CENTER for BIOLOGICAL DIVERSITY Because life is good.

January 11, 2016

VIA FAX (801-539-4237)

Sheri Wysong
BLM
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, UT 84101

Re: Protest of February 16, 2016 Lease Sale

Dear Ms. Wysong:

The Center for Biological Diversity (the "Center") and Living Rivers hereby file this Protest of the Bureau of Land Management ("BLM")'s planned February 16, 2016 oil and gas lease sale and the following Environmental Assessments, pursuant to 43 C.F.R. § 3120.1-3:

DOI-BLM-UT-Y010-2015-0186-EA
DOI-BLM-UT-G021-2015-0031-EA
DOI-BLM-UT-G010-2015-089-EA
DOI-BLM-UT-W020-2015-0004-EA

The Center and Living Rivers formally protest the inclusion of each of the following parcels, covering 45,700.92 acres in the Moab, Vernal, Price, and Fillmore Field Offices and the Fishlake National Forest:

UTU91266	UTU91306	UTU91334	UTU91478
UTU91267	UTU91307	UTU91335	UTU91479
UTU91268	UTU91308	UTU91336	UTU91480
UTU91269	UTU91310	UTU91337	UTU91481
UTU91270	UTU91311	UTU91338	UTU91482
UTU91271	UTU91312	UTU91339	UTU91483
UTU91272	UTU91313	UTU91340	UTU91484
UTU91273	UTU91314	UTU91342	
UTU91274	UTU91315	UTU91343	
UTU91302	UTU91316	UTU91344	
UTU91303	UTU91331	UTU91345	
UTU91304	UTU91332	UTU91346	
UTU91305	UTU91333	UTU91347	

PROTEST

1. Protesting Party: Contact Information and Interests:

This Protest is filed on behalf of the Center for Biological Diversity and Living Rivers, and their boards and members by:

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The Center is a non-profit environmental organization with 50,400 member activists, including members who live and recreate in the Upper Colorado River Basin, Green River basin, Fishlake National Forest, and BLM lands in central and eastern Utah. The Center uses science, policy and law to advocate for the conservation and recovery of species on the brink of extinction and the habitats they need to survive. The Center has and continues to actively advocate for increased protections for species and habitats in the Green River, West Desert, and Canyon Country Districts and the Fishlake National Forest. The lands that will be affected by the proposed lease sale include habitat for listed, rare, and imperiled species that the Center has worked to protect including the Gunnison's sage-grouse, Greater sage-grouse, humpback chub, Colorado pikeminnow, razorback sucker, bonytail, Mexican spotted owl, and California condor. The Center's board, staff, and members use the public lands in Utah, including the lands and waters that would be affected by actions under the lease sale, for quiet recreation (including hiking and camping), scientific research, aesthetic pursuits, and spiritual renewal.

Living Rivers is a nonprofit organization based in Moab, Utah that promotes river restoration through mobilization. By articulating conservation and alternative management strategies to the public, Living Rivers seeks to revive the natural habitat and spirit of rivers by undoing the extensive damage done by dams, and water-intensive energy development on the Colorado Plateau. Living Rivers has approximately 1,200 members in Utah, Colorado and other states. Living Rivers' members and staff use the public lands in Utah, including the lands and waters that would be affected by actions under the lease sale, for quiet recreation (including hiking and camping), scientific research, aesthetic pursuits, and spiritual renewal.

2. Statement of Reasons as to Why the Proposed Lease Sale Is Unlawful:

BLM's proposed decision to lease the parcels listed above is substantively and procedurally flawed for the reasons discussed below.

The proposed lease sale violates the Mineral Leasing Act ("MLA") and the Federal Lands Policy and Management Act ("FLPMA"). New leasing would worsen the climate crisis. To preserve any chance of averting catastrophic climate disruption, the vast majority of all *proven* fossil fuels must be kept in the ground. Opening up new areas to oil and gas exploration and unlocking new sources of greenhouse gas pollution would only fuel greater warming and contravenes BLM's mandate to manage the public lands "without permanent impairment of the productivity of the land and the quality of the environment."[1] BLM must end all new leasing throughout the state and all other areas that it manages, in order to limit the climate change effects of its actions.

Exploration and development would likely involve the highly controversial industry practices of hydraulic fracturing and horizontal drilling. As discussed further below these practices deplete enormous water resources, risk toxic spills, contaminate air, and fragment and degrade habitat for species. The extraction of fossil fuels with these dangerous techniques undermines the protection of our public lands. Full compliance with the spirit and objectives of the National Environmental Policy Act ("NEPA") and other federal environmental laws and regulations requires BLM to avoid these dangers altogether. Therefore BLM should also ban new hydraulic fracturing and other unconventional well stimulation activities in the planning area (collectively, "fracking"). Unconventional well stimulation refers to any activities that extract natural gas and oil from rock formations.

At the very least, BLM must address whether to continue leasing and allow fracking in an updated Resource Management Plan ("RMP") for each of the planning areas in which parcels are available for lease. None of the RMPs governing the areas for lease, or the Fishlake National Forest Oil and Gas Leasing Analysis, address the relatively new and dangerous extraction methods of hydraulic fracturing and horizontal drilling and their impacts on the environment. Nor do they adequately address the impact that potential greenhouse gas ("GHG") emissions of federal fossil fuels (leased and unleased) would have on climate change. These changed conditions require a comprehensive look at the public health, environmental justice, and industrialization impacts of fossil fuel extraction and hydraulic fracturing across each of the planning areas at issue.

For the reasons set forth in this protest, we insist that BLM: (1) cease all new leasing of fossil fuels in the planning area, including oil and natural gas; or, at a minimum (2) defer the proposed February 16, 2016 Sale pending the plan revision which must consider "keep it in the ground" and "no fracking" plan amendments ("no-leasing-no-fracking"). Should BLM proceed with the sale, BLM must: (1) initiate formal consultation with the Fish and Wildlife Service ("Service"), as required by the Endangered Species Act ("ESA"); and (2) prepare a full Environmental Impact Statement ("EIS") for the proposed lease sale in consideration of

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[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).

significant unexamined impacts from the consequences of leasing. Any such EIS must consider a full range of alternatives, including an alternative that bans new hydraulic fracturing and other unconventional well stimulation activities in the planning area, and require strict controls on natural gas emissions and leakage. At the very minimum, BLM must revise each of the Field Office's Environmental Assessments ("Vernal EA," "Price EA," Fillmore EA," and "Moab EA," or, collectively, "EAs") and prepare an EA for the Fishlake National Forest parcels to fully and accurately assess the significance of numerous environmental harms that would result from new leasing.

I. The Dangers of Hydraulic Fracking and Horizontal Drilling

New information, not addressed in the Vernal, Price, Fillmore, and Moab RMPs or the Fishlake National Forest Oil and Gas Leasing Analysis, makes clear that the use of hydraulic fracturing within the area is both readily foreseeable and already occurring with significant environment environmental consequences. NEPA regulations and case law require that BLM evaluate all "reasonably foreseeable" direct and indirect effects of its leasing.[2]

The proposed leasing action is part of a dramatic recent increase in oil and gas leasing in the areas at issue, and reflects increased industry interest in developing Utah's fossil fuel resources. The entire basis for this surge of interest is the possibility that hydraulic fracturing and other advanced recovery techniques will allow the profitable exploitation of geologic formations previously perceived as insufficiently valuable for development. Elements of these technologies have been used individually for decades. However, the combination of practices employed by industry recently is new: "Modern formation stimulation practices have become more complex and the process has developed into a sophisticated, engineered process in which production companies strive to design a hydraulic fracturing treatment to emplace fracture networks in specific areas."[3]

Hydraulic fracturing brings with it all of the harms to water quality, air quality, the climate, species, and communities associated with traditional oil and gas development, but also brings increased risks in many areas. Analysis of the consequences of this practice, prior to irrevocable consequences, is therefore required at the leasing stage. Oil and gas leasing is an irrevocable commitment to convey rights to use of federal land – a commitment with readily predictable environmental consequences that BLM is required to address. These include the specific geological formations, surface and ground water resources, seismic potential, or human, animal, and plant health and safety concerns present in the area to be leased.

Hydraulic fracturing, a dangerous practice in which operators inject toxic fluid underground under extreme pressure to release oil and gas, has greatly increased industry interest

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[2] . 40 C.F.R. § 1508.8; *Davis v. Coleman*, 521 F.2d 661, 676 (9th Cir. 1975)*; Center for Biological Diversity v. Bureau of Land Management* ("*CBD*"),, 937 F. Supp. 2d 1140 (N.D. Cal. 2013) (holding that oil and gas leases were issued in violation of NEPA where BLM failed to prepare an EIS and unreasonably concluded that the leases would have no significant environmental impact because the agency failed to take into account all reasonably foreseeable development under the leases).

[3] Arthur, J. Daniel et al., Hydraulic Fracturing Considerations for Natural Gas Wells of the Marcellus Shale at 2 (Sep. 2008) ("Arthur") at 9.

in developing tightly held oil and gas deposits such as those in the proposed lease area. The first aspect of this technique is the hydraulic fracturing of the rock. When the rock is fractured, the resulting cracks in the rock serve as passages through which gas and liquids can flow, increasing the permeability of the fractured area. To fracture the rock, the well operator injects hydraulic fracturing fluid at tremendous pressure. The composition of fracturing fluid has changed over time. Halliburton developed the practice of injecting fluids into wells under high pressure in the late 1940s;[4] however, companies now use permutations of "slick-water" fracturing fluid developed in the mid-1990s.[5] The main ingredient in modern fracturing fluid (or "frack fluid") is generally water, although liquefied petroleum has also been used as a base fluid for modern fracking.[6] The second ingredient is a "proppant," typically sand, that becomes wedged in the fractures and holds them open so that passages remain after pressure is relieved.[7] In addition to the base fluid and proppant, a mixture of chemicals are used, for purposes such as increasing the viscosity of the fluid, keeping proppants suspended, impeding bacterial growth or mineral deposition.[8]

Frack fluid is hazardous to human health, although industry's resistance to disclosing the full list of ingredients formulation of frack fluid makes it difficult for the public to know exactly how dangerous.[9] A congressional report sampling incomplete industry self-reports found that "[t]he oil and gas service companies used hydraulic fracturing products containing 29 chemicals that are (1) known or possible human carcinogens, (2) regulated under the Safe Drinking Water Act for their risks to human health, or (3) listed as hazardous air pollutants under the Clean Air Act."[10] Recently published scientific papers also describe the harmfulness of the chemicals often in fracking fluid. One study reviewed a list of 944 fracking fluid products containing 632 chemicals, 353 of which could be identified with Chemical Abstract Service numbers.[11] The study concluded that more than 75 percent of the chemicals could affect the skin, eyes, and other sensory organs, and the respiratory and gastrointestinal systems; approximately 40 to 50 percent could affect the brain/nervous system, immune and cardiovascular systems, and the kidneys; 37 percent could affect the endocrine system; and 25 percent could cause cancer and mutations.[12]

The impacts associated with the fracking-induced oil and gas development boom has caused some jurisdictions to place a moratorium or ban on fracking. For instance, in 2011 France

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[4] Tompkins, How will High-Volume (Slick-water) Hydraulic Fracturing of the Marcellus (or Utica) Shale Differ from Traditional Hydraulic Fracturing? Marcellus Accountability Project at 1 (Feb. 2011).
[5] New York State Department of Environmental Conservation, *Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs* (2015) ("NYDEC SGEIS") at 5-5.
[6] *Id.*; Arthur at 10; United States House of Representatives, Committee on Energy and Commerce, Minority Staff, Chemicals Used in Hydraulic Fracturing (Apr. 2011) ("Waxman 2011b").
[7] Arthur at 10.
[8] Arthur at 10.
[9] Waxman 2011b; *see also* Colborn, Theo et al., *Natural Gas Operations for a Public Health Perspective*, 17 Human and Ecological Risk Assessment 1039 (2011) ("Colborn 2011"); McKenzie, Lisa et al., *Human Health Risk Assessment of Air Emissions form Development of Unconventional Natural Gas Resources*, Sci Total Environ (2012), doi:10.1016/j.scitotenv.2012.02.018 ("McKenzie 2012").
[10] Waxman 2011b at 8.
[11] Colborn 2011 at 1.
[12] Colborn 2011 at 1.

became the first country to ban the practice.[13] In May, Vermont became the first state to ban fracking. Vermont's governor called the ban "a big deal" and stated that the bill "will ensure that we do not inject chemicals into groundwater in a desperate pursuit for energy."[14] New York State halted fracking within its borders in 2008, continued the moratorium in 2014 and banned the practice in 2015.The state's seven-year review concluded that fracking posed risks to land, water, natural resources and public health.[15] [16] Also, New Jersey's legislature recently passed a bill that would prevent fracking waste, like toxic wastewater and drill cuttings, from entering its borders,[17] and Pennsylvania, ground zero for the fracking debate, has banned "natural-gas exploration across a swath of suburban Philadelphia . . . ."[18] Numerous cities and communities, like Buffalo, Pittsburgh, Raleigh, Woodstock, and Morgantown have banned fracking.[19]

Separate from hydraulic fracturing, the second technological development underlying the recent shale boom is the use of horizontal drilling. Shale oil and shale gas formations are typically located far below the surface, and as such, the cost of drilling a vertical well to access the layer is high.[20] The shale formation itself is typically a thin layer; however, such that a vertical well only provides access to a small volume of shale—the cylinder of permeability surrounding the well bore.[21] Although hydraulic fracturing increases the radius of this cylinder of shale, this effect is often itself insufficient to allow profitable extraction of shale resources.[22] Horizontal drilling solves this economic problem: by drilling sideways along the shale formation once it is reached, a company can extract resources from a much higher volume of shale for the same amount of drilling through the overburden, drastically increasing the fraction of total well length that passes through producing zones.[23] The practice of combining horizontal drilling with hydraulic fracturing was developed in the early 1990s.[24]

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[13] Castelvecchi, Davide, *France becomes first country to ban extraction of natural gas by fracking*, Scientific American (Jun. 30, 2011).
[14] CNN Staff Writer, *Vermont first state to ban fracking*, CNN U.S. (May 17, 2012).
[15] Public News Service - NY, *Cuomo Declares: No Fracking for Now in NY.* See: http://www.publicnewsservice.org/2014-12-18/health-issues/cuomo-declares-no-fracking-for-now-in-ny/a43579-1 .
[16] RT Network. June 30, 2015. *It's official: New York bans fracking.* https://www.rt.com/usa/270562-new-york-fracking-ban/ .
[17] Tittel, Jeff, *Opinion: Stop fracking waste from entering New Jersey's borders* (Jul 14, 2012) *available at* http://www.nj.com/times-opinion/index.ssf/2012/07/opinion_stop_fracking_waste_fr.html .
[18] Philly.com, *Fracking ban is about our water*, The Inquirer (Jul. 11, 2012).
[19] *CBS, Pittsburgh Bans Natural Gas Drilling*, CBS/AP (Dec 8, 2010)*;* Wooten, Michael *City of Buffalo Bans Fracking* (Feb. 9, 2011); The Raleigh Telegram, *Raleigh City Council Bans Fracking Within City Limits* (Jul. 11, 2012); Kemble, William, *Woodstock bans activities tied to fracking*, Daily Freeman (Jul. 19, 2012); MetroNews.com, *Morgantown Bans Fracking* (June 22, 2011), *available at* http://www.wvmetronews.com/news.cfm?func=displayfullstory&storyid=46214.
[20] CITI, Resurging North American Oil Production and the Death of the Peak Oil Hypothesis at 9 (Feb.15, 2012) ("CITI"); United States Energy Information Administration, Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays at 4 (Jul. 2011) ("USEIA 2011"); Orszag, Peter, Fracking Boom Could Finally Cap Myth of Peak Oil (Jan. 31, 2011) ("Orszag").
[21] *Id.*
[22] *Id.*; Arthur at 8 (Figure 4).
[23] Venoco, Inc., Monterey Shale Focused Analyst Day Slide Show at 23 (May 26, 2010) ("Venoco Slide Show"), USEIA 2012a at 63.
[24] *Id.*

A third technological development is the use of “multi-stage” fracking. In the 1990s industry began drilling longer and longer horizontal well segments. The difficulty of hydraulic fracturing increases with the length of the well bore to be fractured, however, both because longer well segments are more likely to pass through varied conditions in the rock and because it becomes difficult to create the high pressures required in a larger volume.[25] In 2002 industry began to address these problems by employing multi-stage fracking. In multi-stage fracking, the operator treats only part of the wellbore at a time, typically 300 to 500 feet.[26] Each stage “may require 300,000 to 600,000 gallons of water,” and consequently, a frack job that is two or more stages can contaminate and pump into the ground over a million gallons of water.[27]

Notwithstanding the grave impacts that these practices have on the environment, this new combination of multi-stage slickwater hydraulic fracturing and horizontal drilling has made it possible to profitably extract oil and gas from formations that only a few years ago were generally viewed as uneconomical to develop.[28] The effect of hydraulic fracturing on the oil and gas markets has been tremendous, with many reports documenting the boom in domestic energy production. A recent congressional report notes that “[a]s a result of hydraulic fracturing and advances in horizontal drilling technology, natural gas production in 2010 reached the highest level in decades.”[29] A 2011 U.S. EIA report notes how recently these changes have occurred, stating that “only in the past 5 years has shale gas been recognized as a ‘game changer’ for the U.S. natural gas market.”[30] With respect to oil, the EIA notes that oil production has been increasing, with the production of shale oil resources pushing levels even higher over the next decade:

> Domestic crude oil production has increased over the past few years, reversing a decline that began in 1986. U.S. crude oil production increased from 5.0 million barrels per day in 2008 to 5.5 million barrels per day in 2010. Over the next 10 years, continued development of tight oil, in combination with the ongoing development of offshore resources in the Gulf of Mexico, pushes domestic crude oil production higher.[31]

Thus, it is evident that fracking, including fracking with the most recent techniques that have been associated with serious adverse impacts in other areas of the country, is poised to expand; it is further evident that the oil and gas industry is still exploring new locations to develop, and the nation has not yet seen the full extent of fracking’s impact on oil and gas development and production.

In large part through the use of fracking, the oil and gas sector is now producing huge amounts of oil and gas throughout the United States, rapidly transforming the domestic energy outlook. Fracking is occurring in the absence of any adequate federal or state oversight. The

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[25] NYDEC SGEIS at 5-93.
[26] *Id.*
[27] *Id.*
[28] *See* CITI at 9 ; USEIA 2011 at 4; Orszag, Peter, *Fracking Boom Could Finally Cap Myth of Peak Oil* (Jan. 31, 2011) (“Orszag”).
[29] Waxman 2011b at 1.
[30] USEIA 2011 at 4.
[31] USEIA 2012a at 2

current informational and regulatory void on the state level makes it even more critical that the BLM perform its legal obligations to review, analyze, disclose, and avoid and mitigate the impacts of its oil and gas leasing decisions.

II. Oil and Gas Operations Pose Risks to Water Resources

Oil and gas activities pose significant danger to water resources. This includes harms that are common to oil and gas operations in general, and damages fracking in particular can cause. While much remains to be learned about fracking,[32] it is clear that the practice poses serious threats to water resources. Across the U.S., in states where fracking or other types of unconventional oil and gas recovery has occurred, surface water and groundwater have been contaminated. Recent studies have concluded that water contamination attributed to unconventional oil and gas activity has occurred in several states, including Colorado,[33] Wyoming,[34] Texas,[35] Pennsylvania,[36] Ohio,[37] and West Virginia.[38]

The likelihood that the sale will result in fracking raises several issues that BLM must address:

- Where will the water come from and what are the impacts of extracting it?
- What chemicals will be used in the drilling and fracking process?
- How will BLM ensure the collection and disclosure of that information?
- What limitations will BLM place on the chemicals used in order to protect public health and the environment?
- What measures will BLM require to ensure adequate monitoring of water impacts, both during and after drilling?
- What baseline data is available to ensure that monitoring of impacts can be carried out effectively? How will BLM collect baseline data that is not currently available?

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[32] United States Government Accountability Office, Unconventional Oil and Gas Development – Key Environmental and Public Health Requirements (2012); United States Government Accountability Office, Oil and Gas – Information on Shale Resources, Development, and Environmental and Public Health Risks (2012).

[33] Trowbridge, A., *Colorado Floods Spur Fracking Concerns*, CBS News, Sept. 17, 2013, *available at* http://www.cbsnews.com/8301-201_162-57603336/colorado-floods-spur-fracking-concerns/ ("Trowbridge 2013") (accessed July 30, 2015).

[34] U.S. Environmental Protection Agency, Draft Investigation of Ground Water Contamination near Pavillion, Wyoming (2011) ("USEPA Draft Pavillion Investigation").

[35] Fontenot, Brian et al., *An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation*, Environ. Sci. Technol., 47 (17), 10032–10040 DOI: 10.1021/es4011724, *available at* http://pubs.acs.org/doi/abs/10.1021/es4011724 ("Fontenot 2013").

[36] Jackson, Robert et al., *Increased Stray Gas Abundance in a Subset of Drinking Water Wells near Marcellus Shale Gas Extraction*, Proc. Natl. Acad. of Sciences Early Edition, doi: 10.1073/pnas.1221635110/-/DCSupplemental (2013) ("Jackson 2013").

[37] Ohio Department of Natural Resources, Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio (Sep. 2008) ("ODNR 2008").

[38] Begos, K., *Four States Confirm Water Pollution*, Associated Press, January 5, 2014, *available at* http://www.usatoday.com/story/money/business/2014/01/05/some-states-confirm-water-pollution-from-drilling/4328859/ (accessed July 29, 2015); *see also* U.S. EPA, Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources, External Review Draft (June 2015) ("EPA 2015"), *available at* http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=523539 (accessed July 30, 2015).

- Much of the fracking fluid return to the surface as toxic waste. Where will the discharge go?
- Is there the potential for subsurface migration of fracking fluids, or the potential for those fluids to escape into the groundwater by way of a faulty casing?
- What kinds of treatment will be required?
- What is the potential footprint and impact of the necessary treatment facilities?

BLM's analysis of potential impacts to water must take account of all significant and "foreseeable" impacts to water that may arise from the sale, including the following issues.

1. Surface Water Contamination

Surface waters can be contaminated in many ways from unconventional well stimulation. In addition to storm water runoff, surface water contamination may also occur from chemical and waste transport, chemical storage leaks, and breaches in pit liners.[39] The spilling or leaking of fracking fluids, flowback, or produced water is a serious problem. Harmful chemicals present in these fluids can include volatile organic compounds ("VOCs"), such as benzene, toluene, xylenes, and acetone.[40] As much as 25 percent of fracking chemicals are carcinogens,[41] and flowback can even be radioactive.[42] As described below, contaminated surface water can result in many adverse effects to wildlife, agriculture, and human health and safety. It may make waters unsafe for drinking, fishing, swimming and other activities, and may be infeasible to restore the original water quality once surface water is contaminated. BLM should consider this analysis in the EIS.

i. Chemical and Waste Transport

Massive volumes of chemicals and wastewater used or produced in oil and gas operations have the potential to contaminate local watersheds. Between 2,600 to 18,000 gallons of chemicals are injected per hydraulically fracked well depending on the number of chemicals injected.[43] For example, in 2012 alone, New Mexico produced 3 billion gallons of wastewater from fracking.[44] This waste can reach fresh water aquifers and drinking water.

Produced waters that fracking operations force to the surface from deep underground can contain high levels of total dissolved solids, salts, metals, and naturally occurring radioactive

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[39] Vengosh, Avner et al., *A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States*, Environ. Sci. Technol., DOI: 10.1021/es405118y (2014) ("Vengosh 2014").
[40] U.S. Environmental Protection Agency, Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (Nov. 2011) ("EPA Plan to Study Fracking Impacts").
[41] Colborn 2011.
[42] EPA Plan to Study Fracking Impacts; White, Ivan E., Consideration of radiation in hazardous waste produced from horizontal hydrofracking, National Council on Radiation Protection (2012).
[43] EPA 2015 at ES-12.
[44] Elizabeth Ridlington Frontier Group, *Fracking by the Numbers: Key Impacts of Dirty Drilling at the State and National Level*, October 2013 at 21 *available at* http://www.environmentamerica.org/sites/environment/files/reports/EA_FrackingNumbers_scrn.pdf.

materials.[45] If spilled, the effects of produced water or brine can be more severe and longer-lasting than oil spills, because salts do not biodegrade or break down over time. The only way to deal with them is to remove them.[46] Flowback waters (i.e., fracturing fluids that return to the surface) may also contain similar constituents along with fracturing fluid additives such as surfactants and hydrocarbons.[47] Given the massive volumes of chemicals and wastewater produced, their potentially harmful constituents, and their persistence in the environment, the potential for environmental disaster is real.

Fluids must be transported to and/or from the well, which presents opportunities for spills.[48] Unconventional well stimulation relies on numerous trucks to transport chemicals to the site as well as collect and carry disposal fluid from the site to processing facilities. A U.S. Government Accountability Office (GAO) study found that up to 1,365 truck loads can be required just for the drilling and fracturing of a single well pad[49] while the New York Department of Conservation estimated the number of "heavy truck" trips to be about 3,950 per horizontal well (including unloaded and loaded trucks).[50] Accidents during transit may cause leaks and spills that result in the transported chemicals and fluids reaching surface waters. Chemicals and waste transported by pipeline can also leak or spill. There are also multiple reports of truckers dumping waste uncontained into the environment.[51]

The EIS should evaluate how often accidents can be expected to occur, and the effect of chemical and fluid spills. Such analysis should also include identification of the particular harms faced by communities near oil and gas fields. The EIS must include specific mitigation measures and alternatives based on a cumulative impacts assessment, and the particular vulnerabilities of environmental justice communities in both urban and rural settings.

ii. On-site Chemical Storage and Processing

Thousands of gallons of chemicals can be potentially stored on-site and used during hydraulic fracturing and other unconventional well stimulation activities.[52] These chemicals can be susceptible to accidental spills and leaks. Natural occurrences such as storms and earthquakes may cause accidents, as can negligent operator practices.

Some sites may also use on-site wastewater treatment facilities. Improper use or maintenance of the processing equipment used for these facilities may result in discharges of

[45] Brittingham, Margaret C. et al., *Ecological Risks of Shale Oil and Gas Development to Wildlife, Aquatic Resources and their Habitats*, Environ. Sci. Technol. 2014, 48, 11034-11047, p. 11039.
[46] King, Pamela, *Limited study supports findings on bigger brine spill risks*, E&E News (Nov. 4, 2015).
[47] *Id*.
[48] Warco, Kathy, *Fracking truck runs off road; contents spill*, Observer Reporter (Oct 21, 2010).
[49] U.S. Government Accountability Office, Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health Risks, GAO 12-732 (2012) at 33.
[50] New York Department of Environmental Conservation, *Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program*, Ch. 6 Potential Environmental Impacts (2015) at 6-306 –*available at* http://www.dec.ny.gov/docs/materials_minerals_pdf/fsgeis2015.pdf.
[51] Kusnetz, Nicholas, *North Dakota's Oil Boom Brings Damage Along with Prosperity* at 4, ProPublica (June 7, 2012) ("Kusnetz North Dakota"); E&E News, *Ohio man pleads not guilty to brine dumping* (Feb. 15, 2013).
[52] EPA 2015 at ES-10.

contaminants. Other spill causes include equipment failure (most commonly, blowout preventer failure, corrosion and failed valves) and failure of container integrity.[53] Spills can result from accidents, negligence, or intentional dumping.

The EIS should examine and quantify the risks to human health and the environment associated with on-site chemical and wastewater storage, including risks from natural events and negligent operator practices. Again, such analysis must also include an analysis of potential impacts faced by environmental justice communities in both rural and urban settings.

2. Groundwater Contamination

Studies have reported many instances around the country of groundwater contamination due to surface spills of oil and gas wastewater, including fracking flowback.[54] Fracking and other unconventional techniques likewise pose inherent risks to groundwater due to releases below the surface, and these risks must be properly evaluated.[55] Once groundwater is contaminated, it is very difficult, if not impossible, to restore the original quality of the water. As a result, in communities that rely on groundwater drinking water supplies, groundwater contamination can deprive communities of usable drinking water. Such long-term contamination necessitates the costly importation of drinking water supplies.

Groundwater contamination can occur in a number of ways, and the contamination may persist for many years.[56] Poorly constructed or abandoned wells are recognized as one of the most likely ways by which contaminants may reach groundwater. Faulty well construction, cementing, or casing,[57] as well as the injection of fracking waste underground, can all lead to leaks.[58] Older wells that may not have been designed to withstand the stresses of hydraulic fracturing but which are reused for this purpose are especially vulnerable.[59] Improper well construction and surface spills are cited as a confirmed or potential cause of groundwater contamination in numerous incidents at locations across the U.S. including but not limited to Colorado,[60] Wyoming,[61] Pennsylvania,[62] Ohio,[63] West Virginia,[64] and Texas.[65] These sorts of

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[53] EPA 2015 at ES-11.
[54] *See, e.g.*, Fontenot 2013, Jackson 2013.
[55] Vengosh 2014.
[56] Myers, Tom, Potential Contamination Pathways from Hydraulically Fractured Shale to Aquifers, National Groundwater Association (2012).
[57] Natural Resources Defense Council, Water Facts: Hydraulic Fracturing Can Potentially Contaminate Drinking Water Sources at 2 (2012) ("NRDC, Water Facts"); Food and Water Watch, The Case for a Ban on Fracking (2012) ("Food & Water Watch 2012") at 7.
[58] Kusnetz, North Dakota; Lustgarten, Abraham, *Polluted Water Fuels a Battle for Answers*, ProPublica (2012); Lustgarten, Abraham, Injection Wells: *The Poison Beneath Us*, ProPublica at 2 (2012); Lustgarten, Abraham, *Whiff of Phenol Spells Trouble*, ProPublica (2012).
[59] EPA 2015 at 6-11.
[60] Gross, Sherilyn A. et al., *Abstract: Analysis of BTEX groundwater concentrations from surface spills associated with hydraulic fracturing operations*, 63 J. Air and Waste Mgmt. Assoc. 4, 424 doi: 10.1080/10962247.2012.759166 (2013).
[61] U.S. Environmental Protection Agency, Draft Investigation of Ground Water Contamination Near Pavillion, Wyoming (2011) ("EPA Draft Pavillion Investigation").

problems at the well are not uncommon. Dr. Ingraffea of Cornell has noted an 8.9 percent failure rate for wells in the Marcellus Shale.[66] Also, the Draft EPA Investigation of Ground Water Contamination near Pavillion, Wyoming, found that chemicals found in samples of groundwater were from fracked wells.[67] These results have been confirmed with follow-up analyses.[68] Moreover, another study based on modeling found that advective transport of fracking fluid from a fracked well to an aquifer could occur in less than 10 years.[69]

Current federal rules do not ensure well integrity. The well casing can potentially fail over time and potentially create pathways for contaminants to reach groundwater. Well casing failure can occur due to improper or negligent construction. The EIS should study the rates of well casing failures over time and evaluate the likelihood that well casing failures can lead to groundwater contamination.

Also, fluids and hydrocarbons may contaminate groundwater by migrating through newly created or natural fractures.[70] Many unconventional techniques intentionally fracture the formation to increase the flow of gas or oil. New cracks and fissures can allow the additives or naturally occurring elements such as natural gas to migrate to groundwater. "[T]he increased deployment of hydraulic fracturing associated with oil and gas production activities, including techniques such as horizontal drilling and multi-well pads, may increase the likelihood that these pathways could develop," which, "in turn, could lead to increased opportunities for impacts on drinking water sources."[71] Fluids can also migrate through pre-existing and natural faults and fractures that may become pathways once the fracking or other method has been used.

A well in which stimulation operations are being conducted may also "communicate" with nearby wells, which may lead to groundwater and surface contamination, particularly if the nearby wells are improperly constructed or abandoned.[72] In the last 150 years, as many as 12

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[62] Darrah, Thomas H. et al., *Noble Gases Identify the Mechanisms of Fugitive Gas Contamination in Drinking-Water Wells Overlying the Marcellus and Barnett Shales*, Proc. Natl. Acad. Of Sciences Early Edition, doi: 10.1073/pnas.1322107111 (2014) ("Darrah 2014").
[63] Begos, Kevin, *Some States Confirm Water Pollution from Oil, Gas Drilling*, Seattle Times, Jan. 6, 2014, http://www.seattletimes.com/business/some-states-confirm-water-pollution-from-oil-gas-drilling/ (accessed July 29, 2015) ("Begos, Seattle Times, Jan 6, 2014"). *See also*, ODNR 2008, *supra.*
[64] Begos, Seattle Times, Jan 6. 2014.
[65] Darrah 2014.
[66] Ingraffea, Anthony R., Some Scientific Failings within High Volume Hydraulic Fracturing Proposed Regulations 6 NYCRR Parts 550-556, 560, Comments and Recommendations Submitted to the NYS Dept. of Environmental Conservation (Jan 8, 2013).
[67] EPA Draft Pavillion Investigation.
[68] Drajem, Mark, *Wyoming Water Tests in Line with EPA Finding on Fracking*, Bloomberg (Oct. 11, 2012); U.S. Environmental Protection Agency, Investigation of Ground Water Contamination near Pavillion, Wyoming Phase V Sampling Event - Summary of Methods and Results (September 2012); Myers, Tom, Review of DRAFT: Investigation of Ground Water Contamination near Pavillion Wyoming Prepared by the Environmental Protection Agency, Ada OK (Apr. 30, 2012).
[69] Myers, Tom, Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers, Ground Water 50, no. 6, p. 1 (2012).
[70] EPA Draft Pavillion Investigation; Warner, Nathaniel R., et al., Geochemical Evidence for Possible Natural Migration of Marcellus Formation Brine to Shallow Aquifers in Pennsylvania, PNAS Early Edition (2012).
[71] EPA 2015 at 6-55.
[72] *See* Detrow, Scott. (2012) *Perilous Pathways: How Drilling Near An Abandoned Well Produced a*

million "holes" have been drilled across the United States in search of oil and gas, many of which are old and decaying, or are in unknown locations.[73] Fracking can contaminate water resources by intersecting one of those wells. For instance, one study found at least nineteen instances of fluid communication in British Columbia and Western Alberta.[74] Wells as far away as 1.8 miles away have provided pathways for surface contamination.[75]

According to the EPA, "evidence of any fracturing-related fluid migration affecting a drinking water resources…could take years to discover."[76] The EIS must consider long-term studies on the potential for fluid migration through newly created subsurface pathways. Fluid migration is of particular concern when oil and gas operations are close to drinking water supplies.

Fracking fluid can also spill at the surface during the fracking process. For instance, mechanical failure or operator error during the process has caused leaks from tanks, valves, and pipes.[77] At the surface, pits or tanks can leak fracking fluid or waste.[78] Surface pits, in which wastewater is often dumped, are a major source of pollution. In California, a farmer was awarded $8.5 million in damages after his almond trees died when he irrigated them with well water that had been contaminated by nearby oil and gas operations. The contamination was traced to unlined pits where one of California's largest oil and gas producers for decades dumped billions of gallons of wastewater that slowly leached pollutants into nearby groundwater.[79]

Unfiltered drinking water supplies, such as drinking water wells, are especially at risk because they have no readily available means of removing contaminants from the water. Even water wells with filtration systems are not designed to handle the kind of contaminants that result from unconventional oil and gas extraction.[80] In some areas hydraulic fracturing may occur at shallower depths or within the same formation as drinking water resources, resulting in direct aquifer contamination. [81] The EIS must disclose where the potential for such drilling exists.

Methane Geyser, StateImpact Pennsylvania, National Public Radio (October 9, 2012), *available at* https://stateimpact.npr.org/pennsylvania/2012/10/09/perilous-pathways-how-drilling-near-an-abandoned-well-produced-a-methane-geyser/ (accessed July 29, 2015); Alberta Energy Board, Directive 083: Hydraulic Fracturing – Subsurface Integrity, Alberta Energy Regulator (2013), *available at* http://www.aer.ca/documents/directives/Directive083.pdf.

[73] Kusnetz, Nicholas, *Deteriorating Oil and Gas Wells Threaten Drinking Water, Homes Across the Country*, ProPublica (April 4, 2011).

[74] BC Oil & Gas Commission, Safety Advisory 2010-03, Communication During Fracture Stimulation (2010).

[75] King, Pamela, *'Frack hits' provide pathways for methane migration study*, E&E News (Oct. 21, 2015).

[76] EPA 2015 at 6-56 – 6-57.

[77] NRDC, Water Facts at 2; Food & Water Watch 2012 at 7.

[78] *See, e.g.*, E&E Staff Writer, *Fracking Fluid leaks from wellhead in Colo.*, E&E News (Feb 14, 2013). ("At least 84,000 gallons of water contaminated from hydraulic fracturing seeped from a broken wellhead and into a field . . . ."); Michaels, Craig, et al., Fractured Communities: Case Studies of the Environmental Impacts of Industrial Gas Drilling, Riverkeeper (2010) at 12.

[79] Renee Sharp & Bill Allayuad, California Regulator: See No Fracking, Speak No Fracking at 6 (2012); *see also* Miller, Jeremy, *Oil and Water Don't Mix with California Agriculture*, High Country News (2012).

[80] Physicians, Scientist & Engineers for Healthy Energy, Letter from Robert Howarth Ph.D. and 58 other scientists to Andrew M. Cuomo, Governor of New York State re: municipal drinking water filtration systems and hydraulic fracturing fluid (Sept 15, 2011), *available at* http://www.psehealthyenergy.org/data/Cuomo_ScientistsLetter_15Sep20112.pdf (accessed July 29, 2015).

[81] EPA 2015 at ES-15.

Setbacks may not be adequate to protect groundwater from potential fracking fluid contamination. A recent study by the University of Colorado at Boulder suggests that setbacks of even up to 300-feet may not prevent contamination of drinking water resources.[82] The study found that 15 organic compounds found in hydraulic fracturing fluids may be of concern as groundwater contaminants based on their toxicity, mobility, persistence in the environment, and frequency of use. These chemicals could have 10 percent or more of their initial concentrations remaining at a transport distance of 300 feet, the average "setback" distance in the U.S. The effectiveness and feasibility of any proposed setbacks must be evaluated.

3. Disposal of Drilling and Fracking Wastes

Finally, disposal of wastes from oil and gas operations can also lead to contamination of water resources. Potential sources of contamination include:

- leaching from landfills that receive drilling and fracking solid wastes;
- spreading of drilling and fracking wastes over large areas of land;
- wastewaters discharged from treatment facilities without advanced "total dissolved solids" removal processes, or inadequate capacity to remove radioactive material removal; and
- breaches in underground injection disposal wells.[83]

U.S. EPA has found that California's Class II underground injection well program to be insufficiently protective of groundwater resources.[84]

The EIS must evaluate the potential for contamination from each of these disposal methods.

A. More Intensive Oil and Gas Development Will Increase Storm Water Runoff

Oil and gas operations require land clearance for access roads, pipelines, well pads, drilling equipment, chemical storage, and waste disposal pits. As a result, new oil and gas development will cause short-term disturbance as well as long-term disturbance within the areas for lease. While undisturbed land can retain greater amounts of water through plants and pervious soil, land that has been disturbed or developed may be unable to retain as much water, thereby increasing the volume of runoff. The area of land that is able to retain water will be significantly decreased if unconventional oil and gas extraction methods are permitted to expand.

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[82] University of Colorado--Boulder, New study identifies organic compounds of potential concern in fracking Fluids (July 1, 2015), *available at* http://www.colorado.edu/news/releases/2015/06/30/newstudyidentifiesorganiccompoundspotentialconcernfrackingfluids (accessed July 29, 2015).

[83] EPA 2015, 8-20, 8-36, 8-48, 8-65, 8-70.

[84] Walker, James, California Class II UIC Program Review, Report submitted to Ground Water Office USEPA Region 9 at 119 (Jun. 2011); U.S. Environmental Protection Agency Region IX, Letter from David Albright, Manager Ground Water, to Elena Miller, State Oil and Gas Supervisor Dept of Conservation re California Class II Underground Injection Control (UIC) Program Review final report (July 18, 2011).

Water from precipitation and snowmelt can serve as an avenue through which contaminants travel from an operation site to sensitive areas, including population centers. Contaminated water runoff may seep into residential areas, polluting streets, sidewalks, soil, and vegetation in urban areas, adversely affecting human health. Thus, not only do these oil and gas activities create pollution, they create greater conduits for storm water runoff to carry those pollutants from the operation site, into areas in which significant harm can be caused.

Rapid runoff, even without contaminants, can harm the environment by changing water flow patterns and causing erosion, habitat loss, and flooding. Greater runoff volumes may also increase the amount of sediment that is carried to lakes and streams, affecting the turbidity and chemical content of surface waters. Because a National Pollutant Discharge Elimination System permit is not required for oil and gas operations,[85] it is particularly important that the impact of runoff is considered as part of the NEPA process.

B. Fossil Fuel Development Depletes Enormous Amounts of Water

Some unconventional extraction techniques, most notably fracking, require the use of tremendous amounts of freshwater. Typically between 2 and 5.6 million gallons of water are required to frack each well.[86] These volumes far exceed the amounts used in conventional natural gas development.[87]

Water used in large quantities may lead to several kinds of harmful environmental impacts. The extraction of water for fracking can, for example, lower the water table, affect biodiversity, harm local ecosystems, and reduce water available to communities.[88]

Withdrawal of large quantities of freshwater from streams and other surface waters will undoubtedly have an impact on the environment.[89] Withdrawing water from streams will decrease the supply for downstream users, such as farmers or municipalities. Rising demand from oil and gas operators has already led to increased competition for water between farmers and oil and gas operators. With the prolonged drought, some farmers in New Mexico have been forced to sell their water out of the aquifer to the booming oil and gas industry.[90] Reductions in stream flows may also lead to downstream water quality problems by diminishing the water bodies' capacity for dilution and degradation.

Furthermore, withdrawing large quantities of water from subsurface waters to supply oil and gas production will likely deplete and harm aquifers. Removing water from surface water or

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[85] 33 U.S.C. § 1342(l)(2).
[86] U.S. Government Accountability Office 2012 at 17.
[87] *See* Clark, Corrie E. et al., *Life Cycle Water Consumption for Shale Gas and Conventional Natural Gas*, Environ. Sci. Technol., 2013, 47 (20), pp 11829–11836, abstract *available at* http://pubs.acs.org/doi/abs/10.1021/es4013855.
[88] International Energy Agency, Golden Rules for the Golden Age of Gas at 31-32 (2012).
[89] *See* Entrekin, Sally et al., *Rapid Expansion of Natural Gas Development Poses a Threat to Surface Waters*, 9 Front Ecol. Environ. 9, 503 (2011); EPA 2015 at 4-16.
[90] Associated Press, *NM farmers selling water to oil and gas developers*, Albuquerque Journal, June 30, 2013, *available at* http://www.abqjournal.com/216332/news/nm-farmers-selling-water-to-oil-and-gas-developers-2.html.

directly from underground sources of water faster than the rate that aquifers can be replenished will lower the volume of water available for other uses. Depletion can also lead to compaction of the rock formation serving as an aquifer, after which the original level of water volume can never be restored.[91] Depleted aquifer water resources may also adversely affect agriculture, species habitat and ecosystems, and human health.

The freshwater in the area therefore would be greatly affected by the increased demand for water if fracking and other unconventional oil and gas extraction are permitted. A no-fracking alternative would preserve scarce water resources and keep critical sources of drinking water in the planning area safe and clean. The EIS must analyze where water will be sourced, how much, and the effects on water sources under different alternatives. All of these effects must be analyzed in the context of increasing water scarcity in Utah due to climate change, drought, and increasing population growth.

C. Oil and Gas Developments Harm Aquatic Life and Habitat

When streams and other surface waters are depleted, the habitat for countless plants and animals will be harmed, and the depletion places tremendous pressure on species that depend on having a constant and ample stream of water. Oil and gas activities in the Green River District, for example, may harm the four Colorado River endangered fish in the Green river sub-basin and other areas downstream, due to an increased risk of toxic spills and massive water depletions required for hydraulic fracturing and horizontal drilling.

Physical habitats such as banks, pools, runs, and glides (low gradient river sections) are important yet susceptible to disturbance with changing stream flows. Altering the volume of water can also change the water's temperature and oxygen content, harming some species that require a certain level of oxygenated water. Decreasing the volume of streamflow and stream channels by diverting water to fracking would have a negative impact on the environment. Such impacts must (a) be adequately analyzed in an EIS and (b) undergo full and up-to-date consultation with the Fish and Wildlife Service under Section 7 of the Endangered Species Act, using the best and most recent scientific data.

The physical equipment itself that is designed to intake and divert water may also pose a threat to certain wildlife. If not properly designed, such equipment and intake points may be a risk to wildlife.

D. Harm to Wetlands

Oil and gas development, and particularly the practice of fracking, pose an immense threat to water resources. High volume removal of surface or groundwater can result in damage to wetlands, which rely on ample water supplies to maintain the fragile dynamics of a wetland habitat. Damage can also occur from spills of chemicals or wastewater, filling operations, and

[91] Freyman, Monika and Ryan Salmon, Hydraulic Fracturing and Water Stress: Growing Competitive Pressures for Water, CERES, 9 (2013) ("Freyman 2013"), *available at* http://www.ceres.org/resources/reports/hydraulic-fracturing-water-stress-water-demand-by-the-numbers.

sediment runoff.[92] BLM in its environmental document must fully vet the impacts from every potential aspect of the proposed sale.

Many plant and animal species depend on wetland habitats, and even small changes can lead to significant impacts. Wetlands provide a variety of "eco-service" functions, including water purification, protection from floods, and functioning as carbon sinks.[93] The ecological importance of wetlands is unquestionable, and their full protection is paramount. The EIS must analyze these potential impacts to wetlands, and the related, potential indirect impacts that may stem from such impacts.

III. Oil and Gas Operations Harm Air Quality

Oil and gas operations emit numerous air pollutants, including volatile organic compounds (VOCs), NO_X, particulate matter, hydrogen sulfide, and methane. Fracking operations are particularly harmful, emitting especially large amounts of pollution, including air toxic air pollutants. Permitting fracking and other well stimulation techniques will greatly increase the release of harmful air emissions in these and other regions. BLM should adopt the no-leasing (or no action) alternative, or else adopt a no-fracking alternative, which would prevent further degradation of local air quality, respiratory illnesses, premature deaths, hospital visits, as well as missed school and work days.

A. Types of Air Emissions

Unconventional oil and gas operations emit large amounts of toxic air pollutants,[94] 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.[95] 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 air toxics have been used in fracking and other types of unconventional oil and gas recovery in California.[96] Through the implementation of these new reporting requirements, it is now known that operators have been using several types of air toxics in California, 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

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[92] U.S. Department of Justice, *Trans Energy Inc. to Restore Streams and Wetland Damaged by Natural Gas Extraction Activities in West Virginia* (Sep. 2, 2014), http://www.justice.gov/opa/pr/trans-energy-inc-restore-streams-and-wetland-damaged-natural-gas-extraction-activities-west (accessed July 29, 2015); *See also*, Pennsylvania Department of Environmental Protection, Commonwealth of Pennsylvania, DEP Fines Seneca Resources Corp. $40,000 for Violations at Marcellus Operation in Tioga County (Jul. 10, 2010), http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=14655&typeid=1 (accessed July 29, 2015).

[93] U.S. Environmental Protection Agency, Wetlands and People, http://water.epa.gov/type/wetlands/people.cfm (accessed July 29, 2015).

[94] 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.

[95] U.S. EPA, Hazardous Air Pollutants, *available at* http://www.epa.gov/haps (accessed Jan. 10, 2016).

[96] Center for Biological Diversity, Air Toxics One Year Report, p. 1 (June 2014).

pollutants.[97] 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. Concentrations of these pollutants—ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead—will likely 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.[98] The VOCs emitted include the BTEX compounds – benzene, toluene, ethyl benzene, and xylene – which are listed as Hazardous Air Pollutants.[99] There is substantial evidence showing the grave harm from these pollutants.[100] Recent studies and reports confirm the pervasive and extensive amount of VOCs emitted by unconventional oil and gas extraction.[101] In particular, a study covering sites near oil and gas wells in five different states found that concentrations of eight volatile chemicals, including benzene, formaldehyde and hydrogen sulfide, exceeded risk-based comparison values under several operational circumstances.[102] Another study determined that vehicle traffic and engine exhaust were likely the sources of intermittently high dust and benzene concentrations observed near well pads.[103] Recent studies have found that oil and gas operations are likely responsible for elevated levels of hydrocarbons such as benzene downwind of the Denver-Julesburg Fossil Fuel Basin, north of Denver.[104] Another study found that oil and gas operations in this area emit approximately 55% of the VOCs in northeastern Colorado. [105]

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,[106] and sunlight. This reaction can diminish visibility and air quality and harm vegetation. Tropospheric

[97] U.S. Environmental Protection Agency, The Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants, Technology Transfer Network Air Toxics Web Site, http://www.epa.gov/ttnatw01/orig189.html (accessed July 29, 2015).

[98] 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.

[99] 42 U.S.C. § 7412(b).

[100] Colborn 2011; McKenzie 2012; Food & Water Watch 2012.

[101] McCawley, M., 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).

[102] Macey, G.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.

[103] McCawley 2013.

[104] 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").

[105] Gilman, J.B. et al., *Source Signature of Volatile Organic Compounds from Oil and Natural Gas Operations in Northeastern Colorado*, 47 Envtl. Sci & Tech. 1297, 1303 (2013).

[106] *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") at 24.

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.[107] In addition to its role as a greenhouse gas, methane contributes to increased concentrations of ground-level ozone, the primary component of smog, because it is an ozone precursor.[108] 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 . . . ."[109]

Like methane, VOCs and NO_X are also ozone precursors; therefore, 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.[110] Ozone can result in serious health conditions, including heart and lung disease and mortality.[111] 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.[112]

Oil and gas operations can also emit hydrogen sulfide. The hydrogen sulfide is contained in the natural gas and makes that gas "sour."[113] 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.[114]

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[115] that is especially harmful.[116] Vehicles traveling on unpaved roads also kick up fugitive dust,

[107] Fiore, Arlene et al., Linking Ozone Pollution and Climate Change: The Case for Controlling Methane, 29 Geophys. Res Letters 19 (2002).
[108] 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).
[109] Fiore, Arlene et al., Linking ozone pollution and climate change: The case for controlling methane, 29 Geophys. Res Letters 19 (2002); *see also* Martin, Randal et al., Final Report: Uinta Basin Winter Ozone and Air Quality Study Dec 2010 - March 2011 (2011) at 7.
[110] Armendariz at 1, 3, 25-26; Wendy Koch, *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.
[111] U.S. Environmental Protection Agency, Integrated Science Assessment (ISA) for Ozone (O3) and Related Photochemical Oxidants (2013).
[112] Lyman, Seth and Howard Shorthill, Final Report: 2012 Uintah Basin Winter Ozone & Air Quality Study, Utah Department of Environmental Quality (2013); *see also* Gilman, Jessica et al., Source signature of colatile organic compounds from oil and natural gas operations in northeastern Colorado, Environ Sci and Technology (Jan 14, 2013), DOI: 10.1021/es304119a.
[113] Sierra Club Comments.
[114] USEPA, 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").
[115] Earthworks, Sources of Oil and Gas Pollution (2011).
[116] Bay Area Air Quality Management District, Particulate Matter Overview, Particulate Matter and Human Health (2012).

which is particulate matter.[117] Further, both NO_X and VOCs, which as discussed above are heavily emitted by the oil and gas industry, are also particulate matter precursors.[118] Some of the health effects associated with particulate matter exposure are "premature mortality, increased hospital admissions and development of chronic respiratory disease."[119]

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 can harm the cardiovascular system and blood, and 66 percent can harm the kidneys.[120] Also, 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.[121] 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.[122] Further, these proppants often include silica sand, which increases the risk of lung disease and silicosis when inhaled.[123] 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.[124]

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 VOC and air toxics levels.

B. Sources of Air Emissions

Harmful air pollutants are emitted during every stage of unconventional oil and gas recovery, including drilling, completion, well stimulation, production, and disposal. 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.

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[117] 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").
[118] EPA RIA at 2-2.
[119] 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).
[120] Colborn 2011 at 8.
[121] 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 Revised Draft Staff Report PR1148-2").
[122] *Id.*
[123] 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.
[124] SCAQMD Revised Draft Staff Report PR1148-2 at 15.

Similarly, high-powered pump engines are used in the fracturing and completion phase. This too can result 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. 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.[125] 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.[126]

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. 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.

C. Impact of Increased Air Pollution

The potential harms resulting from increased exposure to the dangerous air pollutants described above are serious and wide ranging. 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

[125] Miller 2013.
[126] 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, Environ. Sci. Technol., 2015, 49 (13), pp 7524–7526.

function, and increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.[127]

Sulfur Dioxide (SO_2) has been shown to cause an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms.[128] 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.[129]

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.[130] 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.[131] 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.[132]

Ozone (O_3) can trigger or worsen asthma and other respiratory ailments.[133] 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.

Air toxics and hazardous air pollutants, by definition, can result in harm to human health and safety. 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 range of illnesses that can result are summarized in a study by Dr. Theo Colburn, which charts which chemicals have been shown to be linked to certain illnesses.[134]

Natural gas drilling operations result in the emissions of numerous non-methane hydrocarbons (NMHCs) that have been linked to numerous adverse health effects. A recent study

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[127] 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).
[128] U.S. Environmental Protection Agency, Sulfur Dioxide http://www.epa.gov/airquality/sulfurdioxide/health.html, *available at* (accessed July 29, 2015).
[129] *Id.*
[130] U.S. Environmental Protection Agency, Carbon Monoxide, *available at* http://www.epa.gov/airquality/carbonmonoxide/health.html (accessed July 29, 2015).
[131] *Id.*
[132] *Id.*
[133] U.S. Environmental Protection Agency, Ground Level Ozone, *available at* http://www.epa.gov/airquality/ozonepollution/health.html (accessed July 29, 2015).
[134] Colborn, Theo et al., Natural Gas Operations from a Public Health Perspective, 17 Human and Ecological Risk Assessment 1039 (2011) ("Colborn 2011"); Colborn, Theo, et al., An Exploratory Study of Air Quality near Natural Gas Operations, Human and Ecological Risk Assessment: An International Journal doi:10.1080/10807039.2012.749447 (2012); *see* note 120 & accompanying text below.

that analyzed air samples taken during drilling operations near natural gas wells and residential areas in Garfield County, detected 57 chemicals between July 2010 and October 2011, including 44 with reported health effects.[135] 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.[136]

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.[137] 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."[138] 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.[139] 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.[140] 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.[141]

Another study reviewed exposures to emissions from unconventional natural gas development and noted that trimethylbenzenes are among the largest contributors to non-cancer threats for people living within a half mile of a well, while benzene is the largest contributor to cumulative cancer risk for people, regardless of the distance from the wells.[142]

D. Air Modeling

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[135] Colborn et al., An Exploratory Study of Air Quality Near Natural Gas Operations, Human and Ecological Risk Assessment: An International Journal, Vol. 20, Iss. 1, 2014, pp. 21-22 (pages refer to page numbers in attached manuscript and not journal pages) ("Colborn 2014), *available at* http://www.tandfonline.com/doi/full/10.1080/10807039.2012.749447.

[136] Colborn 2014, p. 11.

[137] *Id*., p. 10.

[138] *Id*., pp. 11-12.

[139] *Id*. p. 12.

[140] *Id*., p. 10-11.

[141] *Id*., p. 12.

BLM should use air modeling to understand what areas and communities will most likely be affected by air pollution. It is crucial to gather independent data rather than relying on industry estimates, which may be inaccurate or biased. Wind and weather patterns, and atmospheric chemistry, determine the fate and transport of air pollution over a region, over time. The EIS should be informed by air modeling to show where the air pollution will flow.

IV. Fossil Fuel Development Will Exacerbate Climate Change

A. BLM Must End New Fossil Fuel Leasing

Climate change is a problem of regional and global proportions resulting from the cumulative greenhouse gas emissions of countless individual sources, which cannot simply be addressed on a project-by-project basis. A comprehensive look at the impacts of fossil fuel extraction, and especially fracking, across all of the planning areas affected by the lease sale in updated RMPs is absolutely necessary. BLM has *never* thoroughly considered the cumulative climate change impacts of *all* potential fossil fuel extraction within each of the planning areas or across all of the state's federal fossil fuel resources, let alone across all BLM lands. Proceeding with new leasing proposals *ad hoc* in the absence of a comprehensive plan that addresses climate change and fracking is premature and risks irreversible damage before the agency and public have had the opportunity to weigh the full costs of oil and gas extraction and consider necessary limits on fracking. Therefore BLM must cease all new leasing at least until the issue is adequately analyzed in amended RMPs.

Expansion of fossil fuel production will substantially increase the volume of greenhouse gases emitted into the atmosphere and jeopardize the environment and the health and well being of future generations. BLM's mandate to ensure "harmonious and coordinated management of the various resources *without permanent impairment of the productivity of the land and the quality of the environment*" requires BLM to limit the climate change effects of its actions.[143] Keeping all unleased fossil fuels in the ground and banning fracking and other unconventional well stimulation methods would lock away millions of tons of greenhouse gas pollution and limit the destructive effects of these practices.

According to a recent report by EcoShift Consulting commissioned by the Center and Friends of the Earth, unleased federal fossil fuels represent a significant source of potential greenhouse gas emissions:

- Potential GHG emissions of federal fossil fuels (leased and unleased) if developed would release up to 492 gigatons (Gt) (one gigaton equals 1 billion tons) of carbon dioxide equivalent pollution (CO2e); representing 46 percent to 50 percent of potential emissions from all remaining U.S. fossil fuels.
- Of that amount, up to 450 Gt CO2e have not yet been leased to private industry for extraction;

[143] *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).

- Releasing those 450 Gt CO2e (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 below scientifically advised levels.[144]

In order to avoid catastrophic climate change, BLM must reduce, rather than increase, greenhouse gas emissions. This requires halting all new leasing and fracking within the Vernal, Price, Moab, Fillmore, and Fishlake planning areas, which would be a responsible step towards slowing the effects of climate change. The internationally agreed-on target for avoiding dangerous climate change and its disastrous consequences is limiting average global temperature rise caused by greenhouse gas pollution to two degrees Celsius (2°C), or 3.6 degrees Fahrenheit.[145] Climate experts have estimated that the world can emit 1,000 gigatons of carbon dioxide (1,000 $GtCO_2$ or 1 trillion tons of CO_2) after 2010 to have a reasonable chance of staying below 2°C of warming.[146] Given uncertainties, coupled with the dire predictions of climate change impacts, a more conservative carbon budget would be more prudent. Nonetheless, using this budget, the IPCC has found that proven fossil fuel reserves amount to **four to seven times more** than what we can afford to burn, to have only a *likely* chance of staying within the 2°C target.[147] In short, the vast majority of *proven* reserves must be kept in the ground for preserving a livable planet. Minimizing new fossil fuel production is critical. Opening up new *unleased, unproven* areas to exploration and potential extraction of fossil fuels that are deemed unburnable, and allowing more fracking, on the other hand, runs completely counter to staying within the 2°C target.[148]

Development of the planning area's oil and gas resources will fuel climate disruption and undercut the needed transition to a clean energy economy. Keeping fossil fuels in the ground is, therefore, not only reasonable but also imperative. As BLM has not yet had a chance to consider a no-fracking alternative as part of any of its RMP planning processes, BLM should suspend new

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[144] EcoShift Consulting et al., The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels (Aug. 2015) (EcoShift 2015), *available at* http://www.ecoshiftconsulting.com/wp-content/uploads/Potential-Greenhouse-Gas-Emissions-U-S-Federal-Fossil-Fuels.pdf.

[145] The Copenhagen Accord forged under the United Nations Framework Convention on Climate Change talks formally recognized the international objective of limiting warming to 2°C above pre-industrial.

[146]The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change, established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). In its Fifth Assessment Report, the IPCC reported that the remaining carbon budget to have a "likely" (at least 66%) chance of staying below 2°C is 1000 GtCO2. See IPCC Climate Change 2014 Synthesis Report 63-64, *available at* http://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf.

[147] *Id*. at 63. In addition, a recent analysis by some of the world's leading climate scientists estimated that burning the Earth's proven fossil fuel reserves (i.e., those that are currently economically recoverable) would emit 4196 $GtCO_2$, over four times the 1000 $GtCO_2$ budget. *See* Raupach M. et al. Sharing a quota on cumulative carbon emissions. Nature Climate Change 4, 873-79 (2014), *available at* http://www.nature.com/nclimate/journal/v4/n10/full/nclimate2384.html. Analyses by the Carbon Tracker Initiative and Australian Climate Commission estimated that 80% of proven fossil fuel reserves must be kept in the ground to have a reasonable probability (75-80%) of staying below 2°C. This estimate includes only the fossil fuel reserves that are considered currently economically recoverable with a high probability of being extracted. *See* Carbon Tracker Initiative, Unburnable Carbon – Are the world's financial markets carrying a carbon bubble? (2011), *available at* http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf; Steffen, Will et al., Australian Climate Commission. The Critical Decade 2013: Climate Change Science, Risks and Responses (2013), *available at* http://apo.org.au/files/Resource/ClimateCommission_The-Critical-Decade-2013.pdf

[148] Unleased reserves are not considered proven reserves. *See* Ecoshift 2015 at 9.

leasing until it properly considers this alternative in an updated RMP or in the EIS. BLM would be remiss to continue leasing when it has never stepped back and taken a hard look at this problem at the programmatic scale. Before allowing more oil and gas extraction in the planning area, BLM must: (1) comprehensively analyze the total greenhouse gas emissions which result from past, present, and potential future fossil fuel leasing and all other activities across all BLM lands and within the various planning areas at issue here, (2) consider their cumulative significance in the context of global climate change, carbon budgets, and other greenhouse gas pollution sources outside BLM lands and the planning area, and (3) formulate measures that avoid or limit their climate change effects. By continuing leasing in the absence of any overall plan addressing climate change BLM is effectively burying its head in the sand.

B. BLM Must Fully Analyze Greenhouse Gas Emissions of Oil and Gas Operations.

BLM cannot ignore the mounting evidence proving that oil and gas operations are a major cause of climate change. This is due to emissions from the operations themselves, and emissions from the combustion of the oil and gas produced. Every step of the lifecycle process for development of these resources results in significant carbon emissions, including but not limited to:

End-user oil and gas combustion emissions. The combustion of extracted oil and gas will add vast amounts of carbon dioxide to the atmosphere, further heating the climate and moving the Earth closer to catastrophic and irreversible climate change. Though much of the oil is used as gasoline to fuel the transportation sector, the produced oil may also be used in other types of products. The EIS should study all end-uses as contributors to climate change.

Combustion in the distribution of product. To the extent that distribution of raw and end-use products will rely on rail or trucks, the combustion of gasoline or diesel to transport these products will emit significant greenhouse gas emissions.

Emissions from Refineries and Production. Oil and gas must undergo intensive refinery and production processes before the product is ready for consumption. Refineries and their auxiliary activities constitute a significant source of emissions.

Vented emissions. Oil and gas wells may vent gas that flows to the surface at times where the gas cannot otherwise be captured and sold. Vented gas is a significant source of greenhouse gas emissions and can also pose a safety hazard.

Combustion during construction and extraction operations. Operators rely on both mobile and stationary sources of power to construct and run their sites. The engines of drilling or excavation equipment, pumps, trucks, conveyors, and other types of equipment burn large amounts of fuel to operate. Carbon dioxide, methane, and nitrous oxide (another potent greenhouse gas) are emitted from oxidized fuel during the combustion process. Engines emit greenhouse gases during all stages of oil and gas recovery, including drilling rig mobilization, site preparation and demobilization, completion rig mobilization and demobilization, well drilling, well completion (including fracking and other unconventional extraction techniques), and well production. Transportation of equipment and chemicals to and from the site is an integral part of the production process and contributes to greenhouse gas emissions. Gas flaring is another important source of carbon dioxide emissions. Significant sources of emissions in oil production include pneumatic devices, dehydrators and pumps, and compressors, and system upsets.[149]

Fugitive emissions. Potent greenhouse gases can leak as fugitive emissions at many different points in the production process, especially in the production of gas wells. Recent studies suggest that previous estimates significantly underestimate leakage rates.[150] New research shows methane leakage from some gas wells may be as high at 17.3 percent.[151] Moreover, new research has shown that unconventional gas wells are up to 2.7 times more likely than a conventional well to have a cement or casing impairment, which can lead to methane leaks.[152] The intersection of new fractures with nearby abandoned wells can also result in methane migration to the surface.[153] Leakage can also occur during storage, processing, and distribution to customers.[154]

Natural gas emissions are generally about 84 percent methane.[155] Methane is a potent greenhouse gas that contributes substantially to global climate change. Its global warming potential is approximately 34 times that of carbon dioxide over a 100 year time frame and at least 86 times that of carbon dioxide over a 20 year time frame.[156] Oil and gas operations release large amounts of methane. While the exact amount is not clear, EPA has estimated that "oil and gas systems are the largest human-made source of methane emissions and account for 37 percent of methane emissions in the United States and is expected to be one of the most rapidly growing sources of anthropogenic methane emissions in the coming decades."[157] That proportion is based

[149] U.S. Environmental Protection Agency, National Gas STAR Program, Basic Information, Major Methane Emission Sources and Opportunities to Reduce Methane Emissions ("USEPA, Basic Information").

[150] Brandt, A. R. et al., *Methane leaks from North American natural gas systems,* 343 Science 733 *(2014);* 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) ("Miller 2013").

[151] Caulton, Dana R. et al., *Toward a Better Understanding and Quantification of Methane Emissions from Shale Gas Development*, 111 Proc. Natl. Acad. Sciences 17 (2014); Schneising, Oliver, et al., Remote Sensing of Fugitive Methane Emissions from Oil and Gas Production in North American Tight Geologic Formations, Earth's Future 2, doi:10.1002/2014EF000265 (2014); Allen, D. T. et al., *(2013), Measurements of Methane Emissions at Natural Gas Production Sites in the United States, 110* Proc. Natl. Acad. Sci. 44 *(2013) ("Allen 2013")*; Zavala-Araizaa, Daniel et al., *Reconciling divergent estimates of oil and gas methane emissions*, 112 Proc. Natl. Acad. Sciences 51 (2015), *available at* www.pnas.org/cgi/doi/10.1073/pnas.1522126112 (leakage rate 1.5% of production in Barnett shale or twice EPA's estimate); Vaidyanathan, G, *Bad news for the climate as methane leaks far surpass previous estimates*,E&E News (Dec. 8, 2015) (leakage rate in Barnett shale equal to annual emissions of 8,000 cars).

[152] Ingraffea, Anthony R, et al., *Assessment and Risk Analysis of Casing and Cement Impairment in Oil and Gas Wells in Pennsylvania, 2000 – 2012*, 111 Proc. Natl. Acad. Sciences 30 (2014).

[153] King, Pamela. *'Frack hits' provide pathways for methane migration study* , E&E News (Oct. 21, 2015).

[154] Howarth, R. W. A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas, Energy Science and Engineering 2014; 2(2): 47–60, 49 ("Howarth 2014").

[155] Brown Memo to EPA at 3; Power, Thomas, The Local Impacts of Natural Gas Development in Valle Vidal, New Mexico, University of Montana (2005) ("Power").

[156] Intergovernmental Panel on Climate Change, Chapter 8: Anthropogenic and Natural Radiative Forcing in Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Table 8.7 (2013); Howarth, Robert, et al., Methane and the greenhouse-gas footprint of natural gas from shale formations, Climactic Change (Mar. 31, 2011) ("Howarth 2011"); Shindell, Drew, *Improved Attribution of Climate Forcing to Emissions*, 326 Science 716 (2009).

[157] USEPA, Basic Information; *see also* Petron, Gabrielle, et al., *Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study*, 117 Journal of Geophysical Research (2012).

on an estimated calculation of methane emissions, rather than measured actual emissions, which indicate that methane emissions may be much greater in volume than calculated.[158]

Fracked wells leak an especially large amount of methane, with some evidence indicating that the leakage rate is so high that shale gas is worse for the climate than coal.[159] In fact, a research team associated with the National Oceanic and Atmospheric Administration recently reported that preliminary results from a field study in the Uinta Basin of Utah suggest that the field leaked methane at an eye-popping rate of nine percent of total production.[160]

The EIS must weigh the no-leasing and no-fracking alternatives' climate-change benefits against the impacts of allowing new leasing and fracking, and address the following:

1. Sources of Greenhouse Gases

In performing a full analysis of climate impacts, BLM must consider all potential sources of greenhouse gas emissions (e.g. greenhouse gas emissions generated by transporting large amounts of water for fracking). BLM should also perform a full analysis of all gas emissions that contribute to climate change, including methane and carbon dioxide. The EIS should calculate the amount of greenhouse gas that will result on an annual basis from (1) each of the fossil fuels that can be developed within the planning area, (2) each of the well stimulation or other extraction methods that can be used, including, but not limited to, fracking, acidization, acid fracking, and gravel packing, and (3) cumulative greenhouse gas emissions expected over the long term (expressed in global warming potential of each greenhouse pollutant as well as CO_2 equivalent), including emissions throughout the entire fossil fuel lifecycle discussed above.

2. Effects of Climate Change

In addition to quantifying the total emissions that would result from the lease sale, an EIS should consider the environmental effects of these emissions, resulting from climate disruption's ecological and social effects.[161] Release of greenhouse gases (from extraction, leakage, and downstream combustion) is not merely a reasonably foreseeable consequence of fracking extraction, it is the necessary and intended consequence. CEQ and the courts have repeatedly

[158] 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).
[159] Howarth 2011; Brune, Michael, Statement of Sierra Club Executive Director Michael Brune Before the Committee on Oversight & Government Reform (May 31, 2012); Wang, Jinsheng, et al., Reducing the Greenhouse Gas Footprint of Shale (2011); Alvarez, Ramon et al., *Greater focus needed on methane leakage from natural gas infrastructure*, Proc. Nat'l. Acad. Sci. Early Edition (Feb 13, 2012) at 3; *see also* Howarth, Robert, et al., Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al., (2012); Hou, Deyi, et al., Shale gas can be a double-edged sword for climate change, Nature Climate Change at 386 (2012)
[160] Tollefson, Jeff, *Methane leaks erode green credentials of natural gas*, Nature News (Jan 2, 2013).
[161] *See* Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts 11 (Dec. 18, 2014), *available at* *https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance* (instructing agencies to consider indirect and connected actions, including "downstream" emissions). Although the CEQ guidance is still in draft form and not binding, it is arbitrary for agencies to ignore its reasoning without explanation.

cautioned federal agencies that they cannot ignore either climate change generally, or the combustion impacts of fossil fuel extraction in particular.[162]

Although cost-benefit analysis is not necessarily the ideal or exclusive method for assessing contributions to an adverse effect as enormous, uncertain, and potentially catastrophic as climate change, BLM does have tools available to provide one approximation of external costs and has previously performed a "social cost of carbon" analysis in prior environmental reviews.[163] Its own internal memo identifies one available analytical tool: "For federal agencies the authoritative estimates of [social cost of carbon] are provided by the 2013 technical report of the Interagency Working Group on Social Cost of Carbon, which was convened by the Council of Economic Advisers and the Office of Management and Budget."[164] As explained in that report:

> The purpose of the "social cost of carbon" (SCC) estimates presented here is to allow agencies to incorporate the social benefits of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions. The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change.[165]

Leasing and development of unconventional wells could exact extraordinary financial costs to communities and future generations, setting aside the immeasurable loss of irreplaceable, natural values that can never be recovered. The EIS must provide an accounting of these potential costs.

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[162] *See* 40 C.F.R. §§ 1508.7, 1508.8; *Center for Biological Diversity v. Nat'l Highway Transp. Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008); *Utahns for Better Transp. v. U.S. Dep't of Transp.*, 305 F.3d 1152, 1176 (10th Cir. 2002); *Dine Citizens Against Ruining Our Env't v. U.S. Office of Surface Mining*, 82 F.Supp.3d 1201, 1212-14 (D. Colo. 2015).

[163] *See High Country Conserv'n Advocates v. United States Forest Serv.*, 2014 U.S. Dist. Lexis 87820 (D. Colo. 2014) (invalidating environmental assessment ["EA"] for improperly omitting social cost of carbon analysis, where BLM had included it in preliminary analysis); Taylor, P., "BLM crafting guidance on social cost of carbon -- internal memo," Greenwire, April 15, 2015, *available at* http://www.eenews.net/greenwire/stories/1060016810/; BLM Internal Memo from Assistant Director of Resources and Planning Ed Roberson ("Roberson Internal Memo"), April 2015, *available at* http://www.eenews.net/assets/2015/04/15/document_gw_01.pdf (noting "some BLM field offices have included estimates of the [social cost of carbon] in project-level NEPA documents") (accessed July 29, 2015); *see also* Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts, p. 18, *available at* www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance (accessed Jul 29, 2015) (quantitative analysis required if GHGs > 25k tons/yr).

[164] BLM, Roberson Internal Memo.

[165] *See* Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis - Under Executive Order 12866, May 2013, *available at* https://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf (accessed July 29, 2015); *see also* Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, Feb. 2010, *available at* http://www.epa.gov/otaq/climate/regulations/scc-tsd.pdf (accessed July 29, 2015).

C. The EAs Fail to Properly Address Climate Change Impacts

1. The Vernal, Price, and Moab EAs Erroneously Fail to Quantify Greenhouse Gas Emissions of New Leasing.

The Vernal, Price, and Moab EAs improperly assume that only one exploratory well per year would be developed within the leasing area, and arbitrarily fail to examine the impacts of full development of a lease. Moab EA at 38; Price EA at 41. Based on this assumption, the EAs rationalize that further analysis is not necessary because the drilling of one exploratory well would not result in emissions exceeding the CEQ's recommended significance threshold of 25,000 tons of GHG per year. BLM's assumption that development would be limited to exploratory development is unsupported.

NEPA requires "reasonable forecasting," which includes the consideration of "reasonably foreseeable future actions…even if they are not specific proposals" *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1079 (9th Cir. 2011)(citation omitted). Full development of the areas for lease is entirely foreseeable in light of the Reasonably Foreseeable Development Scenarios for each of the field offices and existing development patterns. Within the Price FO, all of the areas for lease are "high occurrence [conventional oil and gas] with high development potential" areas. *Compare* EA, Appendix B, Maps 1-2 *with* Price FO RMP, Map 3-21. Many of the parcels for lease are near existing oil and gas fields, including Buzzard Bench and Ferron Fields (parcels 151, 152, 153, 156, 112, 115, 116), as well as Last Chance Conventional Field (parcels 86, 87, 89, 90, 91, 92, 93, 94, 95, 96, 97,, 98, 100, 101). The Moab FO also exhibits a high potential for commercial development. *See* Moab FO RFD at 14 (oil and gas plays within MFO "rated as having a high potential for the occurrence of oil and gas and "[a]ll" plays "rated as having a high development potential"). And, in the Vernal Field Office, the parcels for lease all appear to be located within areas that are "high and moderate potential for the occurrence of oil and gas resources." *Compare* EA, Appendix B at 83 *with* Mineral Potential Report for the Vernal Planning Area at 1 & Appendix A, Figure A-4. It is therefore reasonably foreseeable that the leasing of these parcels will result in the commercial production of oil and gas. BLM must fully quantify the greenhouse gas emissions resulting from full commercial production, including emissions sources listed in section IV.B above.

That BLM cannot accurately calculate the total emissions expected from full development is not a rational basis for cutting off its analysis. "Because speculation is . . . implicit in NEPA," agencies may not "shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as crystal ball inquiry." *Id*. Indeed, the Fillmore EA undercuts BLM's assertions in the other EAs that GHGs from full production cannot be quantified at the leasing stage. *See* Fillmore EA at 57-58; *see also High Country Conservation Advocates v. United States Forest Serv.*, 52 F. Supp. 3d 1174, 1196 (D. Colo. 2014) (decision to forgo calculating mine's reasonably foreseeable GHG emissions was arbitrary "in light of the agencies' apparent ability to perform such calculations"). The EA estimates that sale of the Fillmore parcels will result in GHG emissions of 7,074.54 metric tons of CO2e per year, which includes emissions from the development of oil and gas. *Id*.

Elsewhere, BLM suggests that quantification of GHGs would occur when actual drilling is proposed. But by delaying quantification until after a lease is issued, BLM may prejudice the consideration of alternatives or leasing stipulations that would avoid or reduce greenhouse gas emissions to an extent not otherwise available after leasing. BLM has long (but incorrectly) maintained that leasing stipulations can only be imposed with the issuance of the lease. Thereafter, purportedly, its authority to condition drilling is limited to "reasonable measures" or "conditions of approval" that may not be "[in]consistent with lease rights granted." 43 C.F.R. § 3101.1-2. Cost-prohibitive measures could therefore potentially be barred. Further, measures to "minimize" impacts may be imposed, but those may not necessarily *avoid* impacts altogether. *Id*. Waiting until the drilling stage could also be too little too late, as various other actions may occur between leasing and drilling, such as the execution of unit agreements, or construction of roads or pipelines, all of which may narrow mitigation options available at the drilling stage. *See William P. Maycock et al*., 177 I.B.L.A. 1, 20-21 (Dec. Int. 2008) (holding that unit agreements limit drilling-stage alternatives).

2. The Fillmore EA underestimates GHG emissions.

While the Fillmore EA makes some attempt at quantifying the lease sale's GHG emissions, the EA falls far short of a complete and informative analysis. The rationale behind BLM's "input/output" assumptions that inform the estimate are totally opaque, precluding the reader's understanding of whether the total GHG estimate is reasonable. *See* Fillmore EA at 57-58. For example, no explanation is provided as to why one well drilled per year is a reasonable estimate. Further, while the analysis assumes an average daily production of 550 barrels of oil and 238 MCFD of natural gas from each well (again, without any explanation for these assumptions), it fails to account for the GHGs resulting from transport, refining, and combustion of the extracted mineral. In addition, the analysis lacks any accounting of fugitive emissions from well casings or pipelines. Nor does it acknowledge the widely recognized problem that emissions inventories consistently underestimate methane leakage. As noted above, a study of methane leakage in the Uintah Basin revealed that

3. The EAs Fail to Provide a Reasoned Explanation for Not Assessing the Cumulative Significance of the Lease Sale's Greenhouse Gas Emissions.

The Moab, Vernal, and Price EAs purport to follow the CEQ's draft guidance on analyzing the impacts of greenhouse gas emissions but in actuality evade any assessment of the sales' cumulative impacts on climate change, or even a future commitment to such analysis. BLM's failure to perform this analysis is not based on a "reasoned explanation." On the one hand, the EAs state that BLM lacks the "input data necessary to develop a reasonably accurate estimate of potential GHG emissions," which purportedly could only be obtained once a specific project is proposed, incorrectly suggesting that cumulative GHG impacts can only be analyzed at the *project-level* scale. On the other hand, the EAs maintain that analysis at the leasing stage would not be appropriate given the "aggregate nature of GHG contributions to global climate change." This conclusion necessarily undermines its aforementioned determination that a GHG analysis should be conducted at the project-level stage.

To the extent that BLM actually favors a programmatic analysis to address this issue, it purports to rely on CEQ guidance recommending that agencies select one approach or the other, but in the end, BLM selects neither:

> CEQ recommends that an agency select the appropriate level of action for NEPA review at which to assess the effects of GHG emissions and climate change, either at a broad programmatic or landscape-scale level or at a project- specific level, and that the agency set forth a reasoned explanation for its approach. A specific example CEQ cited of a project- specific action that can benefit from a programmatic NEPA review is authorizing leases for oil and gas drilling. Given the aggregate nature of GHG contributions to global climate change, and the aggregate nature of climate change impacts to area-specific impacts analyzed in a field office NEPA document, analysis at this scale is not appropriate and would not provide meaningful information to inform the decision.

This terse statement fails to adopt *any* approach to analyzing the cumulative impacts of the lease sale's greenhouse gas emissions. It merely rejects analysis at the leasing or project-scale, but neither performs nor relies on a programmatic analysis. No prior programmatic analysis is cited, because none exists. The Green River, Vernal, and House Resource Range Area (Fillmore) RMP FEISs adopted in 2008 did not even quantify greenhouse gas emissions, *see* Green River FO RMP FEIS 4-5 – 4-6, while the Moab RMP FEIS failed to analyze at all the cumulative significance of greenhouse gas emissions on climate change, *see* Moab RMP FEIS at 4-10, 4-507. And BLM has never examined the impacts of its entire leasing program on GHG emissions or climate change.

The upshot is a *de facto* determination not to analyze the lease sale's cumulative significance with respect to climate change, now or ever, without any "reasoned explanation" for this approach. BLM's FONSI with respect to climate change is therefore wholly arbitrary and without substantial evidentiary support.

If BLM intends to perform a programmatic analysis of GHG emissions within the Price, Vernal, Moab, and West Desert planning areas, and/or across all BLM lands–as it should—it must withhold all parcels from leasing until the programmatic analysis is complete. Such analysis must occur *before* lease sale parcels are sold, i.e., before an irretrievable commitment of resources is made.

4. BLM Can and Must Perform a Cumulative Significance Analysis of the Lease Sale's GHG Emissions.

BLM's rejection of any analysis of the cumulative significance of emissions at the leasing stage is all the more irrational in light of (a) its acknowledgement that GHG emissions estimates can serve as a proxy for assessing climate change impacts; (b) the availability of generally accepted tools and guidance to assess the significance of marginal emissions increases; and (c) ample science showing that any new federal leasing undermines U.S. policy to slow the effects of climate change. In short, BLM has readily available information and tools to assess the cumulative significance of emissions from new leasing.

a. A meaningful cumulative impacts analysis is possible at the leasing stage.

BLM recognizes that an increase in GHG emissions by itself, regardless of the specific impact traceable to a specific emission is potentially significant. *See, e.g.*, Fillmore EA at 58 ("increasing concentrations of GHGs are likely to accelerate the rate of climate change"); Price EA Apendix C at 8 ("leasing the parcels would lead to some type of exploration that would have indirect effects on global climate through GHG emissions"). It further acknowledges that "projected GHG emissions [can be used] as a proxy for assessing a proposed action's potential climate change impacts." *See* Moab EA at 34; Price EA at 51. It also acknowledges the CEQ's recommended significance threshold of 25,000 tons per year.[166] But for the difficulty in predicting emissions it would quantify those emissions and apply the CEQ's recommended 25,000 metric tons per year significance threshold to assess their significance. Thus, to the extent that BLM suggests a meaningful analysis of climate change effects is *only* possible through a programmatic analysis (even though quantification of GHGs would involve no less forecasting and unknown contingencies at that stage than at the leasing stage), that determination is undermined by the fact that it has all of the tools to quantify and assess emissions at the leasing stage.

As discussed above, the record does not support that emissions from leasing are likely to be less than 25,000 tons per year. This is all the more so when one considers all parcels offered in the February 2016 sale collectively—indeed, there is no reason why BLM should consider each Field Office's offered parcels in isolation from the others'. The State Office's offer of all parcels constitutes a single federal action.

b. The EAs arbitrarily reject social cost of carbon analysis.

[166] The CEQ's proposed threshold is only one possible approach for determining significance. In California, the Bay Area Air Quality Management District ("BAAQMD") has proposed a threshold of significance of 1,100 metric tons of CO2 for non-stationary sources, and 10,000 metric tons for stationary sources. BAAQMD, Proposed Thresholds of Significance at 7, December 2009, *available at* http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/Proposed%20Thresholds%20of%20Significance%20Dec%207%2009.ashx?la=en. Another district, the South Coast Air Quality Management District ("SCAQMD"), has recommended significance thresholds of 1,400 to 3,500 tons per year over existing emissions depending on land use type. See SCAQMD Greenhouse Gas CEQA Significance Threshold Stakeholder Working Group, November 2009, *available at*: http://www.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqasignificance-thresholds/year-2008-2009/ghg-meeting-14/ghg-meeting-14-mainpresentation.pdf?sfvrsn=2. As the lead agency for industrial projects, it has adopted a "tiered" approach that partially relies on a threshold of 10,000 tons per year over existing conditions. See SCAQMD, Interim CEQA GHG Significance Threshold for Stationary Sources, Rules and Plans, *available at* http://www3.aqmd.gov/hb/2008/December/081231a.htm. Additionally, the California Air Resources Board (ARB) has endorsed a sector-specific approach, based on its recognition that "some sectors contribute more substantially to the problem [of climate change], and therefore should have a greater obligation for emissions reductions[.]" ARB Draft GHG Threshold at 4, *available at* http://www.arb.ca.gov/cc/localgov/ceqa/meetings/102708/prelimdraftproposal102408.pdf. ARB's proposed significance threshold for industrial sources is 7,000 metric tons of CO2e, reflecting its objective to "develop a threshold of significance that will result in the vast majority (~90% statewide) of the [GHG] emissions from new industrial projects being subject to CEQA's requirement to impose feasible mitigation." *Id.* at 9.

Another tool BLM can use is the social cost of carbon analysis, *see* section IV.B.2 above. That this tool was initially developed for application in the rulemaking context is not a rational basis for rejecting its use in the NEPA context. BLM has not provided any reason for distinguishing the application of the SCC analysis in these two contexts. The Price, West Desert, and Vernal EAs supply no reason to reject its use here other than that it is not required under existing law or guidance. Such an out of hand rejection is not reasoned analysis. Indeed, BLM's Washington Office has offered technical assistance to BLM field offices that plan to use this tool, and it plans to offer "additional guidance for the field."[167] The Moab Field Office's stated reasons for not relying on social cost of carbon are also weak. While the IWG's SCC tool does not encompass the social cost of methane emissions, this is no excuse for failing to do any SCC analysis. Other analytical tools exist to evaluate the cost of methane emissions.[168] EPA has peer reviewed and employed such a tool in its "Regulatory Impact Analysis of the Proposed Emission Standards for New and Modified Sources in the Oil and Natural Gas Sector."[169]

c. *New greenhouse gas emissions resulting from new leasing is per se significant.*

Finally, BLM should consider emissions from new leasing *per se* significant, in furtherance of U.S. policy to avoid 1.5 degree warming above pre-industrial levels and slow the effects of climate change. As discussed above, any new leasing opens new reserves that should be deemed unburnable, given that the vast majority of existing reserves must remain in the ground to avoid catastrophic climate change. Indeed, there is no reasonable mitigation scenario under which most existing reserves can be burned and climate change reversed. [170] Application of such a threshold would compel BLM to actually consider mitigation measures to reduce the effects of climate change, in keeping with its duty to manage the public lands "without permanent impairment of the productivity of the land and the quality of the environment."

V. Oil and Gas Development Harms Sensitive Species and Wildlife

The expansion of oil and gas development activities will harm wildlife through habitat destruction and fragmentation, stress and displacement caused by development-related activities (e.g., construction and operation activities, truck traffic, noise and light pollution), surface water depletion leading to low stream flows, water and air contamination, introduction of invasive species, and climate change. These harms can result in negative health effects and population declines. Studies and reports of observed impacts to wildlife from unconventional oil and gas

[167] Roberson Internal Memo.
[168] *See* Marten A.L., Kopits K.A., Griffiths C.W., Newbold S.C., Wolverton A. 2014, online publication (2015, print publication). "Incremental CH4 and N2O mitigation benefits consistent with the US Government's SC-CO2 estimates," Climate Policy 15(2):272-298, abstract available at http://www.tandfonline.com/doi/abs/10.1080/14693062.2014.912981.
[169] *See* USEPA, Social Cost of Carbon, *available at* http://www3.epa.gov/climatechange/EPAactivities/economics/scc.html (noting application of social cost of methane supported by peer review); USEPA, Regulatory Impact Analysis of the Proposed Emission Standards for New and Modified Sources in the Oil and Natural Gas Sector, Ch. 4, available at http://www3.epa.gov/airquality/oilandgas/pdfs/og_prop_ria_081815.pdf.
[170] *See* IPCC 2014 Synthesis Report at 63 ("warming caused by CO2 emissions is effectively irreversible over multi-centry timescales unless measures are taken to remove CO2 from the atmosphere").

extraction activities are summarized in the Center's "Review of Impacts of Oil and Gas Exploration and Development on Wildlife," submitted herewith.[171] Because the allowance of destructive oil and gas extraction runs contrary to BLM's policy of managing resources in a manner that will "protect the quality of…ecological…values" and "provide…habitat for wildlife,"[172] a no-fracking alternative minimizing industrial development and its harmful effects on wildlife must be considered.

A. Habitat Loss

Oil and gas development creates a network of well pads, roads, pipelines, and other infrastructure that lead to direct habitat loss and fragmentation, as well as displacement of wildlife from these areas due to increased human disturbance. Habitat loss occurs as a result of a reduction in the total area of the habitat, the decrease of the interior-to-edge ratio, isolation of one habitat fragment from another, breaking up of one habitat into several smaller patches of habitat, and decreasing the average size of a habitat patch. New research has revealed the extent of this habitat loss. For example, in the western United States, the amount of high-quality habitat for the pronghorn has shrunk drastically due to oil and gas development.[173]

The indirect effects from unconventional oil and gas development can often be far greater than the direct disturbances to habitat. The impacts from the well site—including noise, light, and pollution—extend beyond the borders of the operation site and will consequently render even greater areas uninhabitable for some wildlife. Species dependent on having an "interior" habitat will lose their habitat as operation sites or other infrastructure fragment previously buffered and secluded areas. These and other indirect effects can be far greater than the direct disturbances to land. In the Marcellus shale of Pennsylvania, for instance, research shows that 8.8 acres of forest on average are cleared for each drilling pad along with associated infrastructure, but after accounting for ecological edge effects, each drilling station actually affected 30 acres of forest.[174]

While individual well sites may cause some disturbance and destruction, the cumulative impacts of oil and gas production using unconventional methods must receive attention as well. While the actual well pads may only occupy a small proportion of a particular habitat, their impact can be much greater when their aggregate impact is considered. As discussed above, interior habitats will be destroyed by removing the buffer between the interior habitat and the operation site. For example, one study found that grassland bird species' habitat have been degraded by oil development in the Baaken shale region, as evidenced by their avoidance of these areas. Grassland birds avoided areas within 150 meters of roads, 267 meters of single-bore

[171] *See* Center for Biological Diversity, Review of Impacts of Oil and Gas Exploration and Development on Wildlife (June 20, 2015). This review presents the findings of numerous studies and reports on the impacts of hydraulic fracturing on wildlife.
[172] 43 U.S. Code § 1701(a)(8).
[173] Beckmann, J.P. et al. Human-mediated shifts in animal habitat use: Sequential changes in pronghorn use of a natural gas field in Greater Yellowstone, 147 Biological Conservation 1:222 (2012).
[174] Johnson, N., Pennsylvania energy impacts assessment: Report 1: Marcellus shale natural gas and wind, Nature Conservancy – Pennsylvania Chapter (2010) at 10.

well pads, and 150 meters of multi-bore well pads.[175] In areas of dense development, these habitat effects are greatly multiplied for sensitive species, such as the Sprague's pipit (*Anthus spragueii*), which avoided areas within 350 meters of single-bore well pads. The EIS must quantify the potential cumulative loss of habitat for sensitive species.[176]

B. Water Depletion

Water depletion also affects species whose habitats are far removed from the actual well site. Because of the high volume of water required for even a single well that uses unconventional extraction methods, *see* section II(B) above, the cumulative water depletion has a significant impact on species that rely on water sources that serve to supply oil and gas operations. In addition, water depletion adversely impacts water temperature and chemistry, as well as amplifies the effects of harmful pollutants on wildlife that would otherwise be diluted without the depletion.

C. Water Contamination

Accidental spills or intentional dumping of wastewater contaminate surface water and cause large-scale harm to wildlife. Numerous incidents of wastewater contamination from pipelines, equipment blowouts, and truck accidents have been reported, and have resulted in kills of fish, aquatic invertebrates, and trees and shrubs, as well as negative health effects for wildlife and domestic animals. In 2013, a company admitted to dumping wastewater from fracking operations into the Acorn Fork Creek in Kentucky, causing a massive fish kill.[177] Among the species harmed was the blackside dace, a threatened minnow species.[178] An analysis of water quality of Acorn Creek and fish tissues taken shortly after the incident was exposed showed the fish displayed general signs of stress and had a higher rate of gill lesions, than fish in areas not affected by the dumping.[179] The discharge of fracking wastewater into the Susquehanna River in Pennsylvania is suspected to be the cause of fish abnormalities, including high rates of spots, lesions, and intersex.[180] In West Virginia, the permitted application of hydrofracturing fluid to an area of mixed hardwood forest caused extensive tree mortality and a 50-fold increase in surface soil concentrations of sodium and chloride.[181]

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[175] Thomas, Sarah J. et al. Avoidance of unconventional oil wells and roads exacerbates habitat loss for grassland birds in the North American great plains, Biological Conservation 192 (2015) 82–90, *available at* https://www.researchgate.net/publication/282292567_Avoidance_of_unconventional_oil_wells_and_roads_exacerbates_habitat_loss_for_grassland_birds_in_the_North_American_great_plains.
[176] *Id.*
[177] Vaidyanathan, Gayathri, *Fracking Spills Cause Massive Ky. Fish Kill*, E&E News, Aug. 29. 2013, http://www.eenews.net/greenwire/2013/08/29/stories/1059986559 (accessed July 30, 2015).
[178] *Id.*
[179] Papoulias, D.M. and A.L. Velasco. Histopathological analysis of fish from Acorn Fork Creek, Kentucky, exposed to hydraulic fracturing fluid releases, 12 Southwestern Naturalist (Special Issue 4):92 (2013).
[180] Piette, Betsy, BP Oil Spill, Fracking Cause Wildlife Abnormalities, Workers World (April 27, 2012) available at http://www.workers.org/2012/us/bp_oil_spill_fracking_0503/; Pennsylvania Fish & Boat Commission, Ongoing Problems with the Susquehanna River smallmouth bass, a Case for Impairment (May 23, 2012), www.fish.state.pa.us/newsreleases/2012press/senate_susq/SMB_ConservationIssuesForum_Lycoming.pdf
[181] Adams, Mary Beth, Land Application of Hydrofracturing Fluids Damages a Deciduous Forest Stand in West Virginia, 40 Journal of Environmental Quality 1340 (2011).

In addition, open air pits that store waste fluid pose risks for wildlife that may come into contact with the chemicals stored in the pits. Already, there have been several documented cases of animal mortality resulting from contact with pits. A field inspection of open pits in Wyoming found 269 bird carcasses, the likely cause of death being exposure to toxic chemicals stored in the open pits.[182] Open pits can also serve as breeding grounds for mosquitoes, which serve as a vector for West Nile virus, a threat to humans and animals alike. In Wyoming, an increase of ponds led to an increase of West Nile virus among greater sage-grouse populations.[183] Recently, new information has come to light that operators in California have been dumping wastewater into hundreds of unpermitted open pits.[184] The EIS must take into account the impact of both unpermitted, illegal waste pits as well as those that are regulated.

Contaminants from spills not only directly harm species exposed to these contaminants but can enter the food chain and harm predators. A recent study found that in watersheds where hydraulic fracturing occurs, a top predator , riparian songbird in headwater systems, the Louisiana Waterthrush (*Parkesia motacilla*), accumulated metals associated with the fracking process. "In both the Marcellus and Fayetteville shale regions, barium and strontium were found at significantly higher levels in feathers of birds in sites with fracking activity than at sites without fracking."[185] While the study did not resolve the pathway for these metals entering the food chain, their findings suggested that "hydraulic fracturing may be contaminating surface waters and underscores the need for additional monitoring and study to further assess ecological and human health risks posed by the increasingly widespread development of unconventional sources of natural gas around the world."[186]

D. Invasive Species

Invasive species may be introduced through a variety of pathways that would be increasingly common if oil and gas activity is allowed to expand. Machinery, equipment, and trucks moved from site to site can carry invasive plant species to new areas. In addition, materials such as crushed stone or gravel transported to the site from other locations may serve as a conduit for invasive species to migrate to the well site or other areas en route.

Aquatic invasive species may also spread more easily given the large amounts of freshwater that must be transported to accommodate new drilling and extraction techniques. These species may be inadvertently introduced to new habitats when water is discharged at the surface. Alternatively, hoses, trucks, tanks, and other water use equipment may function as conduits for aquatic invasive species to access new habitats.

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[182] *See, e.g.,* Ramirez, P. Jr., Bird Mortality in Oil Field Wastewater Disposal Facilities, 46 Environ Mgmt 5: 820 (2010).
[183] Zou, Li et al., Mosquito Larval Habitat Mapping Using Remote Sensing and GIS: Implications of Coalbed Methane Development and West Nile Virus, 43 J. Med. Entomol. 5:1034 (2006) ("Zou 2006").
[184] Cart, Julie. *Hundreds of Illicit Oil Wastewater Pits Found in Kern County*, (Feb. 26, 2015), *available at* http://www.latimes.com/local/lanow/la-me-ln-pits-oil-wastewater-20150226-story.html.
[185] Latta, Steven C., et al., Evidence from two shale regions that a riparian songbird accumulates metals associated with hydraulic fracturing," *Ecosphere* vol. 6(9), Article 144 (September 2015), *available at* http://www.esajournals.org/doi/pdf/10.1890/ES14-00406.1.
[186] *Id*.

E. Climate Change

Anthropogenic climate change poses a significant threat to biodiversity.[187] Climate disruption is already causing changes in distribution, phenology, physiology, genetics, species interactions, ecosystem services, demographic rates, and population viability: many animals and plants are moving poleward and upward in elevation, shifting their timing of breeding and migration, and experiencing population declines and extinctions.[188] Because climate change is occurring at an unprecedented pace with multiple synergistic impacts, climate change is predicted to significantly increase extinction risk for many species. The IPCC concludes that it is extremely likely that climate change at or above 4°C will result in substantial special extinction.[189] Other studies have predicted similarly severe losses: 15-37 percent of the world's plants and animals committed to extinction by 2050 under a mid-level emissions scenario[190]; the extinction of 10 to 14 percent of species by 2100 if climate change continues unabated.[191] Another recent study predicts the loss of more than half of the present climatic range for 58 percent of plants and 35 percent of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species.[192] Because expansion of oil and gas production in the planning area will substantially increase the emissions of greenhouse gases, this activity will further contribute to the harms from climate change to wildlife and ecosystems.

F. Population-level Impacts

Oil and gas development has been linked to population-level impacts on wildlife, including lower reproductive success of sage grouse and declines in the abundance of songbirds and aquatic species. For example, young greater-sage grouse avoided mating near infrastructure of natural-gas fields, and those that were reared near infrastructure had lower annual survival rates and were less successful at establishing breeding territories compared to those reared away from infrastructure.[193] In Wyoming, an increasing density of wells was associated with decreased numbers of Brewer's sparrows, sage sparrows, and vesper sparrows.[194] In the Fayetteville Shale

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[187] Warren, R. et al.,Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss, 3 Nature Climate Change 678 (2013) ("Warren 2013").

[188] Cahill, A.E. et al., How Does Climate Change Cause Extinction? Proceedings of the Royal Society B, doi:10.1098/rspb.2012.1890 (2012); Chen, I. et al., Rapid range shifts of species associated with high levels of climate warming, 333 Science 1024 (2011); Maclean, I.M.D., and R.J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 Proc. Natl. Acad. Sci. Early Edition 12337 (2011) ("Maclean and Wilson 2011"); Parmesan, C., Ecological and Evolutionary Responses to Recent Climate Change, 37 Annual Review of Ecology Evolution & Systematics 637 (2006); Parmesan, C., and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 Nature 37 (2003); Root, T.L. et al., Fingerprints of Global Warming on Wild Animals and Plants, 421 Nature 57 (2003); Warren, Rachel et al., Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141 (2011). ("Warren 2011").

[189] Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report, Summary for Policy Makers IPCC Fifth Assessment Synthesis Report*, 18 (2014).

[190] Thomas, C.D. et al., Extinction Risk from Climate Change, 427 Nature 8:145 (2004).

[191] Maclean and Wilson 2011.

[192] Warren 2013.

[193] Holloran, M.J. et al., Yearling Greater Sage-Grouse Response to Energy Development in Wyoming, 74 Journal of Wildlife Management 1:65 (2010).

[194] Gilbert, Michelle M. & Anna D. Chalfoun, Energy Development Affects Populations of Sagebrush Songbirds in Wyoming, 75 The Journal of Wildlife Management 4:816 (2011).

of central Arkansas, the proportional abundance of sensitive aquatic taxa, including darters, was negatively correlated with gas well density.[195] The EIS must consider the population-level impacts that oil and gas development may have on wildlife in the planning area.

G. Endangered, Threatened, and Sensitive Species

BLM must use the existing readily available data to identify which sensitive species that are of critical concern with regards to the lands included in, or in immediate proximity to, the proposed sale parcels. BLM's EIS must discuss any impacts to such species. Here, the EAs fail to address impacts to numerous imperiled species, including the endangered fish, Mexican spotted owl, and Greater sage-grouse, as further discussed below.

In addition, BLM has failed to consult with the Service regarding the impacts of the lease sale on various listed species, in compliance with its section 7 obligations under the ESA. To the extent that BLM relies on its section 7 programmatic consultation for the several management plans governing the lease sale, that reliance is not proper for any of the listed species affected by BLM's action. The RMPs or Fishlake Forest Plan amendments at issue did not at all address the impacts of hydraulic fracturing and horizontal drilling, including increased water use, water contamination risks, surface disturbance, and vehicle traffic required by fracking and horizontal drilling activities. The potential for fracking and horizontal drilling and its associated impacts within the Vernal, Price, Moab, and Fillmore Field Offices, and the Fishlake National Forest constitutes "new information reveal[ing] effects of the [RMPs] that may affect listed species or critical habitat in a manner or to an extent not previously considered [in the prior section 7 programmatic consultations]." 50 CFR § 402.16(b). BLM must therefore reinitiate consultation on all of the planning documents for these areas. In any case, it must formally consult over the lease sale's potential adverse effects on listed species and consider the full scope of fracking and other drilling activities that could affect these species.

1. Endangered Fish

Oil and gas activities within the parcels for sale may affect the four Colorado River endangered fish (humpback chub, Colorado pikeminnow, bonytail, and razorback sucker) and its critical habitat, including habitat downstream of the areas for lease. But the Vernal and Price EAs contain virtually no discussion of the impacts of new leasing on the endangered fish, including greater water depletions and the increased risk of spills and water contamination that could result from horizontal drilling and hydraulic fracturing. As the lease sale is reasonably certain to result in new oil and gas development, BLM must also consult with the Service regarding these potential harms to the endangered fish, in compliance with section 7 of the ESA.

a. Water depletions required by hydraulic fracturing and horizontal drilling will adversely affect the endangered fish.

[195] Green, Jessie J. et al., Abstract: Examining Community Level Variables of Fishes in Relation to Natural Gas Development, Southeastern Fishes Council, Annual Meeting Program, November 8 - 9, 2012, New Orleans, Louisiana (2012).

BLM acknowledges that any water depletion within the Upper Colorado River adversely affects the endangered fish:

> Water depletions from any portion of the Upper Colorado River drainage basin above Lake Powell are considered to adversely affect or adversely modify the critical habitat of the four resident endangered fish species, and must be evaluated with regard to the criteria described in the Upper Colorado River Endangered Fish Recovery Program. Formal consultation with USFWS is required for all depletions. All depletion amounts must be reported to BLM.

Vernal EA at 92.

Given the reasonable certainty that new leasing will result in new drilling, BLM is required to consult over the depletion effects of developing parcels within the Colorado River drainage basin on the endangered fish. This is especially so because prior consultations with the Service did not take into account the massive water requirements of hydraulic fracturing and horizontal drilling.

According to FracFocus, a database reporting fracking fluid composition for individual wells, from January 2011 through February 2013, hundreds of thousands of gallons of water were needed to fracture wells in several Utah counties, as displayed in the table below. [196] The FracFocus figure only represents the volume of water used in fracking fluids, and thus does not include the amount of water needed to also drill the well.[197]

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Uintah	835	140	695	326,600,000	340,715	81,509	804,497
Duchesne	501	498	3	183,500,000	129,079	18,228	1,297,842
Carbon	60	0	60	14,660,000	234,643	122,492	363,483
San Juan	9	6	3	510,900	54,739	25,469	104,540
Sevier	1	1	0	77,860	77,859	77,859	77,859

BLM must also take into account the higher fresh water requirements of drilling, completion, and fracking of horizontal wells. These wells typically require much greater amounts

[196] EPA, State-level Summaries of FracFocus 1.0 Hydraulic Fracturing Data, March 2015, pp. 1-2, 4, 14, *available at* http://www2.epa.gov/sites/production/files/2015-03/documents/ff_statesummarysheets_final_508.pdf.

[197] "Drilling and completion" are separate steps from "hydraulic fracturing" of a well. "Drilling" refers to drilling the borehole into the earth; "fracking" refers to the process of injecting fracking fluids into the well to create high pressure that fractures underground formations and forces trapped hydrocarbons to the surface once the pressure is released; and "well completion" refers to isolating the well from the surrounding environment and turning it into an actively producing well. *See* Jiang, Mohan, et al., *Life Cycle Water Consumption and Wastewater Generation Impacts of a Marcellus Shale Gas Well*, Environ. Sci. Technol. 2014 Feb 4; 48(3): 1911–1920, p. 1912, *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3915742/ (describing steps of drilling, fracking, and completing a well); Kargbo, David M., et al., *Natural Gas Plays in the Marcellus Shale: Challenges and Potential Opportunities*, Environ. Sci. Technol. 2010, 44, 5679–5684, pp. 5680-81, *available at* http://pubs.acs.org/doi/pdf/10.1021/es903811p (same); "How Does Well Completion Work?" Rigzone.com, *available at* http://www.rigzone.com/training/insight.asp?i_id=326 (describing well completion process).

of freshwater than do vertical or directional wells.[198] Since the Vernal and Price RMPs were published in 2008, operators have increasingly turned to horizontal drilling to exploit oil and gas within the Uinta Basin, and greater horizontal drilling is expected to occur within the Basin's Mancos shale play and other plays.[199]

b. Accidental Spills and Leaks Are Foreseeable and Will Increase with New Leasing and Increased Hydraulic Fracturing.

BLM must also consider the increased risk of spills and leaks that will result from new leasing within the planning area. Spills within the Green River sub-basin (including the Vernal and Price Field Offices) could be particularly detrimental to the endangered fish. Some of the most conducive habitat for endangered fish conservation and recovery exists within this sub-basin, including the only known spawning bar for razorback sucker in the Upper Colorado River Basin.[200]

Spills and leaks will certainly increase with the leasing of thousands of acres within the Vernal and Price Field Offices. Despite new measures to reduce the occurrence of spills under the Vernal and Price RMPs, numerous spills have occurred within the Upper Colorado Basin and the Green River sub-basin since 2008, contaminating surface and groundwater.[201] Between January 1, 2008 and July 31, 2014, 26 spills in the Vernal Field Office (including many on federal lands) resulted in contamination of water resources; 20 spills contaminated surface waters and 10 contaminated groundwater. Since August 1, 2014, in Duchesne County alone, dozens of spills or leaks have occurred, many of which impacted surface waters or groundwater or are suspected to have impacted these waters.[202] The number of spills could actually be higher, as spills commonly go unreported.[203]

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[198] EPA 2015 at 4-6 – 4-7; USGS, Water Used for Hydraulic Fracturing Varies Widely Across United States (June 30, 2015), *available at* http://www.usgs.gov/newsroom/article.asp?ID=4262#.VZ7ujvlVikr; *see also* NYDEC SGEIS at 6-2 – 6-7; BLM, Colorado State Office, Water Depletion Logs Reported to Fish and Wildlife Service (2009-2014) (indicating one horizontal wells depleting 63.1 and 70.8 acre-feet of water).

[199] *See, e.g.*, Rose Petroleum, Mancos operations update – Uinta Basin, Utah (Mar. 31, 2015), *available at* http://www.rosepetroleum.com/press/pressreleases/view/502 (discussing planned well development activities to target Mancos shale in Uinta Basin in Utah); Utah Dept. of Natural Resources Geological Survey, Tight-Oil Plays in Utah (2014), *available at* http://www.rpsea.org/media/files/files/0621eae8/EVNT-DOC-2014-SP_Conference_Handout-09-10-14.pdff January 2014 (noting over 200 APDs for horizontal wells targeting the Uteland Butte and other potential Green River tight-oil zones according to Utah Division of Oil, Gas, and Mining, plus other areas targeted with horizontal drilling).

[200] Valdez, R.A. and P. Nelson. 2004. Green River Subbasin Floodplain Management Plan. Upper Colorado River Endangered Fish Recovery Program, Project Number C-6, Denver, CO., available at http://www.coloradoriverrecovery.org/documents-publications/technical-reports/hab/GreenFMP.pdf.

[201] *See* Upper Colorado River Basin Spills (hereinafter "Spills Data"). This Excel spreadsheet consists of data reporting spills in the Upper Colorado River Basin that we compiled from the following sources: Colorado: Colorado Oil and Gas Conservation Commission, http://cogcc.state.co.us ("inspection/incident" database for "spill/release"); Utah: Utah Department of Environmental Quality, http://eqspillsps.deq.utah.gov/Search_Public.aspx; New Mexico: State of New Mexico Oil Conservation Division, https://wwwapps.emnrd.state.nm.us/ocd/ocdpermitting//Data/Incidents/Spills.aspx. The analysis does not include data from Wyoming or Arizona.

[202] *See* Utah Environmental Incidents Database, *available at* http://eqspillsps.deq.utah.gov/Search_Public.aspx included in CD of references as Duchesne County Spill Reports August 1, 2015 through January 8, 2016

Some of these spills could result in the release of large quantities of flowback, produced water (or brine water), fracking chemicals, or hydrocarbons, putting streams and connected groundwater at risk of contamination. For example, several large spills within the Vernal Field Office planning area or Duchesne County have polluted surface waters and/or groundwater:

- In October 2013, a salt water disposal line released 1500 barrels of produced water and 5 barrels of oil, which flowed into a nearby stock pond used for livestock watering.

- In September 2013, 692 barrels of fracking injection fluid was released over the course of a day. The operator did not detect a second leak until more than 12 hours after it began. The injection fluid ran down a leased access road and into a small stream which eventually flows into the Pariette Wetland. It is unknown how far down the stream the contaminants flowed.

- In May 2008, a pipeline leaked an unknown amount of produced water into a pond resulting in the removal of 1,300 barrels of contaminated water from the pond. [204]

- In 2014, a landowner in Duchesne County discovered contamination on his property and groundwater resulting from a condensate pipeline spill. The line leaked into the Roosevelt Lateral, a ditch that flows into Pick-Up Wash and then to the Green River. The landowner complained that several other spills had occurred on his property in the past few years but had gone unreported. The landowner reported he had lost several of his cattle, which were having blind calves.[205]

The potential for spills to move from tributaries into endangered fish critical habitat within main-stem rivers was shown by a 2014 spill into the Green River. On the night of May 20, 2014 an oil well operated by SW Energy on lands administered by BLM "blew out," leaking an estimated 100 barrels per hour of crude oil and production water into Salt Wash which leads to the Green River. SW Energy did not shut-in the well until 1:20 p.m. on May 22, at least 36 hours later. On May 24, flooding from a thunderstorm "overcame prevention measures" washing an

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("Duchense County Incidents") (incident nos. 12283, 11940, 8668, 12285, 12271, 11959, 12417, 12351, 12200, 12008).

[203] Souther, Sara, et al. Biotic Impacts of Energy Development from Shale: Research Priorities and Knowledge Gaps, Front Ecol Environ 2014; 12(6): 330-338, p. 332 (noting that companies routinely violated Pennsylvania's spill reporting requirement; only 59% of documented spills were reported by the drilling company); Gulf Monitoring Consortium Report on Activities from April 2011 to October 20, pp. 3-6, available at http://skytruth.org/gmc/wp-content/uploads/2012/05/Gulf-Monitoring-Consortium-Report.pdf (uncovering evidence of non-reporting and chronic under-reporting of oil spills in Gulf of Mexico 2012, using analysis of National Response Center reports and comparison with satellite imagery); Daneshgar et al., Chronic, Anthropogenic Hydrocarbon Discharges in the Gulf of Mexico, Deep-Sea Research II, Dec. 2014, available at http://www.sciencedirect.com/science/article/pii/S0967064514003725 (peer-reviewed study by scientists at Florida State University validating previous report's analysis); Kunzelman, M. Secrecy Shrouds Decade Old Oil Spill in Gulf of Mexico, Washington Post, April 16, 2015, available at http://www.washingtonpost.com/national/energy-environment/secrecy-shrouds-decade-old-oil-spill-in-gulf-of-mexico/2015/04/16/6f8f9070-e449-11e4-ae0f-f8c46aa8c3a4_story.html (noting vastly underestimated amount of oil leaked from reported spill).

[204] *See* Spills Data (Vernal tab); Vernal Field Office Incident Reports combined (incident nos. 11553, 11599, 6938).

[205] Duchesne County Incidents, incident no. 11959.

unknown quantity of oil and produced water 1.5 miles from Salt Wash into the Green River and critical habitat for endangered fish.[206] The U.S. Fish and Wildlife Service's recent Biological Opinion for the Gasco Energy Inc. Field Development Project anticipates these events and the potential for more frequent spills given expanded drilling:

> There is a greater potential for impacts from pollutants, if a pipeline, well pit, or other source were to inadvertently release contaminated fluids into waterways at points near the Green and White Rivers. Through direct or indirect discharge, these pollutants could reach the Green River and negatively impact water quality to the point of affecting native fish populations. Direct impacts will result from a discharge from a pipeline or well pit reaching the Green River in its original form or within a single release event. Indirect effects occur when discharges are released to the ground and are later released to the river after being carried by an erosion event or carried by rain or snowmelt runoff. As more well and pipeline development occurs in the project area the chance of pollutants reaching the Green River increases, thus increasing the potential of harm to native fish populations.[207]

Like the above Green River incident, some spills or leaks are not detected until long after they have released.[208] A number of spills in the Upper Colorado Basin were of "unknown" quantity and/or substance; these spills could have potentially been quite large, given their belated discovery.[209] In cases where spills are reported only to have contaminated soil, but were not detected until long after they have occurred,[210] runoff may have carried contaminants to surface waters. Thus, it is quite possible that large volumes of chemical substances escape undetected until reaching surface sediments or waters. The Gasco Biological Opinion explains that this is especially possible with smaller leaks:

> The effects of smaller leaks that may cause chronic, sub-lethal effects to fish populations may be more prevalent. While the oil and gas industry has a wide variety of methods available to detect substantial leaks or integrity breeches, the

[206] BLM. 2014. Update: Salt Wash Oil Spill, available at http://www.blm.gov/ut/st/en/fo/moab/SaltWashSpill.html.
[207] Fish and Wildlife Service, Biological Opinion for the Gasco Energy Inc. Field Development Project ("Gasco BO"), Dec. 2011, p. 26, available at http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/gasco_eis/gasco_rod.Par.56176.File.dat/Gasco%20ROD%20Attachment%205%20BO.pdf.
[208] *See* MacPherson, James, "ND wants answers on ruptured pipeline inspections," AP, Oct. 16, 2013, available at http://bigstory.ap.org/article/experts-question-north-dakota-oil-spill-estimates (spill released from quarter-inch pipeline hole contaminated wheat field the size of seven football fields); Vanderklippe, Nathan. "Spill sends 22,000 barrels of oil mix into Alberta muskeg," *The Globe and Mail*, May 30, 2012, available at http://www.theglobeandmail.com/globe-investor/spill-sends-22000-barrels-of-oil-mix-into-alberta-muskeg/article4219809/ (22,000-barrel wastewater pipeline spill not detected until after it had reached surface waters and was spotted by aircraft); Vanderklippe, "Toxic waste spill in northern Alberta biggest of recent disasters in North America," *The Globe and Mail*, June 12, 2013, available at http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/apache-pipeline-leaks-60000-barrels-of-salty-water-in-northwest-alberta/article12494371/ (9.5 million liter spill of produced water from pipeline suspected to be "longstanding" given the extent of damage over 42 hectares).
[209] Spills Data (All Upper Basin tab, columns J-L).
[210] *See, e.g.*, Duchesne County Incidents, incident no. 11967.

> technology for detection of small "pinhole" leaks is not as advanced. This creates a significant problem in that the current available methodology may allow small leaks to go undetected for extended periods of time often evading detection until they are manifested on the surface sediments or water.[211]

Spills and leaks from oil and gas development routinely occur not just in the Vernal and Price Field Offices but also throughout the Upper Colorado Basin. Between January 2008 and July 2014, operators reported at least 135 spills or leaks that resulted in releases to surface or groundwater in the Upper Basin—many of these from facilities were under BLM's jurisdiction.[212] With increasing oil and gas development expected to occur throughout the upper Basin, it is entirely foreseeable that the risk of spills in this region will only increase. The cumulative effects of this increased risk of spills on endangered fish in the region must also be accounted for in the BLM's and Service's analysis of the lease sale's effects on the endangered fish. This includes the effects of spills in other BLM planning areas, and in connection with non-federal wells in the upper Basin.

BLM's and the Service's analysis of the lease sale's effects on the endangered fish must also account for the unprecedented sheer volume of chemicals and wastewaters that will be generated by increased hydraulic fracturing in the lease sale areas. Millions of pounds of fracking chemicals will be transported to these areas, injected into the ground, and either reinjected underground or transported offsite for disposal.[213] The amount of produced water also is likely to increase with increasing rates of hydraulic fracturing.[214] Such wastewaters are highly corrosive, increasing the risk of pipelines and tanks releasing their contents.[215]

b. Spills and Leaks Are Likely to Adversely Affect the Endangered Fish.

An increased risk of spills due to new leasing would adversely affect the endangered fish. Fracking chemicals and fracking wastewaters can be highly toxic to fish. Produced waters that fracking operations force to the surface from deep underground can contain high levels of total dissolved solids, salts, metals, and naturally occurring radioactive materials.[216] Flowback waters (i.e., fracturing fluids that return to the surface) may also contain similar constituents along with fracturing fluid additives such as surfactants and hydrocarbons.[217] The identity and effects of many of these additives is unknown, due to operators' claims of confidential business

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[211] Gasco BO, p. 27.
[212] Spills Data (all Upper Basin tab).
[213] *See* EPA, "Analysis of Hydraulic Fracturing Fluid Data from the FracFocus Chemical Disclosure Registry 1.0 ," Webinar Presentation, March 2015, p. 14, available at http://www2.epa.gov/sites/production/files/2015-04/documents/fracfocus_public_webinars_508_0.pdf (noting that hundreds or thousands of pounds may be brought to, stored, and mixed on the well pad).
[214] Souther 2014 at 332 (noting 570% increase in wastewater production since 2004 from development of the Marcellus Shale).
[215] Petrowiki, "Corrosion Problems in Production," Oct. 29, 2014, available at http://petrowiki.org/Corrosion_problems_in_production ("The fact that most oil and gas production includes co-produced water makes corrosion a pervasive issue across the industry.")
[216] Brittingham, Margaret C., et al. Ecological Risks of Shale Oil and Gas Development to Wildlife, Aquatic Resources and their Habitats. *Environ. Sci. Technol.* 2014, 48, 11034-11047, p. 11039.
[217] *Id*.

information. Compounds in mixtures can have synergistic or antagonistic effects, but it is impossible to know these effects without full disclosure.[218]

Nonetheless, accidental spills and intentional dumping of fracking fluids and wastewaters can cause large-scale harm to aquatic life. Numerous incidents of fracking wastewater contamination from pipelines, equipment blowouts, and truck accidents have been reported, and have resulted in kills of fish.[219] In 2013, a company admitted to dumping wastewater from fracking operations into the Acorn Fork Creek in Kentucky, causing a massive fish kill.[220] Among the species harmed was the blackside dace, a threatened minnow species.[221] The lead author (a scientist at USGS) noted that the "study is a precautionary tale of how entire populations could be put at risk even with small-scale fluid spills," "especially…if the species is threatened or is only found in limited areas, like the Blackside dace is in the Cumberland."[222]

Wastewaters can have high levels of salinity, which aquatic organisms are sensitive to (including plants and invertebrate species that fish may depend on); thus, accidental releases of produced and flowback waters may have harmful effects on fish and their habitat.[223] Increased levels of total dissolved solids in surface waters are associated with higher rates of fish mortality.[224] Further, produced waters can contain copper, iron, lead, manganese, arsenic, cadmium, nickel, zinc, chromium, selenium, and sodium bicarbonate at levels above thresholds that are harmful to aquatic organisms, including fish.[225] Fracking fluids may also contain

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[218] Souther 2014, p. 334.

[219] *See, e.g.*, Department of Environmental Protection, Commonwealth of Pennsylvania, Inspection Report, May 27, 2009, www.marcellus-shale.us/pdf/CC-Spill_DEP-Insp-Rpt.pdf (pipeline accidentally discharged an estimated 4,200 gallons of wastewater, as well as sediments and state investigation report concluded, "The creek was impacted by sediments all the way down to the lake and there was evidence of a fish kill as invertebrates and fish were observed lying dead in the creek."); Warco, Kathie, "Fracking truck runs off road; contents spill", The Observer-Reporter, October 21, 2010, available at http://www.uppermon.org/news/Other/OR-Frac_Truck_Spill-21Oct10.html (tanker truck hauling fracking liquid ran off a road and spilled almost 5,000 gallons of liquid spill, resulting in the contamination of a stream and several dead minnows); Michaels, C., J.L. Simpson, and W. Wegner. 2010. "Fractured Communities, Case studies of the Environmental Impacts of Industrial Gas Drilling," Riverkeeper, p. 6, available at www.riverkeeper.org/wp-content/uploads/2010/09/Fractured-Communities-FINAL-September-2010.pdf (blowout released nearly 1 million gallons of wastewater into nearby creeks, resulting in uncontrolled discharge of wastewater into a tributary of Little Laurel Run, a high-quality coldwater fishery); Department of Environmental Protection, Commonwealth of Pennsylvania, DEP Fines Talisman Energy USA for Bradford County Drilling Wastewater Spill, Polluting Nearby Water Resource," August 2, 2010, available at http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=13249&typeid=1 (spill of used natural gas drilling fluids in Bradford County, PA, sent 4,200-6,300 gallons of fluids into a wetland and a tributary of Webier Creek, which drains into a coldwater fishery).

[220] Vaidyanathan, Gayathri, *Fracking Spills Cause Massive Ky. Fish Kill*, E&E News, Aug. 29. 2013.

[221] *Id*.

[222] *See* US Geological Survey, "Hydraulic Fracturing Fluids Likely Harmed Threatened Kentucky Fish Species, Aug. 28, 2013, available at http://www.usgs.gov/newsroom/article.asp?ID=3677#.VTf3oCFVhBd.

[223] Brittingham 2014, p. 11039; Souther, p. 332 (noting small increases in salinity can harm or kill aquatic plants and invertebrates).

[224] Tuckwiller, Ross, Annotated Bibliography: Potential Impacts of Energy Development on Fisheries in the Rocky Mountain West Prepared for Theodore Roosevelt Conservation Partnership Fish, Wildlife, & Energy Working Group, p. 17.

[225] *Id*. pp. 21-22 (extremely elevated chromium concentrations in fish exposed to produced waters), p. 23 (fish showing lesions and kidney damage after exposure to sodium bicarbonate).

hydrocarbons,[226] which can cause deterioration of body tissues of aquatic organisms and reduced growth.[227] Drilling fluids may also cause impaired immune function in fish.[228] Other contaminant effects may include "changes in heart and respiratory rates; gill hyperplasia; enlarged liver; reduced growth; fin erosion; impaired endocrine system; a variety of biochemical, blood, and cellular changes; and behavioral responses."[229] As Fish and Wildlife Service has previously noted, "[d]isruption of behavioral functions can result in population declines or changes in year-class strength if enough individuals are affected."[230] Thus, chronic and persistent pollution from spills and leaks could result in harm to endangered fish at the population-scale.

c. Measures to Protect the Endangered Fish Are Inadequate.

The leasing stipulation for the endangered fish protection falls short of minimizing the risk of spills adverse effects to the species in several ways. First, neither the EA nor the proposed leasing stipulation addresses how the risk of spills due to corrosion will be mitigated. Corrosion of pipelines and tanks is a common cause of leaks and spills.[231] Oil and gas wastewaters, including produced waters, are especially corrosive and have caused corrosion resulting in numerous spills, including within the Vernal Field Office and Duchesne County.[232] In addition, the EA and proposed leasing stipulation do not address how the problem of pinhole leaks identified in the GasCo Biological Opinion will be addressed. The only measure that seems to address these problems is a required "watershed analysis" of toxicity risk of permanent facilities, but this measure simply defers the analysis of well-known problems that can be done now and that should be addressed "at the earliest possible time." *See Wilderness Socy v. Wisely*, 524 F. Supp. 2d 1285, 1301 (citing 50 C.F.R. § 402.14(a) (""each federal agency shall review its actions at the earliest possible time' to determine whether an action may affect protected species, and if so, to engage in the appropriate level of conferral").

Further, the proposed leasing stipulation for the protection of endangered fish fails to require automatic or emergency shut-off valves and routine "pigging" to monitor pipeline integrity. Emergency shut-off valves and routine pigging are feasible and have been required in large-scale projects. For example, the Gasco Uinta Basin Natural Gas Development project adopted the following condition of approval to protect endangered fish and water resources:

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[226] EPA, State-level Summaries of FracFocus 1.0 Hydraulic Fracturing Data, p. 38 (Colorado fracking chemical disclosures showing high incidence of naphthalene and "solvent naphtha, petroleum, and heavy arom.").
[227] Gasco BO, p. 27; In the Matter of Changes to the Rules and Regulations of the Oil and Gas Conservation Commission of the State of Colorado, Cause No. 1R, Dkt No. 0803-RM-02, Testimony of Colorado Division of Wildlife Staff Regarding Surface Occupancy Restrictions, p. 39 (describing effects of toluene, naphthalene, and crude oil on various fish).
[228] Tuckwiller, p. 22.
[229] Gasco BO, p. 27.
[230] *Id.*
[231] Schardine, Daniel T., Detecting Corrosion in Production Tanks, Inspection Trends, p. 19-21, Summer 2008, available at http://testex-ndt.com/technical-papers/detecting-corrosion-in-production-tanks/; U.S. DOT, Pipeline & Hazardous Materials Safety Administration (PHMSA), Fact Sheet: Internal Corrosion, 2011, available at https://primis.phmsa.dot.gov/comm/FactSheets/FSInternalCorrosion.htm?nocache=6923 ("Corrosion of all types is one of the leading causes of pipeline leaks and ruptures."); *see also* PHMSA, Fact Sheet: External Corrosion, 2011, available at http://primis.phmsa.dot.gov/comm/FactSheets/FSExternalCorrosion.htm?nocache=7104.
[232] *See generally* Vernal Field Office Incident Reports combined; Duchesne County Incidents.

> Natural gas-condensate pipelines that cross perennial, intermittent, and ephemeral stream channels or…100-year floodplain, mapped riparian or wetland areas, or perennial, intermittent, or ephemeral stream channels will be routinely pigged and will have emergency/automatic shutoff valves located directly beyond the area at risk of flooding to reduce the magnitude of contamination in the event of an accidental pipeline break.[233]

To the extent that BLM intends to consider these measures when specific development is proposed, nothing prevents BLM from meaningfully considering and imposing those measures as part of the lease stipulations at the leasing stage. The risk of pipeline spills and ruptures is already known and does not depend on site-specific plans. No other alternatives to avoid such risks are apparent except avoidance of pipelines altogether. It is unclear what factors would persuade BLM not to impose these measures in important areas to the endangered fish, other than economic or technological feasibility concerns. But those concerns should not trump endangered fish protection, and a lease stipulation imposed upfront would avoid conflicts between operators' feasibility claims and measures necessary to protect the fish. The imposition of these measures is extremely critical, as pipelines are allowed to cross river corridors, including the Green River, under the Vernal RMP.[234]

2. Mexican Spotted Owl

The Vernal, Moab, and Price EAs provide very little or no discussion of the impacts of new oil and gas leasing on the Mexican spotted owl, or the habitat needs of the owl. This is despite that many of the parcels for sale include stipulations or lease notices indicating that suitable habitat is located on or within the vicinity of the parcel for lease. *See* T&E-6 ("The Lessee/Operator is given notice that the lands in this parcel contain suitable habitat for Mexican spotted owl, a federally listed species."); UT-S-340 (requiring surveys for Mexican spotted owl, effectively admitting that parcels contain suitable habitat); UT-S-269 (no surface occupancy within 1/2 mile of known Mexican Spotted Owl nests); Price EA, Appendix C at 12 (Price EA noting modeled potential habitat on some of the parcels).

Under the ESA, 16 U.S.C. §1536(a)(2), action agencies must consult with the Fish and Wildlife Service to evaluate the effects and cumulative effects of a proposed project on listed species and critical habitat in the formal consultation process.[235] In addition, the courts have held that:

> An agency's failure to adequately consider recovery needs in its adverse modification or jeopardy analysis renders the agency's determination arbitrary and capricious. *Gifford Pinchot Task Force,* 378 F.3d at 1070 (critical habitat);

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[233] BLM, Record of Decision for the Gasco Energy Inc. Uinta Basin Natural Gas Development Project, Attachment 2, 2012, pp. 2-13, 2-18, available at http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/gasco_eis/gasco_rod.Par.20707.File.dat/Gasco%20ROD%20Attachment%202%20COA%202012.pdf.

[234] *See* BLM Vernal RMP (2008), Appendix K at K-6 – K-7.

[235] 50 C.F.R. §402.14(g)(3).

> *Nat'l Wildlife Fed'n*, 524 F.3d at 933–34 (explaining that although recovery impacts alone may not necessarily require a jeopardy finding, an agency must consider recovery).

Nw. Envtl. Advocates v. EPA, 855 F. Supp. 2d 1199, 1223 (D. Or. 2012). Here, the Service's Recovery Plan has acknowledged that unoccupied habitat may be essential to recover the Mexican spotted owl: it recommends "provid[ing] additional habitat in planning for recovery of [the owl], as increasing population size is a logical goal of recovery efforts and providing additional habitat is one way to accomplish this. This is particularly true given uncertainty over the effects of climate change on habitat quantity, quality, and distribution."[236] Such recovery habitat includes unoccupied rocky-canyon habitat, such as that found on or near the parcels for lease.[237]

Yet neither the EAs for the proposed lease sale nor the EISs to which they tier contains any analysis of whether the areas in question are suitable and/or necessary for recovery of a viable Mexican spotted owl population. The EAs make no mention whatsoever of unoccupied Mexican spotted owl habitat or recovery habitat, and how oil and gas activities may affect the owl's recovery. The mere inclusion of stipulations and notices does not satisfy either BLM's requirement to consult now, at the time of lease issuance, or to analyze the effects of its actions under NEPA.

3. Greater Sage-Grouse

[236] U.S. Fish & Wildlife Serivce. Mexican Spotted Owl Recovery Plan (2012) at 265, available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd475767.pdf.
[237] *Id*. at 256, 274.

The EAs purport to defer all parcels that contain Greater Sage-Grouse habitat, but according to Rocky Mountain Wild's analysis of sensitive species occurrence within the areas proposed for lease, numerous parcels have generalized occurrence of the species.[238] This includes parcels UTU91266, 1267, 1268, 1273, 1274, 1302, 1303, 1308, 1310, 1311, 1313, 1314, 1316, 1332, 1333, 1338 , 1342, 1343, and 1343. Parcels UTU91315 and 1339 contain preliminary priority habitat, brood rearing habitat, winter use areas, and Utah Division of Wildlife Resources ("UTDWR")-designated sage-grouse management areas, according to UTDWR data.[239]

The EAs, however, fails to provide any discussion of the potential disturbance of many thousands of acres used by greater sage-grouse or the potential impacts of cumulative habitat loss in these areas. In addition, even if these areas may not be considered premium habitat for sage-grouse, the potential for open wastewater pits in these areas to serve as a breeding ground for mosquitoes, which could in turn transmit West Nile virus, would result in increased disease risk to sage-grouse.[240]

No stipulations are included to limit surface disturbance within these areas (including parcels 1315 and 1339). Not even timing stipulations are included to protect winter-use areas and brood and rearing areas.

Stipulations and other mitigation measures adopted in the recent sage-grouse RMP amendments are largely centered around leks. Although leks are important focal points for breeding and subsequent nesting in the surrounding region, other seasonal use areas and habitat requirements may be equally limiting to sage grouse populations.[241] Brood occurrence is greater in more heterogeneous sagebrush stands, where patchy cover reduces predator efficiency but still affords necessary forb resources. Sage grouse are more abundant in patchy habitats containing a mix of mesic, forb-rich foraging areas interspersed within suitable sagebrush escape cover.[242] Broods are typically found in areas near nest sites for the first 2 to 3 weeks after hatching. Such habitat needs to provide adequate cover and areas with sufficient forbs and insects to ensure chick survival in this life stage. [243] The EAs, however, entirely fail to analyze the impact of new oil and gas development on brood-rearing areas or set forth mitigation to protect these important areas from surface disturbance.

Suitable and diverse winter habitats are critical to the long-term persistence of grouse populations.[244] As summer ends, the diet of sage grouse shifts from a diet of insects, forbs and

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[238] *See* 15-157_UTFeb2016 CombinedScreen.xlsx located in 2015 Lease Parcel Maps folder on CD of references submitted herewith, *also available at* http://rockymountainwild.org/_site/wp-content/uploads/15-157_UTFeb2016CombinedScreen.xlsx.
[239] *Id*.
[240] *See* Zou 2006.
[241] Knick, Modeling ecological minimum requirements for distribution of greater sage-grouse leks: implications for population connectivity across their western range. Ecology and Evolution (2013).
[242] USGS, Summary of Science, Activities, Programs, and Policies that Influence the Rangewide Conservation of Greater Sage-Grouse, Oopen File Report 2013-1098 (2013) at 21.
[243] *Id.*
[244] NDOW 2012.

sagebrush to one comprised almost entirely of sagebrush.[245] In winter, the grouse depends heavily on sagebrush for cover, habitat selection being driven by snow depth, the availability of sagebrush above the snow, and topographic patterns that favorable mitigate the weather.[246] Abundance of sagebrush at the landscape scale greatly influences the choice of wintering habitat. One study found that the grouse selected for landscapes where sagebrush dominate over 75% of the landscape with little tolerance for other cover types.[247] Because appropriate wintering habitat occurs on a limited basis and because yearly weather conditions influence its availability, impacts to wintering habitat can have large disproportional effects on regional populations. One study in Colorado found that 80% of the wintering use occurred on only 7% of the area of sagebrush available.[248] Additionally, some degree of site fidelity to winter areas is suspected to exist, and wintering areas not utilized in typical years may become critical in severe winters. [249]

Sage grouse in the Powder River Basin were 1.3 times less likely to use otherwise suitable winter habitats that have been developed for energy (12 wells/4 km2), and avoidance was most pronounced in high-quality winter habitat with abundant sagebrush.[250] BLM must analyze whether any of the lease areas for sale provide winter use areas for sage grouse, including winter concentration areas, and if so, prohibit disturbance within these areas.[251] BLM should not allow new surface occupancy on federal leases within winter concentration areas[252] during any time of the year.

H. Metrics

BLM should conduct a full assessment of the direct and indirect impacts of unconventional oil and gas development activities on wildlife and ecosystems through a suite of comprehensive studies on all species and ecosystems that could be affected. The studies should be particularly detailed for federally and state listed species, federal and state candidates for listing, and state species of special concern. The studies should address the following impacts: (1) habitat loss, degradation, and fragmentation, including edge effects; (2) water depletion; (3) air and water contamination; (4) introduction of invasive species; (5) climate change impacts; (6) health and behavioral effects such as increased stress and changes in life history behaviors; (7) changes in demographic rates such as reproductive success and survival; and (8) potential for population-level impacts such as declines and extirpations. These studies should consider these harms individually and cumulatively.

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[245] Doherty, Kevin E., David E. Naugle, Brett L. Walker, and Jon M. Graham. 2008. Greater Sage-Grouse Winter habitat Selection and Energy Development. J. of Wildlife Management 72(1):187/195.
[246] USGS 2013 at 21.
[247] Doherty et al. 2008.
[248] *Id.*
[249] Caudill, Danny, Terry A. Messmer, Brent Bibles,and Michael R. Guttery. 2013. Winter habitat use by juvenile greater sage-grouse on Parker Mountain, Utah: implications for sagebrush management. Human-Wildlife Interactions 7(2):250-259, Fall 2013.
[250] Doherty et al. 2008.
[251] Sage Grouse National Technical Team, A Report on National Greater Sage Grouse Conservation Measures (2011) at 23.
[252] Doherty et al. 2008, Carpenter et al. 2010.

4. Unconventional Extraction Techniques and Underground Wastewater Disposal Pose Seismic Risks and Other Geological Hazards

If oil and gas development is allowed to proliferate in the areas for lease, increased unconventional oil and gas extraction and underground waste injection will increase the risk of induced seismicity. Induced seismic events could damage or destroy property and cause injuries or even death, especially in a state where earthquakes are rare and communities are typically not prepared for them. A no-fracking alternative would minimize these risks, while continued leasing and unconventional well development would increase them.

Research has shown that in regions of the central and eastern United States where unconventional oil and gas development has proliferated in recent years, earthquake activity has increased dramatically.[253] More than 300 earthquakes with magnitude (M) ≥ 3 occurred between 2010 through 2012, compared with an average of 21 per year between 1967 and 2000.[254] Moreover, although earthquakes with magnitude (M) ≥ 5.0 are very uncommon east of the Rocky Mountains, the number per year recorded in the midcontinent increased 11-fold between 2008 and 2011, compared to 1976 to 2007.[255] Mid-continent states experiencing elevated levels of seismic activity include Arkansas, Colorado, New Mexico, Ohio, Oklahoma, Texas, and Virginia.[256]

Research has linked much of the increased earthquake activity and several of the largest earthquakes in the U.S. midcontinent in recent years to the disposal of wastewater into deep injection wells, which is well-established to pose a significant seismic risk.[257] Much of the fracking wastewater is a byproduct of oil and gas production and is routinely disposed of by injection into wells specifically designed and approved for this purpose. The injected fluids push stable faults past their tipping points, and thereby induce earthquakes.[258] In 2015, a study published in *Science* found that, the unprecedented increase in earthquakes in the U.S. mid-continent began in 2009 has been caused solely by the instability caused by fluid injection wells associated with fracking waste disposal.[259] To put an exclamation point on this finding, a 4.7 magnitude earthquake struck northern Oklahoma that was felt in 7 additional states, leading the Oklahoma Geological Survey to reiterate the connection between disposal wells and earthquakes and to shut down the most high risk wells.[260] Earthquakes at magnitudes (M) that are felt (M3 and M4) or destructive (M4 and M5) have been attributed to wastewater injection wells in at

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[253] Ellsworth, W.L. Injection-Induced Earthquakes, 341 Science 1225942 (2013) ("Ellsworth 2013"); Keranen, Katie et al., Potentially Induced Earthquakes in Oklahoma, USA: Links Between Wastewater Injection and the 2011 Mw5.7 Earthquake Sequence, Geology doi:10.1130/G34045.1 (March 26, 2013) ("Keranen 2013").
[254] Ellsworth 2013.
[255] Keranen 2013.
[256] Ellsworth 2013.
[257] *Id*.
[258] Lamont-Doherty Earth Observatory, Columbia University. Distant Quakes Trigger Tremors at U.S. Waste-Injection Sites, Says Study. July 11, 2013. *Available at*: https://www.ldeo.columbia.edu/news-events/distant-quakes-trigger-tremors-us-waste-injection-sites-says-study .
[259] M. Weingarten, S. Ge, J. W. Godt, B. A. Bekins, and J. L. Rubinstein. June 19, 2015. High-rate injection is associated with the increase in U.S. mid-continent seismicity. Science, VOL 348 ISSUE 6241, pages 1336-1340.
[260] Chow, Lorraine. November 19, 2015. Strong Earthquake Rattles Oklahoma, Felt in 7 Other States. https://ecowatch.com/2015/11/19/oklahoma-earthquake-fracking/

least five states - Arkansas, Colorado, Ohio, Oklahoma, and Texas. The largest of these was a M5.7 earthquake in Prague, Oklahoma, which was the biggest in the state's history, destroying 14 homes and injuring two people.[261] Other large earthquakes attributed to wastewater injection include an M5.3 in Colorado,[262] M4.9 in Texas,[263] M4.7 in Arkansas,[264] and M3.9 in Ohio.[265]

The proliferation of unconventional oil and gas development, including increases in extraction and injection, will increase earthquake risk in Utah. Accordingly, the EIS must fully assess the risk of induced seismicity cause by all unconventional oil and gas extraction and injection activities, including wastewater injection wells.

The analysis should assess the following issues based on guidance from the scientific literature, the National Research Council,[266] and the Department of Energy[267]:

(1) whether existing oil and gas wells and wastewater injection wells in the areas for lease have induced seismic activity, using earthquake catalogs (which provide an inventory of earthquakes of differing magnitudes) and fluid extraction and injection data collected by industry;

(2) the region's fault environment by identifying and characterizing all faults in these areas based on sources including but not limited to the USGS Quaternary Fault and Fold database. In its analysis, BLM should assess its ability to identify all faults in these areas, including strike-slip faults and deep faults that can be difficult to detect;

(3) the background seismicity of oil- and gas-bearing lands including the history of earthquake size and frequency, fault structure (including orientation of faults), seismicity rates, failure mechanisms, and state of stress of faults;

(4) the geology of oil- and gas-bearing lands including pore pressure, formation permeability, and hydrological connectivity to deeper faults;

(5) the hazards to human communities and infrastructure from induced seismic activity; and

(6) the current state of knowledge on important questions related to the risk and hazards of induced seismicity from oil and gas development activities, including:

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[261] Ellsworth 2013, Keranen 2013.

[262] Rubinstein, J.L. et al., The 2001–present triggered seismicity sequence in the Raton Basin of southern Colorado/northern New Mexico, 104 Bull. Seismol. Soc'y of America 5 (2014).

[263] Brown, W.A. et al. Abstract: Investigating the cause of the 17 May 2012 M4.8 earthquake near Timpson, East Texas, Abstract 84 Seismol. Res. Lett 374 (2013).

[264] Horton, S., Disposal of Hydrofracking Waste Fluid by Injection into Subsurface Aquifers Triggers Earthquake Swarm in Central Arkansas with Potential for Damaging Earthquake, 83 Seismol. Res. Lett. 2 (2012).

[265] Kim, Won-Young, Induced Seismicity Associated with Fluid Injection into a Deep Well in Youngstown, Ohio, 118 J. of Geophys. Res.: Solid Earth 3506 (February 1, 2013).

[266] National Research Council, *Induced Seismicity Potential in Energy Technologies*. National Academies Press (2012).

[267] U.S. Department of Energy, *Protocol for Addressing Induced Seismicity Associated with Enhanced Geothermal Systems*, DOE/EE-0662 (2012); U.S. Department of Energy, *Best Practices for Addressing Induced Seismicity Associated with Enhanced Geothermal Systems - Draft* (2013).

(a) how the distance from a well to a fault affects seismic risk (i.e., locating wells in close proximity to faults can increase the risk of inducing earthquakes);

(b) how fluid injection and extraction volumes, rates, and pressures affect seismic risk;

(c) how the density of wells affects seismic risk (i.e., a greater density of wells affects a greater volume of the subsurface and potentially contacts more areas of a single fault or a greater number of faults);

(d) the time period following the initiation of injection or extraction activities over which earthquakes can be induced (i.e., studies indicate that induced seismicity often occurs within months of initiation of extraction or injection although there are cases demonstrating multi-year delays);

(e) how stopping extraction or injection activities affects induced seismicity (i.e., can induced seismicity be turned off by stopping extraction and injection and over what period, since studies indicate that there are often delays—sometimes more than a year—between the termination of extraction and injection activities and the cessation of induced earthquake activity);

(f) the largest earthquake that could be induced by unconventional oil and gas development activities in areas for lease, including earthquakes caused by wastewater injection; and

(g) whether active and abandoned wells are safe from damage from earthquake activity over the short and long-term.

5. Oil and Gas Development Poses Significant Human Health and Safety Risks.

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. This is all the more alarming when considering how close wells may be developed to schools, residences, and businesses. Just as troubling, is how much is *unknown* about the chemicals used in well stimulation activities.[268] 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, the EIS should include a health impact assessment, or equivalent, of 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:

[268] *See, e.g.* EPA 2015 at 5-73, 10-7.

- 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.[269]

- 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.[270] 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.[271, 272]

- 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.[273] The chances of a low Apgar score, a summary measure of the health of newborn children, roughly doubled, to more than 5 percent.[274] 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.[275]

- 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.[276] 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.

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[269] 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").
[270] 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").
[271] Hill, Elaine L., Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania, Cornell University (2012).
[272] 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.
[273] *Id*., citing Janet Currie of Princeton University, Katherine Meckel of Columbia University, and John Deutch and Michael Greenstone of the Massachusetts Institute of Technology.
[274] *Id.*
[275] Stacy, Shaina L. et al. (2015) Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania. PLoS ONE 10(6): e0126425. doi:10.1371/journal.pone.0126425, *available at* http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0126425.
[276] Jemielital, T. et al. Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates. PLoS ONE 10(7): e0131093, *available at* http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0131093.

- 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.[277]

- In Texas, a jury awarded nearly $3 million to a family who lived near a well that was hydraulically fractured.[278] 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.[279] 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.[280]

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.[281] 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 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

[277] 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).
[278] *Parr v. Aruba Petroleum, Inc*., Case No. 11-01650-E (Dallas Cty., filed Sept.13, 2013).
[279] 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.
[280] *Id*.
[281] Kassotis, Christopher D. et al., Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region. Endocrinology, March 2014, 155(3):897–907, pp. 905-906, *available at* http://press.endocrine.org/doi/full/10.1210/en.2013-1697.

> 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.[282]

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.[283] 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.[284]

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 federal limits for drinking water.[285] 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).[286] On average, benzene levels were around 700 times the federal limit for drinking water.[287]Among other carcinogenic or otherwise dangerous chemicals found in flowback fluid from fracked wells

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[282] *Id*., p. 905.
[283] Wiserman, Hannah, Untested Waters: the Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation, Fordham Envtl. Law Rev. 115 (2009),138-39.
[284] *Id.*
[285] 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.
[286] *Id*.
[287] *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.

are toluene and chromium-6.[288] 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."[289] Compounds in mixtures can have synergistic or antagonistic effects, but again, it is impossible to know these effects without full disclosure.[290] 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."[291]

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."[292] Without this data, EPA could not adequately assess potential impacts on drinking water resources and human health.[293] 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."[294] 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.[295]

The EIS should 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

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[288] *Id.*; *see also* Center for Biological Diversity, Cancer-causing Chemicals Found in Fracking Flowback from California Oil Wells (2015) Feb. 11, 2015, *available at* http://www.biologicaldiversity.org/news/press_releases/2015/fracking-02-11-2015.html.
[289] EPA 2015 at 10-18.
[290] Souther, Sara et al. Biotic Impacts of Energy Development from Shale: Research Priorities and Knowledge Gaps, Front Ecol Environ 2014; 12(6): p. 334.
[291] EPA 2015 at 10-18.
[292] *Id*. at 10-7, 9-7.
[293] *Id*. at 9-37-38.
[294] *Id*. at 5-73.
[295] *Id*. at 9-38.

methods. Without knowing the effects of each chemical, the EIS cannot accurately project the true impact of unconventional oil and gas extraction.

The EIS should also 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.[296] Rates of traffic fatalities and major injuries may be higher in areas with heavy drilling activity than areas without.[297]

6. Fossil Fuel Development Will Impact Land Use

Increased oil and gas extraction and production have the potential to dramatically and permanently change the landscape of the areas for lease and their surroundings. Countless acres of land will likely be leveled to allow for the construction and operation of well pads and related facilities such as wastewater pits. Roads may have to be constructed or expanded to accommodate trucks transporting chemicals and the large quantities of water needed for some recovery methods. Transmission lines and other utilities may also be required. The need for new distribution, refining, or waste treatment facilities will expand industrial land use. With new roads and other industrial infrastructure, certain areas could open up to new industrial or extractive activities, permanently changing the character and use of the land.

Such changes would result in a significant cumulative losses of agricultural and conservation lands. Vegetation removal by oil and gas development across central North America between 2000 and 2012 is estimated to be 4.5 tetragrams of carbon or 10 tetragrams of dry biomass.[298] This is equivalent to more than half of annual available grazing on public lands managed by BLM or 6% of the wheat produced in 2013 within the region (120.2 million bushels of wheat).[299] This loss of "net primary production" (amount of carbon fixed by plants and accumulated as biomass) is "likely long-lasting and potentially permanent, as recovery or reclamation of previously drilled land has not kept pace with accelerated drilling."[300] The total surface disturbance by oil and gas development within this time period is 3 million hectares, the equivalent of three Yellowstone National Parks.[301] As noted above, the fragmented nature of this surface disturbance negatively impacts wildlife by severing migratory pathways, altering wildlife behavior and mortality, and increasing susceptibility to ecologically disruptive species.[302]

The conversion of substantial acreages from rural or natural landscapes to industrial sites will also mar scenic views throughout the planning area. Given BLM's failure to ensure full

[296] Graham, J., Irving et al., Increased Traffic Accident Rates Associated with Shale Gas Drilling in Pennsylvania. 74 Accident Analysis and Prevention 203 (2015).
[297] *Id.*
[298] Allred, Brady et al. Ecosystem services lost to oil and gas in North America: Net primary production reduced in crop and rangelands. Science, vol. 384, issue 6233 (April 24, 2015) at 401.
[299] *Id.*
[300] *Id.*
[301] *Id* at 402.
[302] *Id.*

reclamation of idle wells and the difficulty of restoring sites to their original condition, scenic resources may be permanently impaired.

7. BLM Must Prepare an Environmental Impact Statement

NEPA demands that a federal agency prepare an EIS before taking a "'major [f]ederal action[] significantly affecting the quality' of the environment." *Kern v. U.S. Bureau of Land Mgmt.*, 284 F.3d 1062, 1067 (9th Cir. 2002). In order to determine whether a project's impacts may be "significant," an agency may first prepare an Environmental Assessment ("EA"). 40 C.F.R. §§ 1501.4, 1508.9. If the EA reveals that "the agency's action may have a significant effect upon the . . . environment, an EIS must be prepared." *Nat'l Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 730 (9th Cir. 2001) (internal quotations omitted). If the agency determines that no significant impacts are possible, it must still adequately explain its decision by supplying a "convincing statement of reasons" why the action's effects are insignificant. *Blue Mountains Biodiversity Project v. Blackwood*, 161 F.3d 1208, 1212 (9th Cir. 1998). Further, an agency must prepare all environmental analyses required by NEPA at "the earliest possible time." 40 C.F.R. § 1501.2. "NEPA is not designed to postpone analysis of an environmental consequence to the last possible moment," but is "designed to require such analysis as soon as it can reasonably be done." *Kern*, 284 F.3d at 1072.

BLM is therefore required under NEPA to prepare an EIS to support this proposed project. This is especially true in light of the likelihood that fracking would occur on the leases. *CBD*, 937 F. Supp. 2d at 1155-59 (holding that oil and gas leases were issued in violation of NEPA where BLM failed to prepare an EIS and failed to properly address the significance factors for context and intensity in 40 C.F.R. § 1508.27).

In considering whether the lease sale would have significant effects on the environment, NEPA's regulations require BLM to evaluate ten factors regarding the "intensity" of the impacts. 40 C.F.R. § 1508.27(b). The Ninth Circuit has held that the existence of any "one of these factors may be sufficient to require preparation of an EIS." *Ocean Advocates*, 402 F.3d at 865; *Nat'l Parks & Conservation Ass'n*, 241 F.3d at 731. Several of these "significance factors" are implicated in the lease sale and clearly warrant the preparation of an EIS:

> The degree to which the effects on the quality of the human environment are likely to be highly controversial.
>
> The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
>
> The degree to which the proposed action affects public health or safety.
>
> The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

40 C.F.R. § 1508.27(b)(4), (5), (2) & (9). *See CBD*, 937 F. Supp. 2d at 1158-59 (holding that BLM failed to properly address the significance factors regarding controversy and uncertainty that may have been resolved by further data collection (citing *Native Ecosystems Council v. U.S. Forest Serv.*, 428 F.3d 1233, 1240 (9th Cir. 2005)). Here, individually and considered as a whole, there is no doubt that significant effects may result from the lease sale; thus, NEPA requires that BLM should have prepared an EIS for the action.

i. The effects on the human environment will be highly controversial

A proposal is highly controversial when "substantial questions are raised as to whether a project . . . may cause significant degradation" of a resource, *Nw. Envtl. Def. Ctr. v. Bonneville Power Admin.*, 117 F.3d 1520, 1536 (9th Cir. 1997), or when there is a "substantial dispute [about] the size, nature, or effect of the" action. *Blue Mtns. Biodiversity*, 161 F.3d at 1212. A "substantial dispute exists when evidence, raised prior to the preparation of [a] . . . FONSI, casts serious doubt upon the reasonableness of an agency's conclusions." *Nat'l Parks & Conserv. Ass'n*, 241 F.3d at 736. When such a doubt is raised, "NEPA then places the burden on the agency to come forward with a 'well-reasoned explanation' demonstrating why those responses disputing the EA's conclusions 'do not . . . create a public controversy.'" *Id. See also* CBD, 937 F. Supp. 2d at 1158 .

Here, the controversy regarding the lease sale is fully evident. This comment letter provides abundant evidence that oil and gas operations can cause significant impacts to human health, water resources, air quality, imperiled species, and seismicity. The potential for these significant impacts to occur is particularly clear in light of the potential for fracking to result from the lease sale.

Fracking is among the top, if not the most controversial energy issue facing America today. The controversy spans the public arena, scientific discourse, local governments, and the halls of Congress. At the request of Congress, EPA is conducting a study into the effects of fracking on drinking and ground water.[303] Similarly, the New York DEC concluded that the health and environmental risks from fracking supports its ban in New York State. However, in addition to the presence of controversy, it is already evident, as discussed above, that fracking is harmful. Clearly, the level of controversy associated with fracking and its expansion in Utah in association with the lease sale is sufficient to trigger the need for an EIS. 40 C.F.R. § 1508.27(b)(4).

ii. The lease sale presents highly uncertain or unknown risks

An EIS must also be prepared when an action's effects are "highly uncertain or involve unique or unknown risks." 40 C.F.R. § 1508.27(b)(5). As the Ninth Circuit has held, "[p]reparation of an EIS is mandated where uncertainty may be resolved by further collection of data, or where the collection of such data may prevent speculation on potential . . . effects." *Native Ecosystems Council v. U.S. Forest Serv.*, 428 F.3d 1233, 1240 (9th Cir. 2005) (internal

[303] U.S. Environmental Protection Agency, Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (November 2011).

citations omitted); *Blue Mtns. Biodiversity*, 161 F.3d at 1213-1214 (finding "EA's cursory and inconsistent treatment of sedimentation issues . . . raises substantial questions about . . . the unknown risks to" fish populations). As one court recently explained regarding oil and gas leasing that may facilitate fracking, "BLM erroneously discounted the uncertainty from fracking that may be resolved by further data collection. 'Preparation [of an EIS] is mandated where uncertainty may be resolved by further collection of data, or where collection of such data may prevent speculation on potential effects.'" *CBD*, 937 F. Supp. 2d at 1159 (quoting *Native Ecosystems Council v. U.S. Forest Serv*., 428 F.3d 1233, 1240 (9th Cir. 2005)).

While it is clear that oil and gas activities can cause great harm, there remains much to be learned about the specific pathways through which harm may occur and the potential degree of harm that may result. Additional information is needed, for example, about possible rates of natural gas leakage, the potential for fluids to migrate through the ground in and around the parcels, the safety of various fracking chemicals, and the potential for drilling to affect local faults. NEPA clearly dictates that the way to address such uncertainties is through the preparation of an EIS.

iii. The lease sale poses threats to public health and safety

As discussed in great detail above, the oil and gas activities that may occur as a result of the lease sale could cause significant impacts to public health and safety. 40 C.F.R. § 1508.27(b)(2). Fracking would pose a grave threat to the region's water resources, harm air quality, pose seismic risks, negatively affect wildlife, and fuel climate change.

As a congressional report noted, oil and gas companies have used fracking products containing at least 29 products that are known as possible carcinogens, regulated for their human health risk, or listed as hazardous air pollutants.[304] The public's exposure to these harmful pollutants alone would plainly constitute a significant impact. So do the many other public health risks associated with unconventional drilling as described above in section VII. Furthermore, and as previously discussed, information continues to emerge on the risk of earthquakes induced by wastewater injected into areas near faults. It is undeniable that these earthquakes pose risks to the residents of the area and points beyond

The use of fracking fluid, which is likely to occur as a result of the lease sale, and other risks associated with unconventional drilling, pose a major threat to public health and safety and therefore constitute a significant impact. BLM therefore must evaluate such impacts in an EIS.

iv. The Lease Sale Action Will Adversely Affect Candidate and Agency Sensitive Species and Their Habitat

An EIS may also be required when an action "may adversely affect an endangered or threatened species or its habitat." 40 C.F.R. § 1508.27(b)(9). Although a finding that a project has "some negative effects does not mandate a finding of significant impact," an agency must

[304] Waxman, Henry et al., United States House of Representatives, Committee on Energy and Commerce, Minority Staff, Chemicals Used in Hydraulic Fracturing (Apr. 2011) ("Waxman 2011")

nonetheless fully and closely evaluate the effects on listed species and issue an EIS if those impacts are significant. *Klamath-Siskiyou Wildlands Ctr. v. U.S. Forest Serv.*, 373 F. Supp. 2d 1069, 1081 (E.D. Cal. 2004) (finding agency's conclusion that action "may affect, is likely to adversely affect" species due to "disturbance and disruption of breeding" and "degradation" of habitat is "[a]t a minimum, . . . an important factor supporting the need for an EIS").

Impacts to BLM sensitive and other rare species threatened by the proposed lease have been highlighted in section "V" subsection "G" of these comments.

8. BLM Must Independently Comply with NEPA's Environmental Review Requirements Before Offering the Fishlake National Forest Parcels for Lease.

BLM must prepare an EA studying the impacts of offering the Fishlake National Forest parcels--UTU91344, 1345, 1346, and 1347 ("Fishlake parcels")--for lease or otherwise independently determine that the sale of these parcels meets the requirements of NEPA. BLM has not performed any review or analysis of whether those requirements have been fulfilled with respect to the Fishlake parcels.

In *Board of Commissioners of Pitkin County v. Wilderness Workshop*, the Interior Board of Land Appeals considered a similar challenge to the error at issue here. 173 IBLA 173, 184, 2007 IBLA LEXIS 67. There, BLM failed to perform any environmental review of its proposal to offer three Forest Service parcels for sale, because it believed that such review was not required, and that it was sufficient to adopt another agency's analysis at its own. However, the IBLA found that the record lacked any showing of BLM's independent determination as to the adequacy of the Forest Service's NEPA document.

BLM contended that because its response to a lease sale protest referred to the Forest Service's responses to objections on the lease sale, it had adopted the Forest Service's environmental analysis at its own, in compliance with NEPA. The Board rejected BLM's contention that such an "oblique reference" to the Forest Service's analysis "demonstrate[d] that BLM complied with its NEPA responsibilities." *Id*. Because BLM "conducted no environmental analysis and prepared no environmental document of its own," before its decision to deny the plaintiffs' protest and offer the parcels for lease, the Board found BLM in violation of NEPA. *Id*.

Here, BLM has similarly failed to independently determine that offering the Fishlake parcels for lease, in exercise of its "discretionary authority to lease national forest lands," 173 IBLA 173, 181, meets the requirements of NEPA. Further, the above discussion demonstrates that BLM must prepare an adequate EIS, or at minimum, an EA, analyzing the lease sale's significant effects with respect to the Fishlake parcels. BLM should withdraw the Fishlake parcels from the lease sale until it prepares and circulates an adequate environmental review of offering these parcels for lease.

9. BLM Must Ensure That the Federal Land Policy and Management Act and the Mineral Leasing Act Are Not Violated

The Mineral Leasing Act ("MLA") requires BLM to demand lessees take all reasonable measures to prevent the waste of natural gas. The MLA states:

> All leases of lands containing oil or gas, made or issued under the provisions of this chapter, shall be subject to the condition that the lessee will, in conducting his explorations and mining operations, use all reasonable precautions to prevent waste of oil or gas developed in the land, or the entrance of water through wells drilled by him to the oil sands or oil-bearing strata, to the destruction or injury of the oil deposits.

30 U.S.C. § 225; *see also id.* § 187 (stating that for the assignment or subletting of leases that "[e]ach lease shall contain . . . a provision . . . for the prevention of undue waste"). This statutory mandate is unambiguous and must be enforced. *Tenn. Valley Auth. v. Hill*, 437 U.S. 153, 184 n.29 (1978) (stating that "[w]hen confronted with a statute which is plain and unambiguous on its face," "it is not necessary to look beyond the words of the statute."). As already discussed in previous sections, oil and gas operations emit significant amounts of natural gases, including methane and carbon dioxide, which can be easily prevented. [305]

Pursuant to the Federal Land Policy and Management Act ("FLPMA"), BLM must "take any action necessary to prevent unnecessary or undue degradation of the [public] lands." 43 U.S.C. § 1732(b). Written in the disjunctive, BLM must prevent degradation that is "unnecessary" and degradation that is "undue." *Mineral Policy Ctr. v. Norton*, 292 F.Supp.2d 30, 41-43 (D. D.C. 2003). The protective mandate applies to BLM's leasing decisions. *See Utah Shared Access Alliance v. Carpenter*, 463 F.3d 1125, 1136 (10th Cir. 2006) (finding that BLM's authority to prevent degradation is not limited to the RMP planning process). Greenhouse gas pollution for example causes "undue" degradation. Even if the activity causing the degradation may be "necessary," where greenhouse gas pollution is avoidable, it is still "unnecessary" degradation. 43 U.S.C. § 1732(b).

In addition to being harmful to human health and the environment, the emissions from oil and gas operations are also an undue and unnecessary waste and degredation of public lands. Consequently, BLM's proposed gas and oil lease sale violates FLPMA. *See* 43 U.S.C. § 1732(b).

Conclusion

Oil and gas leasing is an irrevocable commitment to convey rights to use of federal land – a commitment with readily predictable environmental consequences that BLM is required to address. These include the specific geological formations, surface and ground water resources, seismic potential, or human, animal, and plant health and safety concerns present in the area to be leased. Unconventional oil and gas development not only fuel the climate crisis but entail significant public health risks and harms to the environment. Accordingly, BLM should end all new leasing on BLM lands. Should BLM proceed with the lease sale it must thoroughly analyze

[305] *See* U.S. Government Accountability Office, Federal Oil and Gas Leases, Opportunities Exist to Capture Vented and Flared Natural Gas, Which Would Increase Royalty Payments and Reduce Greenhouse Gases 20 (2010)

the alternatives of no new leasing (or no action), and no fracking or other unconventional well stimulation methods in an EIS. Thank you for your consideration of these comments. The Center and Living Rivers look forward to reviewing a legally adequate EIS for this proposed oil and gas leasing action.

Sincerely,

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