in Oklahoma undertaken by the United States Geological Survey ("USGS") found that soil and groundwater at the site were still polluted after more than 60 years of natural attenuation.[235] Contamination caused by releases of hydrocarbons and produced water can be extremely technologically and financially difficult to remediate, if not impossible. As such, the best way to protect the environment is to halt oil and gas development altogether. BLM's failure to include the most basic safeguards as mitigation measures further demosnatrates the inadequacy of the DEIS. Among the mitigation measures that are omitted are:

- Secondary containment must be required for all well stimulation equipment and material including flowback fluid tanks; waste handling tanks; additive containers; and chemical and waste transport, mixing, and pumping equipment. Such secondary containment must:
    - Be designed and constructed in accordance with good engineering practices;
    - Be constructed, coated or lined with materials that are chemically compatible with the environment and the substances to be contained;
    - Provide adequate freeboard;
    - Be protected from heavy vehicle or equipment traffic; and
    - Have a volume of at least 110 percent of the largest storage tank within the containment area.
- The disposal of flowback and produced water into unlined pits should be prohibited;
- Reuse of produced water for irrigated agriculture should be prohibited.

Proper well design and construction are crucial first step to ensuring long-term mechanical integrity. Both California's and BLM's current well construction rules are outdated and inadequate and must be updated to reflect technological advancements in oil and gas extraction techniques. The following additional mitigation measures should be required:

- In areas where the depth to the deepest protected groundwater is not known, operators must estimate this depth. This depth should then be verified by running petrophysical logs, such as resistivity logs, after drilling to the estimated depth. If the depth to the deepest protected water is deeper than estimated, an additional string of casing is required. Surface casing must be of sufficient diameter to allow the use of one or more strings of intermediate casing. All instances of protected water not anticipated on the permit application must be reported including the formation depth and thickness and water flow rate, if known or estimated.
- A formation integrity test (FIT) must be performed immediately after drilling out of all surface and intermediate casing. The test should demonstrate that the casing shoe will maintain integrity at the anticipated pressure to which it will be subjected while drilling the next section of the well, no flow path exists to formations above the casing shoe, and that the casing shoe is competent to handle an influx of formation fluid or gas without

[234] Otton, J. K., Environmental aspects of produced-water salt releases in onshore and estuarine petroleum-producing areas of the United States - a bibliography, U.S. Geological Survey Open-file report 2006-1154 (2006).http://pubs.usgs.gov/of/2006/1154/pdf/of06-1154_508.pdf

[235] Kharaka, Y. K., Otton, J. K., & eds., Environmental impacts of petroleum production - Initial results from the Osage-Skiatook Petroleum Environmental Research Sites, Osage County, Oklahoma, U.S. Geological Survey Water-Resources Investigations Report 03-4260 (2003).

breaking down. If any FIT fails, the operator must contact the regulator and remedial action must be taken to ensure that no migrations pathways exist. The casing and cementing plan may need to be revised to include additional casing strings in order to properly manage pressure.

- All surface, intermediate, and production casing strings must stand under pressure until a compressive strength of 500 psi is reached before drilling out, initiating testing, or disturbing the cement in any way. In no case should the wait-on-cement (WOC) time be less than 8-hours.
- All surface, intermediate, and production casing strings must be pressure tested. Drilling may not be resumed until a satisfactory pressure test is obtained. Casing must be pressure tested to a minimum of 0.5 psi/foot of casing string length or 1500 psi, whichever is greater, but not to exceed 80% of the minimum internal yield. If the pressure declines more than 10% in a 30-minute test or if there are other indications of a leak, corrective action must be taken.
- Surface casing setting depth must be shallower than any hydrocarbon-bearing zones and must be set at least 100' but not more than 200' into a competent confining zone below the base of the deepest protected groundwater and be fully cemented to surface by the pump and plug method.
- Intermediate casing must be used where necessary to isolate protected water, anomalous pressure zones, lost circulation zones, or other drilling hazards. Casing setting depth must be based on local engineering and geologic factors and be set at least 100' below the deepest protected water, anomalous pressure zones, lost circulation zones, and other drilling hazards. Intermediate casing must be set to protect groundwater if surface casing was set above the base of protected water, and/or if additional protected water was found below the surface casing shoe. When intermediate casing is installed to protect groundwater, the operator shall set a full string of new intermediate casing to a minimum depth of at least 100 feet below the base of the deepest strata containing protected water and cement to the surface. The location and depths of any hydrocarbon strata or protected water strata that is open to the wellbore above the casing shoe must be confirmed by coring, electric logs or testing and shall be reported as part of the post-treatment report.
- If both surface casing and intermediate casing are used as water protection casing, or if intermediate casing is not used, a full string of production casing is required. A production liner may be hung from the base of the intermediate casing and used as production casing as long as the surface casing is used as the water protecting casing and intermediate casing is set for a reason other than isolation of protected water.
- When intermediate casing is installed to protect groundwater, it must be fully cemented to surface. When intermediate casing is set for a reason other than to protect strata that contain protected water, it must be fully cemented to surface unless doing so would result in lost circulation. If not cemented to the surface, intermediate casing shall be cemented with sufficient cement to fill the annular space from the casing shoe to at least 600 feet above fluid-bearing formations, lost circulation zones, oil and gas zones, and anomalous pressure intervals, or other drilling hazards. Where the distance between the casing shoe and shallowest zone to be isolated makes this technically infeasible, multi-stage cementing must be used to isolate any hydrocarbon- or fluid-bearing formations or abnormally pressured zones and prevent the movement of fluids.

- When intermediate casing is not used, production casing must be fully cemented to surface unless doing so would result in lost circulation. If not cemented to the surface, production casing shall be cemented with sufficient cement to fill the annular space from the casing shoe to at least 600 feet above fluid-bearing formations, lost circulation zones, oil and gas zones, anomalous pressure intervals, or other drilling hazards. Where the distance between the casing shoe and shallowest zone to be isolated makes this technically infeasible, multi-stage cementing must be used to isolate any hydrocarbon- or fluid-bearing formations or abnormally pressured zones and prevent the movement of fluids. Sufficient cement shall also be used to fill the annular space to at least 100 feet above the base of the freshwater zone, either by lifting cement around the casing shoe or cementing through perforations or a cementing device placed at or below the base of the freshwater zone.
- If fluid returns, lift pressure, displacement and/or other operations indicate inadequate cement coverage, the operator must (i) run a radial cement evaluation tool, a temperature survey, or other test approved by the Division to identify the top of cement, (ii) submit a plan for remedial cementing to the Division for approval and (iii) implement such plan by performing additional cementing operations to remedy such inadequate coverage prior to continuing drilling operations.
- Prior to cementing the hole must be prepared to ensure an adequate cement bond by circulating at least two hole volumes of drilling fluid and ensuring that the well is static and all gas flows are killed. Top and bottom wiper plugs and spacer fluids must be used to separate drilling fluid from cement and prevent cement contamination. Casing must be rotated and reciprocated during cementing when possible and when doing so would not present a safety risk.
- Cement should be pumped at a rate and in a flow regime that inhibits channeling of the cement in the annulus. During placement of the cement, operator shall monitor pump rates to verify they are within design parameters to ensure proper displacement efficiency. Throughout the cementing process operator shall monitor cement mixing in accordance with cement design and cement densities during the mixing and pumping.
- All cement must have a have a 72-hour compressive strength of at least 1200 psi and free water separation of no more than two milliliters per 250 milliliters of cement, tested in accordance with the current API RP 10B. Cement must conform to API Specification 10A and gas-blocking additives must be used. Cement mix water chemistry must be proper for the cement slurry designs. At a minimum, the water chemistry of the mix water must be tested for pH prior to use, and the cement must be mixed to manufacturer's recommendations. An operator’s representative must be on site verifying that the cement mixing, testing, and quality control procedures used for the entire duration of the cement mixing and placement are consistent with the approved engineered design and meet the cement manufacturer recommendations, API standards, and the requirements of this section.
- Compressive strength tests of cement mixtures without published performance data must be performed in accordance with the current API RP 10B and the results of these tests must be provided to the regulator prior to the cementing operation. The test temperature must be within 10 degrees Fahrenheit of the formation equilibrium temperature at the top of cement. A better quality of cement may be required where local conditions make it necessary to prevent pollution or provide safer operating conditions.

- For surface, intermediate, and production casing, at a minimum, centralizers are required at the top, shoe, above and below a stage collar or diverting tool (if used) and through all protected water zones. In non-deviated holes, a centralizer shall be placed every fourth joint from the cement shoe to the ground surface or to within one joint of casing from the bottom of the cellar, or casing shall be centralized by implementing an alternative centralization plan approved by the Division. In deviated holes, the Division may require the operator to provide additional centralization. All centralizers must meet API Spec 10D (Recommended Practice for Casing Centralizers – for bow string centralizers) or API Spec 10 TR4 (rigid and solid centralizers) and 10D-2 (Petroleum and Natural Gas Industries, Equipment for Well Cementing, Part 2, Centralizer Placement and Stop Collar Testing).
- For any section of the well drilled through fresh water-bearing formations, drilling fluids must be limited to air, fresh water, or fresh water based mud and exclude the use of synthetic or oil-based mud or other chemicals.
- To reduce the risk of external casing corrosion all potential flow zones – as defined in API RP 65-2, Isolating Potential Flow Zones During Well Construction – must be properly isolated. Failure to isolate flow zones can also result in annular overpressurization, which can lead to a loss of mechanical integrity, putting groundwater at risk, and/or allow crossflow of subsurface fluids, potentially into protected water if it has not been properly isolated. All well construction materials must be compatible with fluids with which they may come into contact and be resistant to corrosion, erosion, swelling, or degradation that may result from such contact.
- Internal and external well mechanical integrity must be assessed at least yearly.

Older wells in particular may have been designed and constructed with practices not acceptable by today's standards and endanger groundwater. In particular, shallow wells in the state have sometimes been constructed without water protective casing and/or with a single string of casing, including in areas with protected groundwater. The annular space in these wells may also not be fully cemented.

Newer wells typically have at least two and often three barriers between protected water and fluids contained in the well: 1) surface casing 2) production casing 3) production tubing. Wells lacking surface casing/redundant barriers put protected water at serious risk in the case of a well integrity failure due to the fact that both protected water and hydrocarbon-bearing zones are contained behind the same string of casing.

Casing strings that isolate protected water should not be perforated for the purposes of stimulation, production, or injection. Communication between offset wells during stimulation is a serious problem, risking blow outs in adjacent wells and/or aquifer contamination during well stimulation. A New Mexico oil well recently experienced a blowout, resulting in a spill of more than 8,400 gallons of fracturing fluid, oil, and water. The blowout occurred when a nearby well was being hydraulically fractured and the fracturing fluids intersected this offset well.[236] The incident led the New Mexico Oil Conservation Division to request information about other

[236] Jensen, T., Fracking Fluid Blows Out Nearby Well. EarthWorks. October 19, 2013 available at https://www.earthworksaction.org/media/detail/fracking_fluid_blows_out_nearby_well#.WOavl_nyvIU.

instances of communication between wells during drilling, completion, stimulation or production operations.[237] Incidents of communication between wells during stimulation have been documented in British Columbia,[238] Pennsylvania,[239,240] Texas, and other states across the country.[241]

The Alberta Energy Regulator (AER), the oil and gas regulator in Alberta, Canada, recognized that communication between wells during fracturing is a serious risk to well integrity and groundwater after a number of spills and blowouts resulted from communication between wells during fracturing. As a result, AER created requirements to address the risk of communication and reduce the likelihood of occurrence.[242] Similarly, Enform, a Canadian oil and gas industry safety association, published recommended practices to manage the risk of communication.[243] Neither California's nor BLM's rules adequately address the risk of communication between offset wells. Oil and gas projects under BLM's leasing program do not have even the most basic safeguards, including the following::

- For all wells within the Axial Dimensional Stimulation Area (ADSA), the operator must:
    - Evaluate the adequacy of the well design and construction methods to achieve the goal of isolating protected water
    - Assess the internal and external mechanical integrity of each well identified
    - Prepare a plan for performing corrective action if any of the wells identified are improperly designed, constructed, completed, plugged, or abandoned.
    - Perform an assessment to determine the risk that the stimulation treatment will communicate with each well identified.
    - For each well identified as at-risk for communication, prepare a plan for well control, including but not limited to:
        - A method to monitor for communication
        - A determination of the maximum pressure which the at-risk well can withstand
        - Actions to maintain well control
        - If the at-risk well is not owned or operated by the owner/operator of the well to be stimulated, a plan for coordinating with the offset well operator to prevent loss of well control.

The EIS fails to consider three conceptual pathways through which groundwater could be contaminated by well stimulation activities: 1) direct injection of fluids into or above an

[237] State of New Mexico, Energy, Minerals and Natural Resources Department, Aztec District III - Request for Information. n.p. (Oct 22, 2013).
[238] BC Oil and Gas Commission, Safety Advisory 2010-03, Communication During Fracture Stimulation. n.p. (May 20, 2010).
[239] Detrow, S., Perilous Pathways: How Drilling Near An Abandoned Well Produced a Methane Geyser. StateImpact Pennsylvania, National Public Radio (Oct 9, 2012).
[240] Pennsylvania Department of Environmental Protection, Bureau of Oil and Gas Management., Draft Report - Stray Natural Gas Migration Associated with Oil and Gas Wells (Oct 28, 2009).
[241] Vaidyanathan, G., When 2 wells meet, spills can often follow, EnergyWire, E&E News (Aug 5, 2013).
[242] Alberta Energy Board, Directive 083: Hydraulic Fracturing - Subsurface Integrity (May 2013).
[243] Enform Canada, Interim IRP 24: Fracture Stimulation: Interwellbore Communication; An Industry Recommended Practice For the Canadian Oil and Gas Industry, 24 Interim 1st Edition (Mar 27, 2013).

underground source of drinking water 2) movement of fluids from an injection zone through the confining strata; and 3) lateral movement of fluids from within an injection zone into a protected portion of that stratum[244].

i. Direct Injection of Contaminants into Usable Water

Much of California's oil production occurs in relatively shallow formations that often also contain high quality water that may have beneficial uses. In fact, water in these zones often meets the U.S. Environmental Protection Agency's (EPA) definition of an Underground Source of Drinking Water (USDW). Stimulation fluids are injected directly into these waters, potentially resulting in contamination.

ii. Migration of Contaminants Vertically into Protected Water Due to a Lack of Confining Zone

A geologic confining zone can be generally defined as a geologic formation with sufficient areal extent, impermeability, and absence of transmissive faults and fractures such that it can prevent the vertical migration of injected stimulation fluids or displaced formation fluids into protected water. If an appropriate confining zone is not present, injected or displaced fluids may migrate into groundwater, resulting in contamination. As documented in the EIS, there is frequently little or no vertical separation between hydrocarbon-bearing zones and zones containing protected water in California, another reason BLM should halt leasing altogether.

The DEIS fails to include even the most basic mitigation measures requiring that wells that will be stimulated must be sited such that a suitable confining zone is present. The owner or operator must demonstrate to the satisfaction of the regulator that the confining zone:

1. Is of sufficient areal extent to prevent the movement of injected or displaced fluids into protected water;
2. Is sufficiently impermeable to prevent the vertical migration of injected or displaced fluids;
3. Is free of transmissive faults or fractures that could allow the movement of injected or displaced fluids above the stimulated zone; and
4. Contains at least one formation of sufficient thickness and with geomechanical characteristics capable of preventing or arresting vertical propagation of fractures.
5. BLM may require the operator to identify and characterize additional zones that will impede or contain vertical fluid movement.

iii. Migration of Contaminants Laterally from Non-Protected Water into Protected Water

[244] U.S. Environmental Protection Agency, Office of Drinking Water, Statement of Basis and Purpose, Underground Injection Control Regulations (1980), http://www.epa.gov/ogwdw/uic/pdfs/rept_uic_statemt_basis_purpose_uic_1980.pdf

The quality of water contained in a groundwater aquifer may vary laterally, such that protected or usable water may be present in some portions of the aquifer but not others. It is possible that stimulation fluids injected into a portion of an aquifer that does not contain protected or usable water may migrate into a portion an aquifer that does contain protected or usable water.

The DEIS fails to include even the most basic mitigation measures requiring that operators of stimulated wells predict, using site characterization, monitoring and operational data, and computational modeling, the projected lateral and vertical migration of stimulation fluids and formation fluids in the subsurface and demonstrate that injected or displaced fluids will not migrate laterally into protected or usable water. This includes but is not limited to:

1. Maps, cross-sections, and models delineating aquifer extents, volume, and chemistry.
2. Maps, cross-sections, and models delineating the physical and chemical extent of stimulation operations including hydraulically induced fractures, injected fluids, and displaced formation fluids, based on site-specific data. The physical extent would be defined by the modeled length and height of fractures (if any), horizontal and vertical penetration of stimulation fluids and proppant, and horizontal and vertical extent of the displaced formation fluids. The chemical extent would be defined by that volume of rock in which chemical reactions between the formation, hydrocarbons, formation fluids, or injected fluids may occur, and must take into account potential migration of fluids over time.

IX. BLM Failed to Adequately Address Potential Impacts to Wildlife and Sensitive Species

A large and growing body of published scientific research has documented that fracking and other oil and gas development activities have wide-ranging, adverse impacts on species and ecosystems.[245] The DEIS states that over 300 species of birds, mammals, reptiles, and amphibians occur or have the potential to occur within the Planning Area. These include eighty-three species of rare, threatened, and endangered plants and animals, including but not limited to the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, California tiger salamander, California red-legged frog, Vernal pool fairy shrimp, steelhead, California condor and purple amole.[246] BLM failed to adequately address the potential impacts from the proposed oil and gas leasing on these species and others.

One of the obvious failures of the DEIS is postponing determinations of those areas that are inappropriate for development in all alternatives to a later time, after the RMP has been

[245] *See* Center for Biological Diversity Review of the Impacts of Fracking and Other Oil and Gas Development Activity on Wildlife (March 30, 2017), attached hereto as Exhibit E; *see also* Center for Biological Diversity Review of Impacts of Oil and Gas Exploration and Development on Wildlife in California (February 13, 2014), attached hereto as Exhibit F.

[246] See, e.g., Center for Biological Diversity's Map of California Central Coast Field Office RMP Threatened and Endangered Species (2017), attached as Exhibit B available at http://center.maps.arcgis.com/apps/View/index.html?appid=3089adfdf974487fb6ac263612b9e0a1

adopted. As presented below, adequate data is available now in the public domain alone to identify many of the areas that must be set aside for conservation purposes in order to promote recovery for numerous rare, threatened and endangered species. At minimum, BLM must consider limiting all oil and gas activities in these areas.

The DEIS furthermore fails to present an alternative that would prohibit oil and gas development in the essential and critical habitats for rare, threatened, and endangered species, effectively failing to provide even one alternative that does not push these species closer towards the brink of extinction. In addition we could find no requirement in the draft RMP for protocol level surveys for the listed and sensitive species that the wildlife agencies have established such protocols for. Protocol level surveys need to be a requirement in the RMP

In addition, thorough, seasonal surveys must be performed for sensitive plant species and vegetation communities, and animal species under the direction and supervision of the BLM and resource agencies such as the US Fish and Wildlife Service and the California Department of Fish and Wildlife for any areas that are considered for leasing under the draft RMP. When additional surveys are conducted for site specific oil and gas activities, the BLM's RMP must also require full disclosure of survey methods and results to the public and other agencies without limitations imposed by the applicant/lessee to assure full NEPA/ESA compliance. Confidentiality agreements or non-disclosure agreements regarding environmental resources must not be required of any biologists participating in the surveys on public lands or regarding public mineral estate in support of any proposed project.

Species-specific concerns are detailed below:

A. The San Joaquin kit fox

The highly imperiled San Joaquin kit fox was first listed as federally endangered in 1967 and in 1971 as a state endangered species – 50 and 46 years ago respectively. The San Joaquin kit fox is considered an "umbrella" species because of its formerly broad distribution and requirement for relatively large areas of conserved habitat that includes habitat for other rare, threatened and endangered species. Conserving kit fox and its habitat will result in the protection of many other species. The 1998 Recovery Plan for the Upland Species of the San Joaquin Valley ("1998 Recovery Plan") states that the kit fox is "one of the species that will be hardest to recover."[247]

Tragically, this statement from the 1998 Recovery Plan is born out in 2008 modeling of habitat acquisitions for the San Joaquin kit fox that found that the mean time to extinction for San Joaquin kit foxes in the San Joaquin Valley was 24 years.[248] We are within 15 years of reaching a tipping point at which the amount of conserved habitat will be inadequate to sustain the kit fox in the wild, potentially relegating it to the fate of the long-eared kit fox of southern

[247] U. S. Fish & Wildlife Service, Recovery Plan for the Upland Species of the San Joaquin Valley. USFWS Region 1, Portland, OR (1998), http://ecos.fws.gov/docs/recovery_plan/980930a.pdf at pg.ix

[248] McDonald-Madden, Eve et al., Subpopulation Triage: How to Allocate Conservation Effort among Populations, 22 Conservation Biology 3: 656 (2008), http://cosb.us/Solargen/feir/v2/b026refs/McDonald-Madden%20et%20al%202008%20Subpopulation%20Triage.pdf.

California which was declared extinct in 1910. While a stronghold for the San Joaquin kit fox has been in the larger Bakersfield metropolitan area, these foxes are now also declining due to mange, threatening the integrity of the last stable kit fox population on the planet.[249]

While no range-wide monitoring is currently occurring for the kit fox, habitat continues to be converted to uses incompatible for kit foxes persistence and recovery. The planning area includes the northern most core area for the species – the Ciervo-Panoche core area – as well as at least four satellite population areas and numerous habitat linkages identified by USFWS [250] as well as other key habitat areas.[251] And specifically, the proposed HOGPAs overlap the Ciervo-Panoche core area as well as critical linkage and satellite population areas. The 1998 Recovery Plan identifies the key role for San Joaquin kit fox habitat in the Planning area: "A sound, conservative strategy hinges on the enhanced protection and management of three geographically-distinct core populations, which will anchor the spine of the metapopulation." [252] Ciervo-Panoche is one of the three remaining core areas and is the most northerly core area, which increases its importance for conservation as the effects of climate change continue and encourage animals to move north and upslope.

Based on limited monitoring, this valuable species is in significant decline outside of the Bakersfield metropolitan area as well,[253] and further development proposed in the planning area from oil and gas drilling will only promote additional declines by impacting core population areas essential for breeding and recovery, and fragmenting satellite populations, linkages and movement corridors. The DEIS fails to acknowledge the importance of the Planning Area to the continued existence much less the recovery of the San Joaquin kit fox. It also fails to adequately assess how allowing oil and gas exploration activities within the "spine" of the recovery effort in a core area, linkages and satellite recovery areas will affect core and recovery habitat, effect the connectivity between populations, or effect on the persistence of smaller, satellite populations as well as the population as a whole. Clearly this missing analysis of potential impacts to kit fox habitat and its implications for survival and recovery must be included in a supplemental or recirculated EIS.

Although the planning area covers so much of the habitat necessary for kit fox persistence,[254] the DEIS fails to evaluate how the species and its habitat will be impacted by direct and indirect impacts in the Plan Area. How much recovery habitat (core, satellite and

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[249] U.S. Fish & Wildlife Service, Outfoxing mange in the San Joaquin kit fox, Sacramento Office (2017), https://www.fws.gov/sacramento/outreach/Featured-Stories/Outfoxing_Mange/outreach_featured-stories_outfoxing_mange.htm

[250] U.S. Fish & Wildlife Service, San Joaquin Kit Fox 5-Year Review (2010), http://ecos.fws.gov/docs/five_year_review/doc3222.pdf at pg. 12-14.

[251] http://www.canids.org/app/images/journal/16/san_joaquin_kit_fox_habitat_suitability.pdf

[252] U.S. Fish & Wildlife Service, Recovery Plan for the Upland Species of the San Joaquin Valley, USFWS Region 1, Portland, OR (1998), http://ecos.fws.gov/docs/recovery_plan/980930a.pdf at pg. 132

[253] Stafford, Robert et al., Abstract: Long term population and density estimates for San Joaquin Kit Fox on the Carrizo Plain National Monument (2000-2014): Implications for Conservation, presented at TWS-WS 2015 Annual Meeting (2015), http://wildlifeprofessional.org/western/tws_abstract_detail.php?abstractID=906

[254] Cypher, B.L et al., Quantity and Distribution of Suitable Habitat for San Joaquin Kit Fox: Conservation Implications, 16 Canid Conservation and Biology 7:25 (2013), http://www.canids.org/app/images/journal/16/san_joaquin_kit_fox_habitat_suitability.pdf

linkages) will be directly affected by the potential oil and gas development under each alternative? How much habitat (core, satellite and linkages) will be indirectly affected under each alternative? What are the cumulative impacts to these habitats? Such considerations must be analyzed in order to limit development in key areas for sensitive species in general and the kit fox in particular.

Absent a thorough analysis of the alternatives from development impacts, the DEIS cannot adequately evaluate the appropriate avoidance, minimization and mitigation for impacts associated with oil and gas leasing or development to the highly imperiled and beleaguered San Joaquin kit fox.

Rather than conducting the required environmental review, BLM assumes that the Best Management Practices ("BMPs") listed in Appendix D of the DEIS will minimize negative impacts of management actions to wildlife. However, BLM does not actually provide any analysis, scientific evidence, or any data regarding the effectiveness of these BMPs. The proposed BMPs for the San Joaquin kit fox, for example, are inadequate for the following reasons:

- "Survey for dens in the project area." The BMPs only mention conducting surveys for dens. The surveys, however, should be for the San Joaquin kit fox themselves in addition to their dens. The DEIS appears to assume that dens are the only habitat features important to the kit fox. However, the absence of a den does not indicate that kit fox do not use the area for foraging and other activities crucial to maintain the population.
- "Protect dens and establish no-disturbance buffers. Employ passive relocation of non-natal dens." The DEIS provides a buffer of 200 feet for unoccupied natal dens, and 100 feet for known, occupied, and potential non-natal dens. However, protection of dens needs to extend beyond the breeding/pupping season. Passive relocation activities if allowed at all, must be conducted pursuant to an incidental take permit from the U.S. Fish and Wildlife Service and in coordination with the California Department of Fish and Wildlife.
- "Conduct blasting, seismic surveys, and other non-fatal disturbance outside of breeding season." As noted above, disturbance does not only effect breeding but also other essential activities and may result in abandonment of the area by San Joaquin kit fox. These activities will also require an incidental take permit from the U.S. Fish and Wildlife Service and be conducted in coordination with the California Department of Fish and Wildlife.

B. Blunt-nosed leopard lizard

The blunt-nosed leopard lizard is one of a number of fully-protected species potentially present in the planning area, protected under California law (Fish and Game Code §5050),[255] meaning that individuals of the species may not be "taken" (as defined in the Fish and Game

[255]California Department of Fish and Wildlife, Fully Protected Animals, CA.gov (2017), http://www.dfg.ca.gov/wildlife/nongame/t_e_spp/fully_pro.html.

Code) at any time, unless a Natural Communities Conservation Plan is prepared and implemented. All of the RMP alternatives include allowing activities to occur in habitat for the blunt-nosed leopard lizard, yet the DEIS does not discuss the requirements of "taking" a blunt-nosed leopard lizard from impacts in the Planning Area. This issue needs to be comprehensively addressed in a revised EIS.

The blunt-nosed leopard lizard is also a federally endangered species that has been under endangered species act protection for over 40 years. The most recent five-year review by the USFWS for the blunt-nosed leopard lizard[256] lays out the requirements for down-listing as follows:

> "1) Protection of five or more areas, each about 5,997 acres or more of contiguous, occupied habitat, including one each on (addresses Listing Factor A):
>
> A) Valley floor in Merced or Madera Counties;
>
> B) Valley floor in Tulare or Kern Counties;
>
> C) Foothills of the Ciervo-Panoche Natural Area;
>
> D) Foothills of western Kern County; and
>
> E) Foothills of the Carrizo Plain Natural Area.
>
> 2) Management Plan approved and implemented for all protected areas identified as important to the continued survival of blunt-nosed leopard lizard that includes survival of the species as an objective (addresses Listing Factor C and E).
>
> 3) Each protected area has a mean density of 2 or more blunt-nosed leopard lizards 1 per acre through one precipitation cycle (addresses Listing Factor E)"

Of particular concern here is the Ciervo-Panoche Natural Area. For that area, the USFWS 2010 five-year review states:

> Within the Ciervo-Panoche Natural Area, two Areas of Critical Environmental Concern (ACEC), separated by 2 miles, protect 4,800 acres and 3,800 acres of contiguous blunt-nosed leopard lizard habitat, respectively.[257]

The 2010 five-year review determined that the recovery criterion for protection of 5,997 acres of contiguous habitat had not been achieved in the four of the five specified recovery areas including the Ciero-Panoche recovery area. All of the alternatives in the DEIS Planning Area allow for oil & gas development in the area between the two existing Areas of Critical Environmental Concern in the larger Ciervo-Panoche Natural Area. Therefore, as proposed, the

[256] U.S. Fish & Wildlife Service, Blunt-nosed leopard lizard (Gambelia sila) 5-Year Review: Summary and Evaluation (2010), http://www.fws.gov/ecos/ajax/docs/five_year_review/doc3209.pdf.
[257] *Id.* at pg. 5

RMP woull preclude the down-listing of the blunt-nosed leopard lizard forever because it would allow activities to go forward in that area that would never allow the protection of the lands between the two existing ACEC's in order to meet the down-listing criteria, much less the more stringent recovery goals. BLM must propose and analyze alternatives for the RMP that could support and contribute to achieving the *recovery goals* of the suite of imperiled species that occur within the Planning Area including the blunt-nosed leopard lizard. The impacts of the proposed RMP on the blunt-nosed leopard lizard and its habitat must be comprehensively addressed in a revised and recirculated DEIS.

The proposed Best Management Practices for the blunt-nosed leopard lizard are inadequate for the following reasons:

- "Survey for burrows in the project area." The surveys should be for the lizards, not just burrows. While blunt-nosed leopard lizards use burrows constructed by ground squirrels and kangaroo rats, in the absence of such burrows, they also construct shallow, simple tunnels in earth berms or under rocks[258]
- "Avoid and protect burrows." This should be expanded to protect all escape areas for blunt-nosed leopard lizards.
- "Contact BLM if a blunt-nosed leopard lizard is observed in the project area or along access route and comply with any additional measures required by BLM." The state and federal wildlife agencies should also be alerted to the presence of the blunt-nosed leopard lizard at the sites and they too may require additional measure.
- "Conduct daily monitoring of the work area and access routes. Submit monitoring reports to BLM. Submit an Operations and Maintenance Plan describing impact avoidance measures to BLM." As above, state and federal wildlife agencies should also receive monitoring reports and they would also need to evaluate and approve the Operations and Maintenance Plans.
- "Conduct project activities at night when possible." This requirement could conflict with the avoidance of nocturnal species including the San Joaquin kit fox and giant kangaroo rat, therefore more analysis is needed to determine whether it is prudent in this area with multiple species present.
- "Control vehicle speed. Check under vehicles and equipment prior to operation. Conduct vehicle escorts in occupied areas." The BMPs need to include specific speed limits shown to be effective in avoiding impacts to lizards. Both speed limits and vehicle escorts for another rare lizard, the Mojave fringe-toed lizard in the desert were ineffective alone in eliminating mortalities along an access road to the construction site for the Colorado River substation. Vehicle escorts and pre-clearance of roads by biologist for *each pass* of vehicles and equipment is needed.

C. South-Central Coast Steelhead

Proposed development in high potential oil and gas areas ("HOGPAs") on California Central Coast BLM lands overlaps with important rivers for protected steelhead trout

[258] U.S. Fish & Wildlife Service, Blunt-nosed leopard lizard (Gambelia sila) 5-Year Review: Summary and Evaluation (2010), http://www.fws.gov/ecos/ajax/docs/five_year_review/doc3209.pdf.

(*Oncorhynchus mykiss*) populations. Steelhead which inhabit the San Benito River and Salinas River, as well as the San Antonio River (a tributary of the Salinas River), are part of the South-Central California Coast Distinct Population Segment (DPS) of steelhead trout, which is listed as threatened under the Endangered Species Act. The National Marine Fisheries Service also considers some resident "rainbow trout" in these river systems that are above migration barriers to be part of the listed steelhead DPS, since they play an important role in population dynamics and the evolutionary potential of steelhead populations. Steelhead trout in the San Benito and Salinas rivers are identified by NMFS as high priority "core recovery populations."

Steelhead in the South-Central California Coast DPS have declined dramatically, from an estimated 25,000 returning adults historically, to currently less than 500 returning adults in the whole region. The Salinas basin in particular has steelhead runs significantly reduced in size from historical levels, and the current steelhead run is at critically low levels. Monitoring from 2011-2013 found a mean of only 22 adult upstream migrant steelhead per year in the Salinas River. South-Central California Coast DPS steelhead already face significant threats due to agriculture, mining, urbanization, water diversions, loss of riparian and estuarine habitat, climate change, drought, and impacts from invasive fish.[259] The DEIS fails to adequately address direct, indirect and cumulative impacts to the steelhead populations from potential oil and gas activities including from surface run off and hydrocarbon pollution of streams. The impacts of the proposed RMP on the steelhead populations and habitats must be comprehensively addressed in a revised and recirculated EIS.

The proposed Best Management Practices for the steelhead are inadequate. The BMPs will not prevent potential oil spills into steelhead streams from wells, pipelines, and other infrastructure. The BMPs do not stop the proliferation of roads resulting from oil and gas development, which cause excessive sediment to enter streams and damage steelhead habitat.

D. Giant Kangaroo Rat

The Plan area includes core habitat for the state and federally endangered giant kangaroo rats (GKR). Now relegated to the west side of the San Joaquin Valley and the adjacent coast range foothills, the amount of GKR habitat currently extant is only 3% of its historic habitat[260]. Because GKR are known preferred prey items for kit fox[261] clearly the Plan area is excellent habitat for both GKR and kit fox.

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[259] National Marine Fisheries Service, South-Central California Coast Steelhead Recovery Plan. West Coast Region, California Coastal Area Office, Long Beach, California (2013); National Marine Fisheries Service, 5-Year Review: Summary and Evaluation of South-Central California Coast Steelhead Distinct Population Segment, National Marine Fisheries Service. West Coast Region. California Coastal Office, Santa Rosa, California (2016); National Oceanic and Atmospheric Administration, Updated status of federally listed ESUs of West Coast salmon and steelhead, NOAA Tech. Memo NMFS-NWFSC-66 (2005).

[260] Loew, S.S. et al., Population structure and genetic variation in the endangered Giant Kangaroo Rat (Dipodomys ingens), 6 Conservation Genetics 495 (2005) (Lowe et al 2005).

[261] U.S. Fish & Wildlife Service Endangered Species Recovery Program, Recovery Plan for Upland Species of the San Joaquin Valley, California, USFWS Region 1, Portland, OR (1998) (USFWS 1998). http://esrp.csustan.edu/publications/pubhtml.php?doc=sjvrp&file=cover.html.

In USFWS' five year review for the GKR, recommendations for the core area of the Ciervo-Panoche unit is to conserve 100% of occupied habitat, include all 95,000 acres of existing habitat of which only 17% was conserved by 2010[262]. In addition USFWS' Recovery Plan for Upland Species of the San Joaquin Valley[263] states that for GKR, "Where populations of giant kangaroo rats and associated, listed species appear to be robust, land use should *not be changed* when ownership or conservation status of parcels changes unless there are compelling reasons to do so." [Emphasis added] None of these recommendations are acknowledged the DEIS, even as part of an avoidance, minimization or mitigation strategy. As with the kit fox, identification and analyses of movement corridors and linkages are conspicuously absent and must be identified and analyzed for impacts as well as conservation opportunities. Conservation of occupied GKR habitat, maintenance of connectivity and enhancement of effective dispersal between populations are the keys to recovering this imperiled species[264]

While the DEIS mentions the Panoche Solar project (at 3.2-4), which is under construction, project has been allowed to move forward in one of the densest GKR habitats currently known. This large cumulative impact to the GKR population makes the conservation of other parts of the core area and peripheral populations even more important.

The impacts of the proposed RMP on the GKR and its habitat must be further identified and analyzed in a revised and recirculated EIS.

E. California Tiger Salamander

California tiger salamanders (CTS) that are listed as threatened under the federal ESA are known to occur within the Planning Area. While breeding habitat is of course crucial for the salamander's survival, extensive, contiguous upland habitat is as important as the breeding site in conserving CTS populations. Land use changes in the Planning Area that would reduce the size and availability of upland habitat will adversely affect populations. CTS need at least 300-350 acres of contiguous upland habitat around any breeding sites which are crucial for foraging, estivation, and over-wintering and to protect the breeding adult population. Habitat connections between such upland-aquatic sites are also crucial for long-term metapopulation stability. The DEIS fails to discuss any strategy to prioritize areas for conservation in order to protect foraging, estivation, and over-wintering sites for the breeding adult population of CTS. The impacts of the proposed RMP on the CTS and its habitat must be further identified and analyzed in a revised and recirculated EIS.

F. California Red-Legged Frog

The federally threatened California red-legged frog is known from the Planning Area. This red-legged frog is California's state amphibian and is in decline throughout its range. Development or impacts to crucial habitat for the red-legged frog will decrease the recoverability of the species as it fails to "Protect known populations" as recommended by U.S. Fish and

[262] U.S. Fish & Wildlife Service, Giant kangaroo rat (Dipodomys ingens) 5 Year Review: Summary and Evaluation, Sacramento Office (2010) at pg. 38.
[263] USFWS 1998.
[264] Loew et al. 2005.

Wildlife Service's Recovery Plan.[265] The Recovery Plan also recognizes that oil and gas development is a threat to the California red-legged frog and that "There is always a risk of leakage or breakage [of oil and gas pipelines] near stream crossings."[266]

The DEIS fails to put the impacts to the red-legged frog into context with regards to the ongoing worldwide amphibian extinction crisis[267], and fails to identify the numerous impacts of expanded oil and gas drilling on the California red-legged frog and its habitat. Planning with inadequate identification and evaluation of impacts can lead to a "death by a thousand cuts" (or in this case, extinction by a thousand cuts) scenario. We believe significantly more safeguards need to be put in place to protect the red-legged frog populations in the Planning Area from further declines. The DEIS is wholly inadequate in the impact analysis for this species. The impacts of the proposed RMP on the California red-legged frog and its habitat must be further identified and analyzed in a revised and recirculated EIS.

G. Vernal Pool Fairy Shrimp

The U.S. Fish and Wildlife Service's Recovery Plan for Vernal Pool Ecosystems of Northern California and southern Oregon[268] identifies that 80% of all occurrences of vernal pool fairy shrimp need to be conserved in order for delisting to be considered. The DEIS relies on inadequate language of "Specialized habitats such as riparian areas, vernal pools, other wetlands, floodplains, native perennial grasses, saltbrush, and oak woodlands would be avoided by surface disturbing activities *when practical and feasible alternatives exist*." [Emphasis added] (at pg.4.11-7). This vague requirement does nothing to ensure avoidance of impacts. The DEIS also suggests that mitigation ratio of 5:1 (acquisition:disturbance) will be used instead of in-place preservation. However, mitigation still results in net loss of habitat for the species. The DEIS needs to include clearer avoidance requirements and a hard limit for a disturbance cap for existing vernal pools in the Planning Area for those rare instances where impacts are truly unavoidable. We recommend a disturbance cap of 5% or less of the vernal pools that contain vernal pool fairy shrimp, so that the goals of the Recovery Plan can ultimately be achieved. The impacts of the proposed RMP on the vernal pool fairy shrimp and its habitat must be further identified and analyzed in a revised and recirculated EIS.

H. Santa Lucia Purple Amole and Other Rare and Imperiled Plants

The Planning Area and HOGPA include habitat for the highly imperiled Santa Lucia purple amole **(***Chlorogalum purpureum* var. *purpureum*) including federally designated critical

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[265] U.S. Fish & Wildlife Service, Recovery Plan for the California Red-legged Frog (Rana aurora draytonii), USFWS Region 1, Portland, OR (1998), http://ecos.fws.gov/docs/recovery_plan/020528.pdf.
[266] *Id*. at pg. 20.
[267] Bishop, P.J. et al., The amphibian extinction crisis – what will it take to put the action into the Amphibian Conservation Actio Plan? 5 S.A.P.I.E.N.S. 2 (2012), available at https://www.researchgate.net/profile/Phillip_Bishop/publication/236858285_The_Amphibian_Extinction_Crisis_-what_will_it_take_to_put_the_action_into_the_Amphibian_Conservation_Action_Plan/links/00b7d519976a250885000000.pdf
[268] U.S. Fish & Wildlife Service, Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon, USFWS Region 1, Portland, OR (2005).

habitat.[269] While there is no recovery plan for this extremely narrow endemic, the development of oil and gas in the Planning Area in and near the purple amoles' habitat has the potential to impact the plants and habitat. Because this species has been observed to grow on undisturbed soils that are cryptogamic or with cryptogamic crusts,[270] any soil disturbance could be detrimental to their persistence over the long-term.

The DEIS fails to analyze the potential serious impact that oil and gas development in the Planning Area may have on the Santa Lucia purple amole. While the critical habitat lies outside of the San Ardo Oil and Gas Field (DEIS at Figure 3.12-1b), it is unclear if BLM has surveyed for the amole on its surface estate in the area. It is also unclear, and perhaps less likely that surveys for the amole have occurred on the split estate because of the private surface rights. If surveys have been done, the results must be provided. The DEIS mentions the amole in only two places: in Table 3.12-2 and that "Santa Lucia purple amole is located in the vicinity of lease lands" (at pg. 3.12-28). The DEIS does state that "Field surveys would be required to determine if these species are present or potentially present on the lease lands" (at pg 3.12-28). For purposes of adequate analysis in this DEIS, surveys determining the presence of the species is essential in order to ensure that occupied habitat is precluded from being included in the lease or development areas.

Furthermore, the Environmental Consequences section provides no safeguards for any rare plant populations including the Santa Lucia purple amole stating only: "Listed plant populations *usually* would be avoided by development." (at pg. 4.12-12) [Emphasis added.] This language is totally inadequate when coupled with the lack of surveys in the Planning Area. Because the purple amole is a herbaceous perennial plant, it spends most of its time under the soil surface, undetectable except when it is above ground in flower and fruit.

Much greater safeguards must be put in place for the rare plants that could be affected by oil and gas development in the area including the endangered purple amole. We suggest at a minimum, the revised DEIS include requirements for appropriate surveys for all rare plants following the California Native Plant Society (CNPS) and California Department of Fish and Game (CDFG) floristic survey guidelines[271] and should be documented as recommended by CNPS[272] and California Botanical Society policy guidelines.

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[269] U.S. Fish & Wildlife Service, Final Designation of Critical Habitat for Chlorogalum purpureum, a Plant From the South Coast Ranges of California; Correction, 79 Fed Reg 20083 (April 24, 2003), https://ecos.fws.gov/docs/federal_register/fr4084.pdf

[270] U.S. Fish & Wildlife Service, Purple Amole (Chlorogalum purpureum) Five-year Review: Summary and Evaluation (September 2008), https://ecos.fws.gov/docs/five_year_review/doc1996.pdf

[271] California Native Plant Society, Rare Plant Program: CNPS Botanical Survey Guidelines (2011), http://www.cnps.org/cnps/rareplants/inventory/guidelines.php ; California Department of Fish and Game, Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (Nov 24, 2009), https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18959&inline; and U. S. Fish & Wildlife Service, Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants (Sept 23, 1996), http://www.fws.gov/sacramento/es/Survey-Protocols-Guidelines/Documents/Listed_plant_survey_guidelines.PDF

[272] California Native Plant Society, Policy with Regard to Plant Collecting for Educational Purposes (1993), http://www.cnps.org/cnps/archive/collecting.php

The impacts of the proposed RMP on the purple amole and its habitat and other rare plants in the planning area must be further identified and analyzed in a revised and recirculated EIS.

I. California Condor

The Planning Area is known habitat for the highly imperiled California condor which is a state and federally listed endangered species and a fully protected species in California. Despite the relative success that the California condor recovery efforts over the past decades,[273] lead poisoning and other threats continue to require substantial management efforts. The Planning Area is also included in the Ridley-Tree Condor Preservation Act, which requires use of non-lead ammunition in condor habitat to help eliminate the threat of lead poisoning to California condors. However, the development of more oil and gas within the Planning Area will increase the threats to California condors, potentially mooting the benefits of this important legislation.

The DEIS downplays the potential serious impact of oil and gas development in the Planning Area may have on the California condor. This species is in such dire circumstances and requires such large swaths of habitat that every acre of occupied habitat is needed for its ongoing recovery. Oil and gas development on foraging habitat reduces the amount of contiguous habitat safely available to the condor and causes a range contraction, which the California condor cannot afford.

Impacts to California condors can occur even from condors simply landing on oil pads, , from noise associated with drilling new wells, reactivating and/or reworking existing wells (including converting the wastewater well to an oil and gas well), landing in or near waste ponds and sumps, and habituation impacts can occur well beyond the boundaries of an oil pad. These impacts should be evaluated, avoided, minimized and mitigated. Oil development has harmed California condors and their habitat on several occasions. In April 2002, the U.S. Fish and Wildlife Service had to flush condor number 100 from an oil pad, and later recorded oil on its face and wings. The U.S. Fish and Wildlife Service determined that the condor became oiled while trying to tear an oily rag from a pipe. Photographs and reports demonstrate habituation of condors to oil drilling equipment. The U.S. Forest Service also noted in 2005 that a condor became oiled due to "a small spill of oil that occurred when the condor was present and flew down to the spill before the workers could remove the oil." Other condors have been found with oil on their heads as well, according to FWS. See e.g. photo of condor with oil on its head, attached as Exhibit D,[274] to see how oil and gas drilling may impact California condors.

While the DEIS includes Best Management Practices and SOPs specifically for California condors (at pg.4.12-4), many of them are wholly inadequate as follows:

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[273] U.S. Fish & Wildlife Service, California Condor Recovery Program 2015 Annual Condor Population Status Update (2015), https://www.fws.gov/cno/es/pdf%20files/Ca-Condor-Recovery-Prog2015PopulationStatus.pdf

[274] U.S. Fish & Wildlife Service, California Condor Recovery Program 2015 Annual Report, Hopper Mountain National Wildlife Refuge Complex (2015) https://www.fws.gov/cno/es/CalCondor/PDF_files/2015_Annual_HMNWRC_Condor_Field_Report_Final_24AUG2016.pdf

- Appendix D states that drilling and well completion activities "may be" restricted to "certain time periods" to reduce impacts. BLM however does not have a strict requirement for reducing impacts and does not specify what time periods it means. Are these seasonal, or temporal restrictions? What impacts would these restrictions reduce?
- BLM also claims that operators will "designate a representative to oversee compliance." Because BLM would be the authorizing agency, the representative overseeing compliance needs to be a BLM employee and answerable to the agency, not a private company.
- The DEIS also vaguely claims that "direct contact with California condors shall be avoided." This statement leaves open the possibility of direct contact (i.e. avoid does not assure no contact) with condors. Therefore, an incidental take permit would be required from US Fish and Wildlife Service for any contact by individuals. Close coordination with the California Department of Fish and Game is also required because the California condor is a fully protected species under State law, and therefore no lethal take is allowed.
- The DEIS states that all equipment and work-related materials, as well as liquids "shall be contained in closed containers" and that any spills of hazardous liquids shall not be left unattended until clean-up is complete." Despite the best of intentions, as identified above, condors can still sustain impacts from oil spills. The RMP requirements need to be stricter and more specific to reduce and avoid impacts to the condor from equipment and work related materials.
- The DEIS states that landing deterrents will be attached to walking beams on pumping units. A clear definition of "walking beams" needs to be provided. Condors are known to land on pumping units,[275] (see photo attached as Exhibit D) and deterrents need to be installed on all surfaces of pumping units to deter condor landings. If any active deterrence is proposed to be used, such as various forms of hazing, a federal ESA incidental take permit would be required for each operator as well as approvals from the California Department of Fish and Game.
- The DEIS states that power lines will not span canyons or be located on ridgelines, and that bird deflectors will be installed on power lines, and that these power lines will be designed with "sufficient separation" to prevent electrocution of condors. Actually U.S. Fish and Wildlife Service's Condor Recovery Program recommends relocating power lines underground or encasing them in insulated tree wire, which improves visibility to condors, to minimize the potential for collisions and electrocutions.[276] This strategy needs to be incorporated into the avoidance and minimization measures in the RMP.

Because the impacts of the proposed RMP for oil and gas leasing and operations on the California condor and its habitat are not adequately identified or analyzed in the DEIS, it must be revised and recirculated for public comment.

[275] Los Padres Forest Watch, California Condor: Gymnogyps californianus, http://lpfw.org/our-region/wildlife/california-condor/ (accessed April 6, 2017).
[276] U.S. Fish & Wildlife Service, Threats to California Condor Survival, USFWS Pacific Southwest Region, https://www.fws.gov/cno/es/CalCondor/Condorthreats.html (accessed April 6, 2017).

X. BLM Failed to Take a Hard Look at the Risks of Induced Seismicity or Other Geological Hazards

Despite the foreseeability of a higher risk of induced earthquake activity resulting from new oil and gas development, the DEIS does not discuss the direct or indirect impacts that more and greater induced earthquakes are likely to have on the resources in the areas to be leased, including harms to people, property, and the environment. As detailed below, the DEIS mischaracterizes the state of scientific research on induced seismicity from oil and gas development; ignores the large and growing body of scientific evidence linking wastewater disposal, fracking, and other oil and gas development practices to induced earthquakes in California and other parts of the country, including damaging earthquakes; has a fundamentally flawed cumulative effects analysis; and proposes wholly inadequate mitigation measures.

A. The DEIS mischaracterizes the state of scientific research on induced seismicity from oil and gas development

The DEIS mischaracterizes the state of the science on seismic risks from oil and gas development, by inaccurately reporting the conclusions of the CCST (2014) report and by ignoring the findings of the large and growing body of scientific research on induced seismicity.

The DEIS inaccurately cites the CCST (2014) report to assert that the potential for induced seismicity due to wastewater disposal in California is "considered to be low."[277] This is incorrect. The CCST (2014) report repeatedly states that the potential seismic hazard from wastewater disposal is "uncertain," in large part due to lack of research and data limitations resulting from DOGGR's failure to require needed data from the oil and gas industry.[278] Although the CCST (2014) report states that the fracking as currently carried out in California "is not considered to pose a high seismic risk,"[279] the report concludes that an increase in fracking activity and the resultant increase in oil and gas production in California could increase seismic hazards.[280]

The DEIS fails to disclose other important findings from the CCST (2014) report on the seismic risks and hazards stemming from oil and gas development in California, including the following:

[277] DEIS at 4.3-1 ("The potential for induced seismicity due to hydraulic fracturing or fluid disposal in Class II injection wells as they are currently carried out is considered to be low (CCST, 2014)."); DEIS at 5-6 ("The current risk of induced seismicity from wastewater disposal in California is small").
[278] CCST (2014) at 267-268 ("However, the potential seismic hazard posed by current water disposal in California is uncertain because possible relationships between seismicity and wastewater injection have yet to be studied in detail."); CCST (2014) at 303 ("the relationship between seismicity and wastewater injection in California has not been fully evaluated. Therefore, the potential level of seismic hazard posed by wastewater disposal is at present uncertain").
[279] CCST (2014) at 303 ("Therefore, based on experience elsewhere, hydraulic fracturing as currently carried out in California is not considered to pose a high seismic risk.").
[280] CCST (2014) at 268 ("Injection of larger volumes of produced water from increased well stimulation activity and the subsequent increase in oil and gas production could conceivably increase the hazard").

- The risk of induced earthquakes, and the size of those earthquakes, may be as great or greater in California as in the central US: "Based just on the observed depths of earthquakes relative to injection depths in the reported cases of induced seismicity discussed in Section 4.3.5, it would appear that the overall potential for seismicity to be induced by wastewater injection may be at least as high in California as in the central U.S. Furthermore, some M5-6 events are observed to occur at relatively shallow depths in California, which suggests that induced earthquakes could be at least as large as those experienced to date in the continental interior."[281]

- "[T]he overall likelihood of nuisance from wastewater injection-induced earthquakes is relatively high."[282]

- Many of California's wastewater disposal wells are close to active faults: "Across all six oil-producing basins, over 1,000 wells are located within 2.5 km (1.5 miles) of a mapped active fault, and more than 150 within 200 m (650 ft)."[283]

- Future injection could increase the likelihood of triggering earthquakes on the San Andreas Fault, which runs through the project area: "If future high-volume injection took place in or close to these existing oilfields, it is plausible that the likelihood of triggering earthquakes on the SAF could increase."[284]

- Gaps in the DOGGR injection database "seriously limit its usefulness for investigating induced seismicity in California": (1) DOGGR requires the industry to report injection rates and wellhead pressures as monthly averages, instead of providing the needed finer scale data, and (2) injection depths are not reported for majority of injection wells (more than 85% have no depth data).[285]

Several key findings of the CCST (2014) report are also outdated as the science on induced seismicity has rapidly evolved in recent years, but this is not acknowledged by the DEIS. As detailed below, studies published subsequent to the CCST (2014) report have documented wastewater-injection-induced earthquakes in California and at least eight other states, as well as fracking-induced earthquakes ranging up to magnitude 4.6. New studies also suggest that there is no upper bound on the size of fracking and wastewater-induced earthquakes, meaning that large and dangerous earthquakes can be induced by oil and gas development activities.[286] For example, Van der Elst (2016) concluded that

> If induced earthquakes occur on tectonic faults oriented favorably with respect to the tectonic stress field, then they may be limited only by the regional tectonics

[281] CCST (2014) at 280.
[282] *Id.* at 303.
[283] *Id.* at 30.
[284] *Id.* at 303-304.
[285] *Id.* at 299.
[286] Atkinson, G.M. et al., Hydraulic fracturing and seismicity in the Western Canada Sedimentary Basin87 Seismoligcal Research Letters May/June (2016); Van der Elst, N.J. et al., Induced earthquake magnitudes are as large as (statistically) expected, 121 J. Geophys. Res. Solid Earth 4575 (2016) ("Van der Elst 2016").

and connectivity of the fault network. In this study, we show that the largest magnitudes observed at fluid injection sites are consistent with the sampling statistics of the Gutenberg-Richter distribution for tectonic earthquakes, assuming no upper-magnitude bound... [T]he results imply that induced earthquake magnitudes should be treated with the same maximum magnitude bound that is currently used to treat seismic hazard from tectonic earthquakes.[287]

B. The DEIS ignores scientific research linking wastewater injection and other oil and gas development practices with induced earthquakes in California

The DEIS fails to acknowledge scientific studies that have linked oil and gas wastewater injection and fluid withdrawal to induced earthquakes in California. Research published in February 2016 linked wastewater injection in the Tejon oil field near Bakersfield with an earthquake swarm in 2005, in which two earthquakes reached magnitude 4.7.[288] These earthquakes occurred about five miles from the injection wells linked to the seismic activity. In a related 2015 study, researchers identified at least three other cases in Kern County where wastewater injection likely induced earthquakes, including earthquakes greater than magnitude 4.[289] The seismologists cautioned that the damage from induced earthquakes in California can be disastrous: "considering the numerous active faults in California, the seismogenic consequences of even a few induced cases can be devastating."[290] The researchers also cautioned that fluid flow from injection wells may be extensive in areas with active faults, meaning that siting injection wells at a prescribed distance from the nearest active fault "may not be sufficient to mitigate a potential seismic hazard increase."[291]

A retrospective analysis of early twentieth-century earthquakes in the Los Angeles basin concluded that several highly damaging earthquakes were likely induced by oil and gas production.[292] The study suggested that the earthquakes were induced by fluid (oil and water) withdrawal, and influenced by the proximity of wells to active faults and well depth. Although not examined by the study, the researchers noted that several other damaging earthquakes, including the 1925 Santa Barbara, 1927 Ventura, and 1952 Kern County earthquakes may have also been induced by oil and gas development activities. A U.S. Geological Survey report noted that earthquake swarms in the San Ardo oil field ranging up to magnitude 4.5 were likely induced by oil industry fluid withdrawal.[293]

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[287] Van der Elst 2016 at 4575.
[288] Goebel, Thomas et al., Wastewater disposal and earthquake swarm activity at the southern end of the Central Valley, California, 43 Geophys. Res. Lett. doi:10.1002/2015GL066948 (2016)
[289] Goebel, T.H.W. et al., An objective method for the assessment of fluid injection-induced seismicity and application to tectonically active regions in central California, 120 J. Geophys. Res. Solid Earth 7013 (2015).
[290] Goebel, T.H.W. et al. 2016 at 1098.
[291] Goebel, T. et al., A probabilistic assessment of wastewater injection induced seismicity in central California, Abstract of presentation at 2014 Meeting of American Geophysical Union, San Francisco (2014)
[292] Hough, S.E. and M. Page, Potentially induced earthquakes during the early twentieth century in the Los Angeles Basin, 106 Bulletin of the Seismological Society of America 2419 (2016).
[293] Rosenberg, L.L. and J.C. Clark, Map of the Rinconada and Reliz Fault Zones, Salinas River Valley, California, U.S. Geological Survey (2009) at 21.

Scientific research has established that high volumes, pressures, and duration of injection can increase the risks of induced seismicity,[294] yet DOGGR continues to allow the oil industry to inject high volumes, rates, and pressures of wastewater near faults.[295] Published research, not acknowledged by the DEIS, highlights that many of California's wastewater disposal wells are injecting at rates associated with an increased risk of induced seismicity (e.g., greater than 100,000 barrels per month),[296] and extremely high injection rates of 600,000 barrels per month are common.[297] Moreover, wastewater injection volumes in California more than doubled between 2000 and 2015, according to Department of Conservation data,[298] which is associated with higher seismic risk.

Table 2. Total Wastewater Injected Statewide in CA.

Year	barrels (bbl)	gallons
1995	450,050,232	18,902,109,744
1996	437,773,845	18,386,501,479
1997	434,207,137	18,236,699,758
1998	397,756,658	16,705,779,636
1999	350,708,918	14,729,774,556
2000	363,047,553	15,247,997,226
2001	362,232,993	15,213,785,706
2002	397,467,282	16,693,625,844
2003	416,969,361	17,512,713,162
2004	455,295,784	19,122,422,928
2005	463,777,827	19,478,668,734
2006	535,871,677	22,506,610,434
2007	558,816,108	23,470,276,536
2008	553,762,144	23,258,010,048
2009	635,517,685	26,691,742,770
2010	700,422,410	29,417,741,220
2011	761,797,881	31,995,511,002
2012	819,588,712	34,422,725,904
2013	829,734,622	34,848,854,124
2014	904,632,098	37,994,548,116
2015	916,590,308	38,496,792,936

[294] Rubinstein, J.L. and A.B. Mahani, Myths and facts on wastewater injection, hydraulic fracturing, enhanced oil recovery, and induced seismicity, 86 Seismological Research Letters July/August (2015); Weingarten, M. et al., High-rate injection is associated with the increase U.S. mid-continent seismicity, 348 Science 1336 (2015).
[295] Goebel, T.H.W. et al. 2015.
[296] Goebel, T.H.W. et al. 2015, at 7016
[297] Goebel, T.H.W. et al. 2015, at 7022
[298] Wastewater injection data from California Department of Conservation. 2015. Oil and Gas: Online Data, Division of Oil, Gas, and Geothermal Resources. Accessed at ftp://ftp.consrv.ca.gov/pub/oil/monthly_production_reports

More than 38 billion gallons (~917 million barrels) of wastewater were injected into California disposal wells in 2015 alone.[299] The use of extreme, water-intensive oil and gas recovery techniques, such as fracking, waterflood, and cyclic steam injection, has contributed to this significant rise in wastewater production.

Furthermore, many of California's wastewater disposal wells are close to active faults, which increases the risks of induced seismicity.[300] When recently active faults are considered (e.g., faults that have caused earthquakes within the past 200 years), a recent analysis found that 87 of California's active wastewater disposal wells are injecting within one mile of fault, while 350 are injecting within five miles of a fault.[301] When all known faults are considered, nearly one-fifth of California active wastewater injection wells are within one mile of a fault (302 wells), while half are within five miles of a fault (808 wells).[302]

Despite the documented risks from induced seismicity, California's Underground Injection Control (UIC) regulations fail to address the seismic hazards from injection operations. DOGGR does not require the oil and gas industry to report, and make publicly available, the fluid injection data needed for researchers to adequately detect and monitor induced seismicity near injection wells, such as hourly injection rates, wellhead pressure, and downhole pressures, despite calls from seismologists for this crucial data.[303]

DOGGR similarly does not require adequate seismic monitoring in California oil fields needed to precisely locate earthquakes, including earthquakes of low magnitudes (e.g., 1.5 and 2) that provide important early warnings that large and potentially dangerous faults are being reactivated by fluid injection before larger earthquakes occur.[304] Moreover, DOGGR's UIC regulations fail to require even the most basic best practices recommended by the Environmental Protection Agency for monitoring and mitigating induced seismicity hazards.[305]

C. The DEIS fails to acknowledge the large body of research linking induced seismicity to fracking, wastewater disposal, and other oil and gas development activities across the United States

[299] California Department of Conservation, Oil and Gas: Online Data, Division of Oil, Gas, and Geothermal Resources (2015),ftp://ftp.consrv.ca.gov/pub/oil/monthly_production_reports
[300] CCST (2014) at 30; Arbalaez, Jhon et al., On Shaky Ground: Fracking, Acidizing, and Increased Earthquake Risk in California, Earthworks, Center for Biological Diversity, and Clean Water Action (March 2014), http://www.shakyground.org/wp-content/uploads/2014/02/ShakyGround-FINAL1.pdf (Arbalaez 2014)
[301] Arbalaez 2014.
[302] *Id*.
[303] McGarr, A. et al., Coping with earthquakes induced by fluid injection, 47 Science 830 (2015); Rubinstein, J.L. and A.B. Mahani. 2015
[304] *Id*
[305] U.S. Environmental Protection Agency, Minimizing and Managing Potential Impacts of Injection-Induced Seismicity From Class II Disposal Wells: Practical Approaches, Underground Injection Control National Technical Workgroup. (2015).

The DEIS fails to acknowledge the large and growing body of published scientific research documenting that oil and gas development activities, including fracking, wastewater injection, enhanced oil recovery, and fluid (oil and water) extraction, have induced earthquakes across many regions of the United States.[306]

Notably, the DEIS fails to disclose that fracking can induce larger earthquakes than previously thought, and that fracking is increasingly recognized as a significant source of seismic hazard.[307] Scientific research has linked fracking with induced earthquakes ranging up to magnitude 4.6.[308] Induced earthquakes have been linked to fracking in Ohio[309] and Oklahoma,[310] England,[311] British Columbia and Alberta,[312] including larger events of magnitudes 3 and 4. Research also indicates that maximum earthquake size induced by fracking may be controlled by the size of the fault surface in a critical stress state, rather than the net injected fluid volume, meaning that large fracking-induced earthquakes are possible.[313]

Atkinson et al. (2016) cautioned that fracking in the United States may be causing higher-than-recognized induced earthquake activity that is being masked by more abundant wastewater-induced earthquakes:

> In the United States basins where the pace of development has been even greater [than in Canada], previous assertions that hazards from HF [fracked] wells are negligible (National Research Council, 2013) warrant re-examination. In particular, it is possible that a higher-than-recognized fraction of induced earthquakes in the United States are linked to hydraulic fracturing, but their identification may be masked by more abundant wastewater-induced events.[314]

Although not discussed by the DEIS, the injection of oil and gas wastewater, often associated with fracking, has been linked to the dangerous proliferation of earthquakes in many

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[306] Ellsworth, W.L., Injection-induced earthquakes, 341 Science 1225942 (2013); Nicholson, C. and R. Wesson, Triggered earthquakes and deep well activities, 139 Pure Appl. Geophys. 561 (1992); National Research Council, Induced Seismicity Potential in Energy Technologies, National Academies Press (2013).
[307] Atkinson, G.M. et al. 2016.
[308] Schultz, R. et al., Hydraulic fracturing and the Crooked Lake Sequences: Insights gleaned from seismic networks, 42 Geophysical Research Letters (2015); Schultz, R. et al., A seismological overview of the induced earthquakes in the Duvernay play near Fox Creek, Alberta, 122 J. Geophys. Res. Solid Earth 492 (2017)
[309] Skoumal, R., et al., Earthquakes induced by hydraulic fracturing in Poland Township, Ohio, Bulletin of the Seismological Society of America 105 (2015); Friberg, P.A. et al., Characterization of an earthquake sequence triggered by hydraulic fracturing in Harrison County, Ohio, 85 Seismological Research Letters 6 (2014).
[310] Holland, A., Earthquakes Triggered by Hydraulic Fracturing in South-Central Oklahoma, 103 Bulletin of the Seismological Society of America 3:1784 (2013).
[311] Clarke, H. et al., Felt seismicity associated with shale gas hydraulic fracturing: The first documented example in Europe, 41 Geophysical Research Letters 8308 (2014).
[312] Farahbod, A.M. et al., Investigation of regional seismicity before and after hydraulic fracturing in the Horn River Basin, northeast British Columbia, 52 Canadian Journal of Earth Sciences 112 (2014); Atkinson, G. et al., Abstract: Ground motions from three recent earthquakes in Western Alberta and Northeastern British Columbia and their implications for induced-seismicity hazard in eastern regions. Seismological Research Letters (2015); Schultz, R. et al. 2015); Atkinson, G.M. et al. 2016.
[313] Atkinson, G.M. et al. 2016.
[314] Atkinson, G.M. et al. 2016, at 13.

parts of the country, including damaging earthquakes. [315] For example, a magnitude 5.8 induced earthquake near Pawnee, Oklahoma, in 2016 caused at least one injury and severe structural damage; a magnitude 5.7 induced earthquake outside Oklahoma City in 2011[316] injured two people, destroyed 14 homes, and caused millions of dollars' worth of damage to buildings and infrastructure. [317] A magnitude 5.3 induced earthquake near Trinidad, Colorado, in 2011[318] and magnitude 4.8 near Timpson, Texas, in 2012[319] also caused significant structural damage. In the central and eastern U.S., a U.S. Geological Survey analysis found that 7 million people live and work in areas vulnerable to damaging injection-induced earthquakes.[320]

Published research has linked oil and gas wastewater injection to induced earthquakes in at least nine states, including California. Oklahoma's earthquake activity has skyrocketed because of the massive amounts of wastewater disposal resulting from fracking.[321] In 2015 earthquake activity was 600 times greater than it was prior to 2008 according to the Oklahoma Geological Survey, [322] and earthquake swarms are occurring over ~15% of the state's area.[323] Large earthquakes linked to wastewater injection in Oklahoma include the 2016 magnitude 5.8 earthquake near Pawnee which was the largest in the state's history; the 2011 magnitude 5.7 near Prague; the 2016 magnitude 5.2 near Fairview; and the 2016 magnitude 5.0 near Cushing beneath the US's largest oil storage facility.[324]

In Texas, recent analysis indicates that oil and gas development activities have induced earthquakes in many regions of Texas over the past 90 years due wastewater injection, fluid withdrawal, and enhanced oil recovery, with recent increases in induced earthquake activity attributed primarily to wastewater injection.[325] Published research has linked wastewater injection to induced earthquakes in the heavily populated Dallas-Fort Worth region,[326]

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[315] Ellsworth, W.L. 2013.
[316] Keranen, K.M. et al., Potentially induced earthquakes in Oklahoma, USA: Links between wastewater injection and the 2011 M_w 5.7 earthquake sequence, 41 Geology 699 (2013); Keranen, K.M. et al., Sharp increase in Central Oklahoma seismicity since 2008 induced by massive wastewater injection, 345 Science 448 (2014).
[317] Yeck, W.L. et al., Oklahoma experiences largest earthquake during ongoing regional wastewater injection hazard mitigation efforts, 44 Geophys. Res. Lett. 711 (2017).
[318] Rubinstein, J. et al., The 2001-present induced earthquake sequence in the Raton Basin of northern New Mexico and southern Colorado, 104 Bulletin of the Seismological Society of America 5 (2014).
[319] Frohlich, C. et al., The 17 May 2012 *M*4.8 earthquake near Timpson, East Texas: An event possibly triggered by fluid injection, 119 Journal of Geophysical Research 581 (2014).
[320] Petersen, M.D. et al., One-year seismic hazard forecast for the Central and Eastern United States from induced and natural earthquakes, U.S. Geological Survey Open-File Report 2016-1035 (2016)
[321] Keranen, K.M. et al. 2014.
[322] Oklahoma Geological Survey, Statement on Oklahoma Seismicity (April 21, 2015) http://wichita.ogs.ou.edu/documents/OGS_Statement-Earthquakes-4-21-15.pdf
[323] *Id*.
[324] Yeck, W.L. et al., Far-field pressurization likely caused one of the largest injection induced earthquakes by reactivating a large preexisting basement fault structure, 43 Geophys. Res. Lett. 10,198 (2016).
[325] Frohlich, C. et al., A historical review of induced earthquakes in Texas, 87 Seismological Research Letters 1 (2016).
[326] Frohlich, C. et al., The Dallas–Fort Worth earthquake sequence: October 2008 through May 2009, the Leading Edge (March 2010); Hornbach, M.J. et al., Ellenburger wastewater injection and seismicity in North Texas, 261 Physics of the Earth and Planetary Interiors 54 (2016).

Timpson,[327] Azle and Reno,[328] and Cleburne.[329] Enhanced oil recovery was linked to magnitude 4.6 earthquake near Snyder, Texas.[330]

Scientific research has also linked oil and gas wastewater injection to induced earthquakes in Colorado, including a 5.3 quake near Trinidad[331]; Kansas including a 4.9 quake[332]; Arkansas including a 4.7 quake near Guy[333]; Ohio including a 3.9 quake[334]; southeastern New Mexico[335]; and Utah.[336]

Fluid extraction (oil and water) has also been documented to induce earthquakes. A recent study investigating earthquake activity near Azle, Texas, concluded that "[i]t is notable that we observe earthquake swarms in the Ellenburger [i.e., the area of study] apparently associated with extraction, not just injection."[337] The authors explained:

> Earthquakes caused by fluid extraction near faults are not a new phenomenon in the United States or even Texas. Induced seismicity is often associated with subsurface pressure changes, and extensional stresses will concentrate on the boundary of the fluid draw-down region, promoting normal faulting. It is therefore perhaps no coincidence that we observe swarms of normal-faulting events in regions where more significant near fault stress changes occur.[338]

Another study in Texas found that "the majority of small earthquakes may be triggered/induced by human activity" in this region and "are more often associated with fluid

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[327] Frohlich, C. et al., The 17 May 2012 *M*4.8 earthquake near Timpson, East Texas: An event possibly triggered by fluid injection, 119 Journal of Geophysical Research 581 (2014); Shirzaei, M. et al. 2016. Surface uplift and time-dependent seismic hazard due to fluid injection. Science 353: 1416-1419

[328] Hornbach, M.J. et al., Causal factors for seismicity near Azle, Texas, 6 Nature Communications 6728 (2016).

[329] Justinic, A.H. et al., Analysis of the Cleburne, Texas, Earthquake Sequence from June 2009 to June 2010, 103 Bulletin of the Seismological Society of America 6 (2013).

[330] Gan, W. and C. Frohlich, Gas injection may have triggered earthquakes in the Cogdell oil field, Texas, 110 PNAS 18786 (2013).

[331] Rubinstein, J. et al., The 2001-present induced earthquake sequence in the Raton Basin of northern New Mexico and southern Colorado, 104 Bulletin of the Seismological Society of America 5 (2014)

[332] Choy, G.L. et al., Abstract: A Rare Moderate-Sized (M_w 4.9) Earthquake in Kansas: Rupture Process of the Milan, Kansas, Earthquake of 12 November 2014 and Its Relationship to Fluid Injection, 87 Seismological Research Letters 1433 (2016).

[333] Horton, S., Disposal of hydrofracking waste fluid by injection into subsurface aquifers triggers earthquake swarm in Central Arkansas with potential for damaging earthquake, 83 Seismological Research Letters 2:250 (2011); Ogwari, P.O. et al., Characteristics of induced/triggered earthquakes during the setup phase of the Guy-Greenbrier earthquake in North-Central Arkansas, 87 Seismological Research Letters 3 (2016)

[334] Kim, W-Y, Induced seismicity associated with fluid injection into a deep well in Youngstown, Ohio, 118 Journal of Geophysical Research 3506 (2013).

[335] Zhang, Y. et al. Exploring the potential linkages between oil-field brine reinjection, crystalline basement permeability, and triggered seismicity for the Dagger Draw Oil field, southeastern New Mexico, USA, using hydrologic modeling, 16 Geofluids 971 (2016).

[336] Brown, M.R.M. and M. Liu, Injection-induced seismicity in Carbon and Emery Counties, central Utah, 16 Geofluids 801 (2016).

[337] Hornbach, M.J. et al., Causal factors for seismicity near Azle, Texas, 6 Nature Communications 6728 (2016).

[338] *Id*. at 7.

extraction than with injection."[339] The study noticed several examples of increased fluid extraction (i.e., oil and water) preceding earthquakes of substantial magnitude (3.4 to 4.8), suggesting a link between the two.[340]

The National Resource Council's review of human induced seismicity notes the well-documented causes of induced seismicity resulting from fluid extraction:

> Fluid extraction from a reservoir can cause declines in the pore pressure that can reach hundreds of bars. The declining pore pressure causes large contraction of the reservoir, which itself induces stress changes in the surrounding rock (Segall, 1989), in particular increasing horizontal stresses above and below the reservoir that could lead to reverse faulting (Figure 2.2). Grasso (1992) estimates that volume contraction of reservoirs from fluid withdrawal can cause earthquakes up to M 5.0.[341]

D. The DEIS must analyze the full suite of geologic hazards stemming from oil and gas development

The DEIS must analyze all potential geologic hazards stemming from oil and gas development, including the impacts from induced earthquakes that damage well integrity, pipelines, and other fossil fuel infrastructure which could result in dangerous and environmentally damaging oil and gas leaks.

E. The DEIS's cumulative impacts analysis is fundamentally flawed

The DEIS's cumulative effects analysis for geologic hazards is fundamentally flawed in (1) failing to analyze the potential cumulative impacts of new oil and gas development in increasing induced earthquake risks and hazards, and (b) by incorrectly limiting the geographic scope of analysis.

BLM must address the cumulative effects that new oil and gas development could have in contributing to the increased risk of earthquakes, for example, through increased fluid injection from fracking and wastewater disposal. As detailed above, it is highly likely that new oil and gas development, and increased fracking and wastewater injection associated with new development, would cumulatively increase the risk of increased earthquake activity, and larger quakes. For example, scientific research has established that higher volumes and pressures of fluid injection can increase the risks of induced seismicity.[342] Multiple fracking operations that are close in time and space can also increase seismic risks:

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[339] Frohlich, Cliff and Michael Brunt, Two-year survey of earthquakes and injection/production wells in the Eagle Ford Shale, Texas, prior to the MW4.8 20, 402 Earth and Planetary Science Letters 15, 257 (Sept. 2014)
[340] *Id*. at 263.
[341] National Research Council. 2013, at 44-45.
[342] Rubinstein, J.L. and A.B. Mahani. 2015; Weingarten, M. et al. 2015.

> In the case of HF [fracking] operations, high injection rates and the relatively large spatial footprint of the stimulated region produces transient risks that may be compounded by multiple operations that are proximate in time and space.[343]

Second, BLM incorrectly limited the geographic area considered for cumulative effects related to geologic hazards to only a half-mile radius of open areas for all alternatives. BLM's reason is based on the assertion that "impacts resulting from seismic events are localized in nature and are unlikely to extend beyond the actual oil and gas occurrence boundaries":

> The majority of the Federal mineral estate lands where the RFD Scenario would occur for Alternatives A, C, D, and E are not within 0.5-miles of other cumulative projects or existing infrastructure except within existing oil and gas fields. Cumulative effects due to ground shaking and other seismic events would therefore be limited in nature . . .
>
> The potential for cumulative induced seismicity due to the combination of the RFD Scenario and the reasonably foreseeable future actions is low as there are only three cumulative oil and gas projects presented in Table 5-1 and it is unknown if they would undergo well stimulation activities. In addition, the current use of well stimulation technologies (including hydraulic fracturing) in California is not considered to pose a significant seismic hazard. [344]

This is incorrect. Numerous studies have established that cumulative pressure increases from injection may induce swarms of earthquakes on faults located tens of kilometers or more from injection wells.[345] One study suggests far-field pressurization from clustered, high-rate wells greater than 12 km from an earthquake sequence in Fairview, Oklahoma (of five earthquakes with Mw 4.4 or larger) induced these earthquakes, and points to the far-reaching impact of wastewater injection.[346] A study in northern Texas concluded that the cumulative pressure increase from wastewater injection "may trigger earthquakes on faults located tens of kilometers or more from injection wells," including earthquakes affecting the heavily populated Dallas area.[347] Wastewater-injection-induced earthquakes in California occurred about five miles from the injection wells linked to the seismic activity.[348]

Accordingly, it is highly likely that new oil and gas development, and increased wastewater injection associated with new development, would cumulatively increase the risk of increased earthquake activity, and larger quakes.

In sum, BLM cannot assume that opening up potentially 793,000 acres for oil and gas development will have no or minimal impact on seismic activity. BLM must analyze the

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[343] Atkinson, G.M. et al. 2016, at 13.
[344] DEIS at 5-6.
[345] Keranen, K.M. et al. 2014; Hornbach, M.J. et al., Ellenburger wastewater injection and seismicity in North Texas, 261 Physics of the Earth and Planetary Interiors 54 (2016)
[346] Yeck, W.L. et al. 2016.
[347] Hornbach, M.J. et al., Ellenburger wastewater injection and seismicity in North Texas, 261 Physics of the Earth and Planetary Interiors 54 (2016)
[348] Goebel, T.H.W et al. 2016.

potential for fracking and wastewater disposal to induce earthquakes, and the possible risks of induced seismicity in the specific areas for lease. These risks could possibly include significant property damage, injuries, or even death.

F. The mitigation measures are wholly inadequate

The proposed mitigation measures – a non-binding and non-specific setback measure and monitoring and reporting only by the operators themselves – do nothing to mitigate the impacts for induced seismicity. Because the consequences of induced seismicity from well stimulation and underground waste disposal could be catastrophic, it is essential that the DEIR fully and accurately analyze this issue and propose comprehensive mitigation measures.

Conclusion

Oil and gas development not only fuels the climate crisis but entails significant public health risks and harms to the environment. Accordingly, the analyses and information omitted from the DEIS is critical and must be reflected in the agency's Final Environmental Impact Statement.

For the reasons described above, we urge BLM to prepare a supplemental EIS that: (1) analyzes the foreseeable environmental impacts from the disturbance of more than only 206 acres, given that BLM is proposing to open 793,000 acres to oil and gas leasing, nearly half of which is considered High Oil and Gas Potential Areas; (2) fully considers a range of alternatives, including "no-leasing" and "no-fracking" alternatives; (3) fully considers current scientific and economic information, especially regarding climate change; and (4) strengthens its "hard look" at impacts to air, water, induced seismicity and human health, including by conducting a Health Impact Assessment.

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