



November 19, 2015

**VIA E-MAIL (blm\_ut\_mb\_mlpcomments@blm.gov)**

Bureau of Land Management  
Canyon Country District Office  
Attn: MLP Comments  
82 East Dogwood  
Moab UT 84532

*Re: Moab Master Leasing Plan and Draft Management Plan DEIS Comments*

To Whom It May Concern:

The Center for Biological Diversity, Living Rivers, Colorado Riverkeeper, and Holiday River Expeditions, write to submit public comments on the Moab Master Leasing Plan (“MLP”) and Draft Resource Management Plan (“RMP”) Amendments/Draft Environmental Impact Statements (“DEIS”), which will govern the management of approximately 786,000 acres of federal public land and minerals in portions of the Moab and Monticello resource areas (“planning area”). Each of our organizations is deeply concerned that continued extraction of fossil fuels worsens the climate crisis, endangers water, air, wildlife, public health, and local communities, and undermines the protection of our public lands. Although we appreciate that the proposed MLP provides some protection from mineral development impacts for certain scenic and recreational values, the DEIS fails to address significant climate, air, water, health, and wildlife effects of oil and gas development. BLM also appears to have failed entirely to consider a “no-leasing” proposal raised in the BLM’s stakeholder input workshops. BLM should end new fossil fuel leasing and ban new hydraulic fracturing and other unconventional well stimulation activities in the planning area.

Four “high potential” oil and gas plays underlie the planning area, the extraction of which could occur over approximately 334,000 of acres of public land. The potential development of over 168 or more oil and gas wells will irreversibly damage the environment and harm local communities. As BLM’s DEIS indicates, continued fossil fuel development—including a trend towards increased use of risky hydraulic fracturing techniques in vulnerable formations—will worsen air quality, accelerate soil erosion, pollute and deplete shrinking water resources, scar and despoil scenic landscapes, fragment and degrade habitat for imperiled species, and diminish the biological diversity of natural communities. The DEIS acknowledges that climate change is already exacerbate these effects, through rapidly warming regional temperatures, declining spring snowfall, earlier and less runoff, and declining Colorado River flows. And plainly, more

fossil fuel extraction will result in more global warming pollution further contributing to the climate crisis and the degradation of our public lands.

In light of this context, the only truly reasonable alternative to current management direction—that would both protect public health and preserve public lands for future generations—is to (1) suspend all new leasing of fossil fuels in the planning area, and (2) disallow new hydraulic fracturing (or “fracking”) or other unconventional well stimulation operations on existing leases. Unconventional well stimulation refers to any activities that extract natural gas and oil from rock formations. As discussed below, 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, and strip and underground coal mining.

The discussion below both serves to describe the many unacceptable risks of fossil fuel development which compel the consideration of a “no-leasing-no-fracking” alternative and serves to identify issues that must be addressed in the PRMP and EIS, including (1) the climate change impacts of new fossil fuel development; (2) the ecological and public health impacts of unconventional oil and gas well stimulation, including hydraulic fracturing; and (3) similar impacts with respect to coal mining. We request BLM to fully consider these issues in its development of a final EIS reasonable range of alternatives, adopt no-leasing-no-fracking as the preferred alternative, and address each of the issues below in the EIS.

### **I. More Fossil Fuel Development Will Fuel Climate Change**

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. In order to avoid catastrophic climate change, BLM should be looking for ways to reduce, rather than increase, greenhouse gas emissions. A no-leasing alternative is not only reasonable but also imperative. Such an alternative is not even mentioned in the DEIS, see DEIS 2-3 to 2-4, but is documented by having been raised by at least one stakeholder (the Sierra Club) in the stakeholder working group report submitted to BLM.<sup>1</sup>

The harms from continued anthropogenic greenhouse emissions are nothing short of catastrophic. A rise in global average temperature by just a few degrees Celsius would likely result in a wide range of devastating consequences. Climate change will lead to: sea level rise and population displacement, increased frequency of extreme weather events, change in weather patterns, extreme floods and droughts, ocean acidification, mass species extinction, loss of biodiversity, spread of vector-borne disease, and reduction of food and water security.<sup>2</sup>

BLM cannot ignore the mounting evidence about the potential for oil and gas development to contribute to the climate crisis. Full development and combustion of the planning area’s oil, gas, and coal resources will fuel climate disruption and undercut the needed transition

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<sup>1</sup> The Keystone Center, Moab Master Leasing Plan Stakeholder Mapping Workshops February – March 2014; Final Report, April 2014.

<sup>2</sup> Hansen, James and Makiko Sato, Greenhouse Gas Growth Rates, 101 Proc. Natl. Acad. Sciences 46 (2004); Hansen, James et al., Climate Change and Trace Gases, Phil. Trans. R. Soc. A 365, doi: 10.1098/rsta.2007.2052 (2007) ; Whiteman G. et al., Climate Science: Vast Costs of Arctic Change, 499 Nature 401 (2013); Shindell, Drew et al., Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security, 335 Science 183 (2012).

to a clean energy economy. Approximately 334,000 acres are proposed (under alternative D) as available to lease for oil and natural gas development, on top of the 228,000 acres that are currently “authorized or pending.”<sup>3</sup> Within this area as many as 232 additional oil and gas wells could be drilled between 2015 and 2030, according to the DEIS.<sup>4</sup> Although the DEIS fails entirely to disclose the potential total fossil fuel production and carbon emissions from those wells, analysis of its fiscal impact discussion reveals that BLM anticipates production of as much as 97,852,980 barrels of oil over 15 years.<sup>5</sup>

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 and operations 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.

*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.

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<sup>3</sup> DEIS at 2-17, 3-35.

<sup>4</sup> DEIS at 4-41.

<sup>5</sup> DEIS at 4-108 and Table 4-38 (expected production value of \$9,716,801,000 divided by assumed \$99.30/barrel market price).

Recent studies suggest that previous estimates significantly underestimate leakage rates.<sup>6</sup> New research shows methane leakage from some gas wells may be as high at 17.3 percent.<sup>7</sup> Recent research from Pennsylvania shows that following abandonment, oil wells can serve as leakage pathways for methane to shallow groundwater aquifers and the atmosphere.<sup>8</sup> Leakage can also occur during storage, processing, and distribution to customers.<sup>9</sup>

Methane emissions make a significant difference in part because the greenhouse gas warming potential of methane is 87 times that of carbon dioxide over a 20-year period.<sup>10</sup> The oil and gas sector is a leading source of global methane emissions, accounting for approximately 30 percent of U.S. methane emissions,<sup>11</sup> and is expected to be one of the most rapidly growing sources of anthropogenic methane emissions in the coming decades.<sup>12</sup>

A no-leasing-no-fracking alternative would curb all of the above sources of greenhouse gas emissions within the planning area, consistent with national policies to reduce climate-warming pollution. As stated in the President's Climate Action Plan:

While no single step can reverse the effects of climate change, we have a moral obligation to future generations to leave them a planet that is not polluted and damaged. Through steady, responsible action to cut carbon pollution, we can protect our children's health and begin to slow the effects of climate change so that we leave behind a cleaner, more stable environment.<sup>13</sup>

Halting all new leasing within the planning area 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

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<sup>6</sup> Brandt, A. R., *et al.*, (2014), 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.")

<sup>7</sup> 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).

<sup>8</sup> Kang, Mary. CO<sub>2</sub>, Methane, and Brine Leakage Through Subsurface Pathways: Exploring Modeling, Measurement, and Policy Options, Princeton University 2014, <http://arks.princeton.edu/ark:/88435/dsp019s1616326>.

<sup>9</sup> Howarth, R. W. A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas, *Energy Science and Engineering* 2(2): 47–60, 49 ("Howarth 2014").

<sup>10</sup> 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) ("IPCC WG1 2013, Table 8.7").

<sup>11</sup> U.S. Environmental Protection Agency, Climate Change Overview of Greenhouse Gases, <http://epa.gov/climatechange/ghgemissions/gases/ch4.html> (Accessed Mar 3, 2015).

<sup>12</sup> Institutional Investors Group on Climate Change *et al.*, Controlling Fugitive Methane Emissions in the Oil and Gas Sector (2012) available at <http://www.ceres.org/files/methane-emissions/investor-joint-statement-on-methane-emissions>.

<sup>13</sup> Executive Office of the President, THE PRESIDENT'S CLIMATE ACTION PLAN 4 (June 2013).

Fahrenheit.<sup>14</sup> Climate experts have estimated that the world can emit 1,000 gigatons of carbon dioxide (1,000 GtCO<sub>2</sub> or 1 trillion tons of CO<sub>2</sub>) after 2010 to have a reasonable chance of staying below 2°C of warming.<sup>15</sup> 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.<sup>16</sup> In short, the vast majority of proven reserves must be kept in the ground for preserving a livable planet. Minimizing new fossil fuel production generally, and new federal leasing in particular, is critical.<sup>17</sup> Opening up new areas to extraction, allowing more fracking, and locking in new fossil fuel production infrastructure for decades, on the other hand, runs completely counter to slowing the effects of climate change.

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

### *1. Sources of Greenhouse Gases*

BLM should 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<sub>2</sub> equivalent), including emissions throughout the entire fossil fuel lifecycle discussed above.

The DEIS discloses generally the fact of climate change in Chapter 3, but its analysis completely fails to describe or address the climate impact of combustion, as opposed to merely production, of oil and gas from the proposed action.<sup>18</sup> This failure includes a total omission of any discussion of end-use combustion and life cycle impacts of oil and gas in the discussion

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<sup>14</sup> 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.

<sup>15</sup> 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 GtCO<sub>2</sub>. See IPCC Climate Change 2014 Synthesis Report 63-64, available at [http://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC\\_SynthesisReport.pdf](http://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf).

<sup>16</sup> *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<sub>2</sub>, over four times the 1000 GtCO<sub>2</sub> 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](http://apo.org.au/files/Resource/ClimateCommission_The-Critical-Decade-2013.pdf)

<sup>17</sup> See Mulvaney et al. 2015.

<sup>18</sup> DEIS 4-16.

cumulative greenhouse gas and climate effects.<sup>19</sup> As best as we can ascertain from the minimal information provided, the DEIS's consideration of greenhouse gas emissions is restricted to fuel combustion by drill rigs, vehicles, and construction equipment and emissions of methane from the production process itself.<sup>20</sup> Based on this incomplete analysis, the DEIS discounts greenhouse gas emissions excluding combustion (approximately 200,000 tons/year CO<sub>2</sub>e) as de minimis.<sup>21</sup> This improperly ignores the fact that the sole and intended purpose of oil and gas extraction is, in fact, combustion. Release of greenhouse gases is not merely a reasonably foreseeable consequence of fossil fuel extraction, it's the necessary and intended consequence. CEQ and the courts have repeatedly cautioned federal agencies that they cannot ignore either climate change generally, or the combustion impacts of fossil fuel extraction in particular.<sup>22</sup> As discussed below, although the DEIS does not disclose fossil fuel production totals, its economic assumptions reveal that BLM assumes production of up to 98 million barrels of crude oil. Without a full life cycle analysis, simply using EPA assumptions for carbon dioxide emissions per barrel of crude oil (5.80 mmbtu/barrel × 20.31 kg C/mmbtu × 44 kg CO<sub>2</sub>/12 kg C × 1 metric ton/1,000 kg = **0.43 metric tons CO<sub>2</sub>/barrel**),<sup>23</sup> this results in approximately 42 million metric tons of CO<sub>2</sub>, or (at a 1.39 CO<sub>2</sub>e/CO<sub>2</sub> ratio)<sup>24</sup>, 58 million metric tons of CO<sub>2</sub>e.

## 2. *Effects of Climate Change*

As earlier noted, new fossil fuel development will intensify climate disruption and its ecological and social consequences, which must be studied in the EIS. Although cost-benefit analysis is problematic 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.<sup>25</sup> 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

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<sup>19</sup> See DEIS 4-227.

<sup>20</sup> DEIS 4-16, 4-227 (“Oil and gas and potash development results in emissions of GHGs during fuel combustion in vehicles, drill rigs, and construction equipment, and through emissions of methane associated with oil and gas production.”); *see also* Bureau of Land Management Utah, Oil Wells – Annual Emissions Summary, available at [http://www.blm.gov/ut/st/en/prog/more/air\\_quality/airprojs.html](http://www.blm.gov/ut/st/en/prog/more/air_quality/airprojs.html) (cited in DEIS at 4-16).

<sup>21</sup> DEIS 4-16.

<sup>22</sup> *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 (9<sup>th</sup> Cir. 2008); *Utahns for Better Transp. v. U.S. Dep't of Transp.*, 305 F.3d 1152, 1176 (10<sup>th</sup> 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).

<sup>23</sup> <http://www2.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references>

<sup>24</sup> *See* Meinshausen, M. et al. 2009. Greenhouse gas emission targets for limiting global warming to 2 degrees Celsius. *Nature* 458, 1158–1162.

<sup>25</sup> *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](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”); *see also* Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts, available at [www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance](http://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance).

convened by the Council of Economic Advisers and the Office of Management and Budget.”<sup>26</sup>  
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<sub>2</sub>) 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.<sup>27</sup>

While the Moab MLP and RMP Amendment’s emissions have not yet been quantified, its SCC is potentially in the billions of dollars. As discussed above, the DEIS’s financial assumptions appear to disclose production of up to 97,852,980 barrels of oil over 15 years. Applying the 2013 SCC estimates to the RMPA’s CO<sub>2</sub>e emissions (approximately 58 million metric tons), by 2030, depending on the discount rate used the Moab RMPA’s social cost of carbon would be somewhere between \$696 million and \$6.32 billion,<sup>28</sup>. Clearly, new leasing and development of unconventional wells in the planning area will exact extraordinary costs to communities and future generations, setting aside the immeasurable loss of irreplaceable, natural values that can never be recovered.

## **II. Unconventional Oil and Gas Development Causes Significant Harms to Public Health and the Environment**

The advent of improved well stimulation technologies within the last decade, including horizontal drilling, hydraulic fracturing, and multi-stage fracturing, has increased the overall capacity for new oil and gas development. These technologies have opened up new areas that would otherwise remain untouched and prolonged the life of existing well fields. Multi-well pads, located with at high density across the landscape, are now viable with these techniques, allowing operators to maximize the surface area exposed by widespread fracturing of underlying rock formations. The DEIS acknowledges that a trend in the planning area towards increased use of oil-based hydraulic fracturing of initially unsuccessful wells is likely to continue.<sup>29</sup>

The proximity of projected new oil and gas development to communities, National Parks, pristine recreational areas, and important drinking water aquifers<sup>30</sup> within the planning area is all the more reason for BLM to end new leasing and fracking of oil and gas. Nearly every peer-reviewed study on fracking—96 percent—concludes that there are actual or potential human

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<sup>26</sup> BLM, Roberson Internal Memo.

<sup>27</sup> 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](https://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf); 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>.

<sup>28</sup> See Technical Update of the Social cost of Carbon for Regulatory Impact Analysis 3.

<sup>29</sup> DEIS 3-37.

<sup>30</sup> See DEIS at 4-134.

health risks attributable to this dangerous practice.<sup>31</sup> After reviewing the more than 400 peer-reviewed scientific studies on fracking, four independent panels of public health scientists have reached the same conclusion—due to the known and unknown risks, fracking cannot be conducted safely.<sup>32</sup> Following this science, and acknowledging the experiences of those affected by fracking and fracking-related activities, many state and local governments have adopted bans or approved moratoriums on fracking, including New York, Vermont, Maryland, Boulder County, Fort Collins, Los Angeles, and several California counties.<sup>33</sup> Clearly, an end to new leasing and unconventional oil and gas extraction is a reasonable approach to protecting public health and the environment. The DEIS improperly assumes that the (currently-enjoined) BLM hydraulic fracturing regulations will be sufficient to minimize impacts on groundwater resources.<sup>34</sup> As discussed in detail below, this assumption is invalid and improperly discounts a host of water and health impacts associated with hydraulic fracturing, not limited solely to potential aquifer contamination from target formation fractures.

BLM should similarly recognize that the environmental and public health hazards of these increasingly widespread extraction techniques are too great to continue allowing them to be used in the planning area. These risks include contamination of water resources and increased surface runoff, over-depletion of dwindling water resources, deterioration of air quality, human health and safety risks, radioactive contamination, induced seismicity, harm to wildlife, and industrialization of landscapes and changes in land use.

#### ***A. Hydraulic Fracturing and Other Unconventional Stimulation Methods Contaminate 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,<sup>35</sup> Wyoming,<sup>36</sup> Texas,<sup>37</sup> Pennsylvania,<sup>38</sup> and

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<sup>31</sup> Hays, Jake & Seth B. Shonkoff, *Toward an Understanding of the Environmental and Public Health Impacts of Shale Gas Development: an Analysis of the Peer-Reviewed Scientific Literature, 2009-2014*, Physicians Scientists and Engineers (rev. January 2015) (“Hays and Shonkoff 2015”) at 9.

<sup>32</sup> See New York State Department of Health, *A Public Health Review of High Volume Hydraulic Fracturing for Shale Gas Development* (Dec. 2014); Concerned Health Professionals of New York, *Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking* (Dec. 2014) (“CHPNY”); Hays and Shonkoff 2015; see also, Vendeville, Geoffrey, *Fracking Provides Few Benefits to Quebec*, *Environmental Review Says*, *Montreal Gazette* Dec. 15, 2014, <http://montrealgazette.com/news/quebec/fracking-provides-few-benefits-to-quebec-environmental-review-says>.

<sup>33</sup> Food & Water Watch, *Local Actions Against Fracking*, available at <http://www.foodandwaterwatch.org/water/fracking/anti-fracking-map/local-action-documents/>; Keep Tap Water Safe, *List of Bans Worldwide*, available at <http://keeptapwatersafe.org/global-bans-on-fracking/>.

<sup>34</sup> DEIS 4-131.

<sup>35</sup> 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/](http://www.cbsnews.com/8301-201_162-57603336/colorado-floods-spur-fracking-concerns/) (“Trowbridge 2013”) (accessed Mar. 3, 2015).

<sup>36</sup> U.S. Environmental Protection Agency, *Draft Investigation of Ground Water Contamination near Pavillion, Wyoming* (2011) (“USEPA Draft Pavillion Investigation”).

<sup>37</sup> 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.*, DOI: 10.1021/es4011724 (2013) (“Fontenot 2013”).

<sup>38</sup> Jackson, Robert et al., *Increased Stray Gas Abundance in a Subset of Drinking Water Wells near Marcellus Shale*

Ohio.<sup>39</sup> In recent years, studies have confirmed that oil and gas drilling was responsible for water contamination in four states—Pennsylvania, Ohio, West Virginia, and Texas—that have allowed fracking to extract oil or gas from shale formations.<sup>40</sup>

### **I. 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.<sup>41</sup> 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 not always be infeasible to restore the original water quality once surface water is contaminated.

#### **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, with considerable variation as far as what chemicals injected.<sup>42</sup>

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. GAO study found that up to 1,365 truck loads can be required just for the drilling and fracturing of a single well pad<sup>43</sup> while the New York Department of Conservation estimated the number of “heavy truck” trips to be about 3,950 per horizontal well (including loaded and unloaded).<sup>44</sup> 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.

EPA does not have spill estimates for Utah, it has estimated that for every 100 hydraulically fractured wells in Colorado, 1.3 spills occurred on or near the well pad (including spills of fracking chemicals and produced water), and for every 100 in Pennsylvania, between

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Gas Extraction, Proc. Natl. Acad. of Sciences Early Edition, doi: 10.1073/pnas.1221635110/-DCSupplemental (2013) (“Jackson 2013”).

<sup>39</sup> 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) .

<sup>40</sup> Begos, K, *Four States Confirm Water Pollution*, Associated Press, January 5, 2014, <http://www.usatoday.com/story/money/business/2014/01/05/some-states-confirm-water-pollution-from-drilling/4328859/> (accessed Mar. 3, 2015).

<sup>41</sup> 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”).

<sup>42</sup> U.S. Env’t Protection Agency, Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources, External Review Draft (June 2015) at ES-12 (“EPA 2015”).

<sup>43</sup> 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.

<sup>44</sup> New York Department of Environmental Conservation, *Revised Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program*, Ch. 6 Potential Environmental Impacts (2011) at 6-303.

3.3 and 12.2 spills, based on operator's self-reported data.<sup>45</sup> The number could actually be higher, as spills commonly go unreported.<sup>46</sup> Further, this figure is based on an estimate of spills occurring over a limited time period and not the entire lifetime of the well.<sup>47</sup> Thus, at minimum, even using the lower Colorado figure, two *additional* spills (1.3% x 142 wells) can be expected to occur in the planning areas, an impact which is nowhere disclosed in the DEIS.

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.<sup>48</sup> 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.<sup>49</sup> Given the volumes of chemicals and waste produced and their potentially harmful constituents, the potential for environmental disaster is real.

The Final 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 Final 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.<sup>50</sup> 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. Floods in Colorado have shown that weather events may result in uncontrolled chemical spills and leaks on a massive scale.<sup>51</sup>

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

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<sup>45</sup> EPA 2015 at 5-75.

<sup>46</sup> 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](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).

<sup>47</sup> EPA 2015 at E-11, n.1.

<sup>48</sup> 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.

<sup>49</sup> *Id.*

<sup>50</sup> EPA 2015 at ES-10.

<sup>51</sup> Trowbridge 2013.

contaminants. Other spill causes include equipment failure (most commonly, blowout preventer failure, corrosion and failed valves) and failure of container integrity.<sup>52</sup>

The Final 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 rural 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.<sup>53</sup> Fracking and other unconventional techniques likewise pose an inherent risks to groundwater due to releases below the surface, and these risks must be properly evaluated.<sup>54</sup> 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 may persist for many years.<sup>55</sup> Surface spills and poorly constructed or abandoned wells are recognized as one of the most likely ways by which contaminants may reach groundwater. 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,<sup>56</sup> Wyoming,<sup>57</sup> Pennsylvania,<sup>58</sup> Ohio,<sup>59</sup> West Virginia,<sup>60</sup> and Texas.<sup>61</sup>

Mechanical integrity, which refers to an absence of leakage pathways through the casing and cement, can degrade over time, eventually leading to mechanical integrity failures that may impact groundwater. 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.<sup>62</sup> A well in which stimulation operations are being conducted may also “communicate” with nearby wells,

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<sup>52</sup> EPA 2015 at ES-11.

<sup>53</sup> *See, e.g.*, Fontenot 2013, Jackson 2013.

<sup>54</sup> Vengosh 2014.

<sup>55</sup> Myers, Tom, Potential Contamination Pathways from Hydraulically Fractured Shale to Aquifers, National Groundwater Association (2012).

<sup>56</sup> 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).

<sup>57</sup> USEPA Draft Pavillion Investigation.

<sup>58</sup> 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”).

<sup>59</sup> 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 Mar 3, 2015) (“Begos, Seattle Times, Jan 6, 2014”). *See also*, ODNr, *supra*.

<sup>60</sup> Begos, Seattle Times, Jan 6. 2014.

<sup>61</sup> Darrah 2014.

<sup>62</sup> EPA 2015 at 6-11.

which may lead to groundwater contamination, particularly if the nearby wells are improperly constructed or abandoned.<sup>63</sup>

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.

Chemicals and naturally occurring substances can also migrate to groundwater through newly created fractures underground. 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.”<sup>64</sup> 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.

Further, according to the EPA, “evidence of any fracturing-related fluid migration affecting a drinking water resources...could take years to discover.”<sup>65</sup> 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.

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.<sup>66</sup>

In some areas hydraulic fracturing may occur at shallower depths or within the same formation as drinking water resources, resulting in direct aquifer contamination.<sup>67</sup> The EIS must disclose where the potential for such drilling exists.

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.<sup>68</sup> The study

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<sup>63</sup> See: Detrow, Scott. (2012) *Perilous Pathways: How Drilling Near An Abandoned Well Produced a Methane Geyser*, StateImpact Pennsylvania, National Public Radio (October 9, 2012), <http://stateimpact.npr.org/pennsylvania/2012/10/09/perilous-pathways-how-drilling-near-anabandoned-well-produced-a-methane-geyser/>; Alberta Energy Board, Directive 083: Hydraulic Fracturing – Subsurface Integrity, Alberta Energy Regulator (2013), available at <http://www.aer.ca/documents/directives/Directive083.pdf>.

<sup>64</sup> EPA 2015 at 6-55.

<sup>65</sup> EPA 2015 at 6-56 – 6-57.

<sup>66</sup> 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](http://www.psehealthyenergy.org/data/Cuomo_ScientistsLetter_15Sep20112.pdf).

<sup>67</sup> EPA 2015 at ES-15.

<sup>68</sup> University of Colorado--Boulder, New study identifies organic compounds of potential concern in fracking Fluids (July 1, 2015), available at

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 proposed RMPA contains a wide variety of setback distances, ranging from a mere 100 feet, subject to exceptions, for ephemeral streams, to 330 feet for riparian areas and streams, to 1,000 feet for the Colorado River and Fisher Creek.<sup>69</sup> The effectiveness and feasibility of any setbacks considered as part of the PRMP must be substantively evaluated, not merely described generally in acreages affected by particular stipulations.

### **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 pits or underground disposal wells.<sup>70</sup>

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

#### ***B. 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 over 71,000 acres of short-term disturbance within the planning area, as well as over 25,000 acres of long-term disturbance.<sup>71</sup> 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.

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, adversely affecting human health. Thus, not only do these oil and gas activities create

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<http://www.colorado.edu/news/releases/2015/06/30/newstudyidentifiesorganiccompoundspotentialconcernfrackingfluids>.

<sup>69</sup> RMPA Appendix A at A-29.

<sup>70</sup> EPA 2015, 8-20, 8-36, 8-48, 8-65, 8-70.

<sup>71</sup> RFD, Tables 14a & 14b.

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,<sup>72</sup> it is particularly important that the impact of runoff is considered as part of the NEPA process.

To the extent that the DEIS assumes that disturbed areas will be successfully reclaimed in 10 years,<sup>73</sup> these assumptions are unreliable given the proposed stipulations' vague standards regarding the timing of reclamation activities (“extensive interim reclamation”)<sup>74</sup> and BLM's overall poor record in ensuring that operators follow-through on reclamation.<sup>75</sup> The EIS must justify any assumptions regarding the reclamation of disturbed areas by addressing the rate of operator compliance with reclamation standards, timeliness of compliance, effectiveness of reclamation, and proposed or existing monitoring and enforcement mechanisms that assure successful reclamation.

### ***C. Oil and gas development will harm air quality***

Unconventional well stimulation is a large contributor to local and regional air quality problems. Permitting fracking and other well stimulation techniques will greatly increase the release of harmful air emissions. On the other hand, a no-leasing-no-fracking alternative would prevent further degradation of local air quality, along with respiratory illnesses, premature deaths, hospital visits, and missed school and work days.

#### ***1. Sources of Air Emissions***

Harmful air pollutants are emitted in all stages 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. Similarly, high-powered pump engines are used in the fracturing and completion phase. This too can amount in large volumes of air pollution.

Flaring, venting, and fugitive emissions of gas are also a potential source of air emissions. Gas flaring and venting can occur in both oil and gas recovery processes when underground gas rises to the surface and is not captured as part of production. 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.<sup>76</sup> Recent studies show that emissions from

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<sup>72</sup> 33 U.S.C. § 1342(1)(2).

<sup>73</sup> DEIS at 4-3.

<sup>74</sup> DEIS 2-15.

<sup>75</sup> Royal Gorge Field Office RMP at G-20; Olmstead, Stan, Report of oil & gas well abandonment and reclamation on federal lands administered by BLM-Utah (March 14, 2015).

<sup>76</sup> 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”).

pneumatic valves (which control routine operations at the well pad by venting methane during normal operation) and fugitive emissions are higher than EPA estimates.<sup>77</sup>

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.

## **2. Types of Air Emissions**

As a result of drilling, well stimulation or completion, production of a well, open pits, truck traffic, flaring and venting, and fugitive emissions, the emission of several air pollutants will undoubtedly increase, further harming air quality and endangering the health of vulnerable populations.

Unconventional oil and gas operations are likely to result in the emissions of air toxics. For example, 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.<sup>78</sup> 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 pollutants.<sup>79</sup>

The DEIS, however, assessed impacts of only three Hazardous Air Pollutants – acrolein, benzene, and formaldehyde.<sup>80</sup> The Final 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.

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<sup>77</sup> Allen David T. et al., Measurements of methane emissions at natural gas production sites in the United States, Proceedings of the National Academy of Science, 2013, 110 (44), pp. 17768–17773; 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.

<sup>78</sup> Air Toxics One Year Report at 1.

<sup>79</sup> 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 Mar 3, 2015).

<sup>80</sup> DEIS 4-14 to 4-15.

### 3. *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* (NO<sub>x</sub>) 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<sub>x</sub> and volatile organic compounds react in the presence of heat and sunlight to form ozone.

*Particulate matter* (PM) - especially fine particles - contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including: premature death in people with heart or lung disease, increased mortality, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.<sup>81</sup>

*Sulfur Dioxide* (SO<sub>2</sub>) – has been shown to cause an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms.<sup>82</sup> 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.<sup>83</sup>

*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.<sup>84</sup> 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.<sup>85</sup> 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.<sup>86</sup>

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<sup>81</sup> U.S. Environmental Protection Agency, Particulate Matter, (PM)

<http://www.epa.gov/airquality/particlepollution/health.html> (accessed Mar 3, 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)

<sup>82</sup> U.S. Environmental Protection Agency, Sulfur Dioxide <http://www.epa.gov/airquality/sulfurdioxide/health.html>, available at (accessed Feb. 24, 2015).

<sup>83</sup> *Id.*

<sup>84</sup> U.S. Environmental Protection Agency, Carbon Monoxide, available at <http://www.epa.gov/airquality/carbonmonoxide/health.html> (accessed Feb. 24, 2015).

<sup>85</sup> *Id.*

<sup>86</sup> *Id.*

*Ozone* (O<sub>3</sub>) can trigger or worsen asthma and other respiratory ailments.<sup>87</sup> 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.<sup>88</sup>

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 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.<sup>89</sup> 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.<sup>90</sup>

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.<sup>91</sup> 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.”<sup>92</sup> 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.<sup>93</sup> For example, the study detected polycyclic aromatic hydrocarbon (PAH) levels that could be of “clinical significance,” as recent studies have linked low levels of

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<sup>87</sup> U.S. Environmental Protection Agency, Ground Level Ozone, available at <http://www.epa.gov/airquality/ozonepollution/health.html> (accessed Feb. 24, 2015).

<sup>88</sup> Colborn 2011 and Colborn 2012; *see note* & accompanying text below.

<sup>89</sup> 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>.

<sup>90</sup> Colborn 2014, p. 11.

<sup>91</sup> *Id.*, p. 10.

<sup>92</sup> *Id.*, pp. 11-12.

<sup>93</sup> *Id.* p. 12.

exposure to lower mental development in children who were prenatally exposed.<sup>94</sup> 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.”<sup>95</sup> Additional related studies are discussed in more detail below.

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

#### **4. Air Modeling**

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 air pollution over a region, over time. The EIS should be informed by air modeling to show where the air pollution will flow.

#### ***D. 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.<sup>96</sup> 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 planning area. In comparing a no-leasing-no-fracking alternative to leasing and continued unconventional well development scenarios, the Final 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.

While all phases of oil and gas production put people at risk, in recent years attention has focused on the new dangers of fracking and other forms of well stimulation which use chemicals, the majority of which are known to have adverse human health effects. A study of gas production in Colorado yielded 632 chemicals used in 944 different products known to have been used.<sup>97</sup> Of these chemicals, 75 percent have been shown to cause harm to the skin, eyes, and other sensory organs; approximately 40-50 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.<sup>98</sup> These chemicals must be transported, mixed, stored, injected, captured and disposed of. Each step creates a risk for

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<sup>94</sup> *Id.*, p. 10-11.

<sup>95</sup> *Id.*, p. 12.

<sup>96</sup> *See, e.g.* EPA 2015 at 5-73, 10-7.

<sup>97</sup> Colborn, Theo et al., Natural Gas Operations from a Public Health Perspective, 17 Human and Ecological Risk Assessment 1039, p. 1045 (2011) (“Colborn 2011”).

<sup>98</sup> *Id.* p. 1046.

communities that are nearby the well site, transportation route, or disposal site. Chemicals used during the drilling process showed many of the same dangers.<sup>99</sup> Chemicals identified in evaporation pits also were linked to the same array of harms.<sup>100</sup>

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

- In one study, residents living within one-half mile of a fracked well were significantly more likely to develop cancer than those who live more than one-half mile away, with exposure to benzene being the most significant risk.<sup>101</sup>
- 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.<sup>102</sup> 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.<sup>103, 104</sup>
- 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.<sup>105</sup> The chances of a low Apgar score, a summary measure of the health of newborn children, roughly doubled, to more than 5 percent.<sup>106</sup> 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.<sup>107</sup>
- 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

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<sup>99</sup> *Id.*

<sup>100</sup> *Id.* at 1048.

<sup>101</sup> 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”).

<sup>102</sup> 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”).

<sup>103</sup> Hill, Elaine L., *Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania*, Cornell University (2012).

<sup>104</sup> Whitehouse, Mark, *Study Shows Fracking is Bad for Babies*, Bloomberg View, Jan. 4, 2014, available at <http://www.bloombergvew.com/articles/2014-01-04/study-shows-fracking-is-bad-for-babies>.

<sup>105</sup> *Id.*, citing Janet Currie of Princeton University, Katherine Meckel of Columbia University, and John Deutch and Michael Greenstone of the Massachusetts Institute of Technology.

<sup>106</sup> *Id.*

<sup>107</sup> 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> and attached hereto.

Pennsylvania.<sup>108</sup> The results suggested that if a zip code went from having zero wells to well density greater than 0.79 wells/km<sup>2</sup>, 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<sup>2</sup>, a 14% increase in cardiology inpatient prevalence rates would be expected. Further, higher rates of neurology-patient hospitalizations were correlated with zip codes with higher well density.

- Recently published reports indicate that people living in proximity to fracked gas wells commonly report skin rashes and irritation, nausea or vomiting, headache, dizziness, eye irritation and throat irritation.<sup>109</sup>
- In Texas, a jury awarded nearly \$3 million to a family who lived near a well that was hydraulically fractured.<sup>110</sup> 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.<sup>111</sup> 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.<sup>112</sup>

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.<sup>113</sup> 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

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<sup>108</sup> 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>.

<sup>109</sup> 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).

<sup>110</sup> *Parr v. Aruba Petroleum, Inc.*, Case No. 11-01650-E (Dallas Cty., filed Sept.13, 2013).

<sup>111</sup> 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>.

<sup>112</sup> *Id.*

<sup>113</sup> 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>.

displayed activities similar to those measured in water samples collected from a drilling-dense region, [3] several of these chemicals and similar compounds were detected by other researchers at our sample collection sites, and [4] known spills of natural gas fluids occurred at these spill sites.

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

Despite an understanding of adverse health outcomes associated with exposure to EDCs, research on the potential health implications of exposure to chemicals used in hydraulic fracturing is lacking. Bamberger and Oswald (26) analyzed the health consequences associated with exposure to chemicals used in natural gas operations and found respiratory, gastrointestinal, dermatologic, neurologic, immunologic, endocrine, reproductive, and other negative health outcomes in humans, pets, livestock, and wildlife species.

Of note, site 4 in the current study was used as a small-scale ranch before the produced water spill in 2004. This use had to be discontinued because the animals no longer produced live offspring, perhaps because of the high antiestrogenic activity observed at this site. There is evidence that hydraulic fracturing fluids are associated with negative health outcomes, and there is a critical need to quickly and thoroughly evaluate the overall human and environmental health impact of this process. It should be noted that although this study focused on only estrogen and androgen receptors, there is a need for evaluation of other hormone receptor activities to provide a more complete endocrine-disrupting profile associated with natural gas drilling.<sup>114</sup>

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.<sup>115</sup> 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).<sup>116</sup> On average, benzene levels were around 700 times the federal limit for drinking water.<sup>117</sup> Among other carcinogenic or otherwise dangerous chemicals found in flowback fluid from fracked wells are toluene and chromium-6.<sup>118</sup> These hazardous substances were detected in excess of federal

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<sup>114</sup> *Id.*, p. 905.

<sup>115</sup> 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.

<sup>116</sup> *Id.*

<sup>117</sup> *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>.

<sup>118</sup> *Id.*; see also Center for Biological Diversity, Cancer-causing Chemicals Found in Fracking Flowback from California Oil Wells (2015) Feb. 11, 2015, available at

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/or 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."<sup>119</sup> Compounds in mixtures can have synergistic or antagonistic effects, but again, it is impossible to know these effects without full disclosure.<sup>120</sup> 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."<sup>121</sup>

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."<sup>122</sup> Without this data, EPA could not adequately assess potential impacts on drinking water resources and human health.<sup>123</sup> 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."<sup>124</sup> 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.<sup>125</sup>

Similarly, poor understanding exists as to how fracking wells perform. For example, information about the performance and subsurface movement of wells is limited due to confidential business information claims by operators, poor recordkeeping, and lack of baseline

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[http://www.biologicaldiversity.org/news/press\\_releases/2015/fracking-02-11-2015.html](http://www.biologicaldiversity.org/news/press_releases/2015/fracking-02-11-2015.html).

<sup>119</sup> EPA 2015 at 10-18.

<sup>120</sup> Souther 2014, p. 334.

<sup>121</sup> EPA 2015 at 10-18.

<sup>122</sup> *Id.* at 10-7, 9-7.

<sup>123</sup> *Id.* at 9-37-38.

<sup>124</sup> *Id.* at 5-73.

<sup>125</sup> *Id.* at 9-38.

data collection, hindering any understanding of the “design and performance of individual wells or wells in a region” and groundwater impacts.<sup>126</sup>

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.<sup>127</sup> Rates of traffic fatalities and major injuries may be higher in areas with heavy drilling activity than areas without.<sup>128</sup>

#### ***E. Oil and Gas Drilling Increases Risks of Exposure to Radioactive Material***

Naturally occurring radioactive materials can be brought to the surface through drilling and extraction processes, yet BLM rules do not appear to require any testing for radioactive materials whatsoever before waste fluids are disposed. The buildup of radioactive materials in pipes and equipment can accumulate to amounts that are harmful to workers who interact with the pipes and equipment. Studies have found high concentrations of the element radium, a highly radioactive substance, in water samples from streams in Pennsylvania where treated shale gas wastewater was disposed.<sup>129</sup> Concentrations were roughly 200 times higher than background levels. Given the potential for radioactive substances to be present in treated wastewater and the high potential for accidental spills and releases, the EIS should assess the amount, the type, and the potency of radioactive elements that are naturally occurring in the landforms subject to the RMP and evaluate the likely risks that stem from bringing such materials to the surface. This analysis should address how radioactive materials could impact the specific areas in which wastewaters are treated, disposed, or accidentally released.

#### ***F. Unconventional Extraction Techniques and Underground Wastewater Disposal Pose Seismic Risks***

If oil and gas development is allowed to proliferate in the planning area, 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-leasing-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

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<sup>126</sup> *Id.* at

<sup>127</sup> Graham, J., Irving et al., Increased Traffic Accident Rates Associated with Shale Gas Drilling in Pennsylvania. 74 Accident Analysis and Prevention 203 (2015).

<sup>128</sup> *Id.*

<sup>129</sup> Warner, Nathaniel R. et al., Impacts of Shale Gas Wastewater Disposal on Water Quality in Western Pennsylvania, Environ. Sci. Technol. dx.doi.org/10.1021/es402165b (Sept 10, 2013); *see also* Stromberg, Joseph, *Radioactive Wastewater from Fracking is Found in a Pennsylvania Stream*, Surprising Science, Smithsonian.com, <http://blogs.smithsonianmag.com/science/2013/10/radioactive-wastewater-from-fracking-is-found-in-a-pennsylvania-stream/> (Oct 2, 2013).

increased dramatically.<sup>130</sup> More than 300 earthquakes with magnitude (M)  $\geq 3$  occurred between 2010 through 2012, compared with an average of 21 per year between 1967 and 2000.<sup>131</sup> Moreover, although earthquakes with magnitude (M)  $\geq 5.0$  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.<sup>132</sup> Mid-continent states experiencing elevated levels of seismic activity include Arkansas, Colorado, New Mexico, Ohio, Oklahoma, Texas, and Virginia.<sup>133</sup>

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.<sup>134</sup> Earthquakes at magnitudes (M) that are felt (M3 and M4) or destructive (M4 and M5) have been attributed to wastewater injection wells in at 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.<sup>135</sup> Other large earthquakes attributed to wastewater injection include an M5.3 in Colorado,<sup>136</sup> M4.9 in Texas,<sup>137</sup> M4.7 in Arkansas,<sup>138</sup> and M3.9 in Ohio.<sup>139</sup>

The proliferation of unconventional oil and gas development, including increases in extraction and injection, will increase earthquake risk. 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,<sup>140</sup> and the Department of Energy<sup>141</sup>:

- (1) whether existing oil and gas wells and wastewater injection wells in the area covered by the RMP 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;

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<sup>130</sup>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").

<sup>131</sup>Ellsworth 2013.

<sup>132</sup>Keranen 2013.

<sup>133</sup>Ellsworth 2013.

<sup>134</sup>*Id.*

<sup>135</sup>Ellsworth 2013, Keranen 2013.

<sup>136</sup>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).

<sup>137</sup>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).

<sup>138</sup>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).

<sup>139</sup>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).

<sup>140</sup>National Research Council, *Induced Seismicity Potential in Energy Technologies*. National Academies Press (2012).

<sup>141</sup>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).

- (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:
  - (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 covered by the RMP, 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.

### ***G. Oil and Gas Development Is Incompatible with Preserving Wildlife***

Utah's wildlife already suffer innumerable harms from urban development, grazing, agriculture, water impoundments, climate change, invasive species, hunting, roads, logging, and

industrial development, which new oil and gas leasing and unconventional well stimulation methods in the planning area will only exacerbate. Depending on the area and the species, wildlife can be affected from oil and gas activity in a variety of ways.<sup>142</sup> 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 extraction activities are summarized in Appendix A.<sup>143</sup> 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,"<sup>144</sup> a no-leasing-no-fracking alternative minimizing industrial development and its harmful effects on wildlife must be considered.

### **I. 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 can occur 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.<sup>145</sup>

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.<sup>146</sup>

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

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<sup>142</sup> See generally Northrup, Joseph M. & George Wittemyer, Characterising the Impacts of Emerging Energy Development on Wildlife, With an Eye Towards Mitigation, 16 Ecology Letters 112 (2013).

<sup>143</sup> See Appendix A: Center for Biological Diversity, Review of Impacts of Oil and Gas Exploration and Development on Wildlife (June 15, 2015). This review presents the findings of 28 studies and reports on the impacts of hydraulic fracturing on wildlife.

<sup>144</sup> 43 U.S. Code § 1701(a)(8).

<sup>145</sup> 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).

<sup>146</sup> Johnson, N., Pennsylvania energy impacts assessment: Report 1: Marcellus shale natural gas and wind, Nature Conservancy – Pennsylvania Chapter (2010) at 10.

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.

## 2. Water Depletion

Water depletion can also affect 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, the cumulative water depletion could have a significant impact on species that rely on water sources that serve to supply oil and gas operations. In addition, water depletion can adversely impact water temperature and chemistry, as well as amplify the effects of harmful pollutants on wildlife that would otherwise be diluted without the depletion.

## 3. Contamination from Wastewater Causing Harm and Mortality

Accidental spills or intentional dumping of wastewater can contaminate surface water and cause large-scale harm to wildlife. Numerous incidents of wastewater contamination from pipelines, equipment blowouts, and trucks 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. Contamination incidents have occurred that demonstrate that wildlife harm from contamination is a real, not just theoretical, impact that must be considered. In 2013, a company admitted to dumping wastewater from fracking operations into the Acorn Fork Creek in Kentucky, causing a massive fish kill.<sup>147</sup> Among the species harmed was the blackside dace, a threatened minnow species.<sup>148</sup> 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.<sup>149</sup> 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.<sup>150</sup> 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.<sup>151</sup>

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.<sup>152</sup> Open pits can also serve as breeding grounds for mosquitoes, which serve as a

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<sup>147</sup> 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 Oct 2, 2013).

<sup>148</sup> *Id.*

<sup>149</sup> 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).

<sup>150</sup> 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/](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](http://www.fish.state.pa.us/newsreleases/2012press/senate_susq/SMB_ConservationIssuesForum_Lycoming.pdf)

<sup>151</sup> Adams, Mary Beth, Land Application of Hydrofracturing Fluids Damages a Deciduous Forest Stand in West Virginia, 40 *Journal of Environmental Quality* 1340 (2011).

<sup>152</sup> *See, e.g.,* Ramirez, P. Jr., Bird Mortality in Oil Field Wastewater Disposal Facilities, 46 *Environ Mgmt* 5: 820 (

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.<sup>153</sup> Recently, new information has come to light that operators in California have been dumping wastewater into hundreds of unpermitted open pits.<sup>154</sup> The EIS must take into account the impact of both unpermitted, illegal waste pits as well as those that are regulated.

#### 4. 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.

#### 5. Climate Change

Anthropogenic climate change poses a significant threat to biodiversity.<sup>155</sup> 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.<sup>156</sup> 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.<sup>157</sup> Other studies have predicted similarly severe losses: 15-37 percent of the world's

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2010).

<sup>153</sup> 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).

<sup>154</sup> 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>.

<sup>155</sup> Warren, R. et al., Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss, 3 Nature Climate Change 678 (2013) (“Warren 2013”).

<sup>156</sup> 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”).

<sup>157</sup> Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report, Summary for Policy Makers IPCC Fifth Assessment Synthesis Report*, 18 (2014).

plants and animals committed to extinction by 2050 under a mid-level emissions scenario<sup>158</sup>; the extinction of 10 to 14 percent of species by 2100 if climate change continues unabated.<sup>159</sup> 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.<sup>160</sup> Because expansion of oil and gas production in Utah will substantially increase the emissions of greenhouse gases, this activity will further contribute to the harms from climate change to wildlife and ecosystems.

## 6. 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.<sup>161</sup> In Wyoming, an increasing density of wells was associated with decreased numbers of Brewer's sparrows, sage sparrows, and vesper sparrows.<sup>162</sup> In the Fayetteville Shale of central Arkansas, the proportional abundance of sensitive aquatic taxa, including darters, was negatively correlated with gas well density.<sup>163</sup> Recent studies indicate that grassland bird species avoid habitat as much as 350 meters from fracked oil and gas wells and roads.<sup>164</sup> The EIS must consider the population-level impacts that oil and gas development may have on wildlife in Utah.

## 7. Endangered, Threatened, and Sensitive Species

The DEIS identifies 9 federally protected, threatened, endangered, or proposed species that are known or suspected to occur in the planning area, as well as 28 BLM sensitive species (including both plants and animals).<sup>165</sup> Many of these species will be adversely affected by an increase in oil and gas activity. The species include those highly vulnerable to both oil and gas development directly and climate change broadly, including the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker.<sup>166</sup> Other species are vulnerable to oil and gas development, infrastructure water depletions and stream flow changes, including the yellow-billed cuckoo and southwestern willow flycatcher.<sup>167</sup> Hundreds of thousands of acres of Mexican spotted owl (threatened) and burrowing owl (sensitive) habitat are vulnerable to direct habitat loss, avoidance effects, and forage loss from oil and gas drilling, activity, and infrastructure.<sup>168</sup>

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<sup>158</sup> Thomas, C.D. et al., Extinction Risk from Climate Change, 427 Nature 8:145 (2004).

<sup>159</sup> Maclean and Wilson 2011.

<sup>160</sup> Warren 2013.

<sup>161</sup> Holloran, M.J. et al., Yearling Greater Sage-Grouse Response to Energy Development in Wyoming, 74 Journal of Wildlife Management 1:65 (2010).

<sup>162</sup> Gilbert, Michelle M. & Anna D. Chalfoun, Energy Development Affects Populations of Sagebrush Songbirds in Wyoming, 75 The Journal of Wildlife Management 4:816 (2011).

<sup>163</sup> 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).

<sup>164</sup> Sarah J. Thompson *et al.*, Avoidance of unconventional oil wells and roads exacerbates habitat loss for grassland birds in the North American great plains, Biological Conservation 192:82-90 (2015).

<sup>165</sup> DEIS 3-100 to 3-104.

<sup>166</sup> DEIS 3-102.

<sup>167</sup> *Id.*

<sup>168</sup> DEIS 4-156 to -157.

The DEIS, however, lacks any substantive effect of the potential effects of development on riparian, upland or grassland birds, disclosing only general information regarding the number of acres of habitat open under standard, CSU/TL, or NSO stipulations. Such general information is inadequate to permit an informed evaluation of the proposed action's effect on populations of species of concern.

Although, as discussed above, BLM must consider an alternative of closing the entire area to new leasing and fracking, the least damaging alternative in the DEIS is alternative C, which would close 180,169 acres to oil and gas leasing, including 12,819 acres of Mexican spotted owl habitat, 60,749 acres of burrowing owl habitat, and 19,230 acres of sensitive plant habitat.<sup>170</sup> Similarly, Alternative C provides greater protection for fish, riparian habitat and wetland habitat, and water quality, including protection for the four Colorado River endangered fish, Southwestern willow flycatcher, yellow-billed cuckoo, and Western red bat. The BLM should also address the effect of the proposed plan on proposed critical habitat for the yellow-billed cuckoo on BLM lands along the Colorado and Dolores River.<sup>171</sup>

In particular, the DEIS lacks any discussion of water use and depletion that may be associated with either oil and gas or potash operations, and the effects such depletions may have on habitat and population for endangered fish or riparian birds and bats. Water use by oil and gas and potash operations is an indirect but readily foreseeable effect of authorizing such operations within the planning area. Potential use of water from the Green, Colorado, or Dolores Rivers or their tributaries has the potential to affect habitat for the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker, yellow-billed cuckoo, Southwestern willow flycatcher, and Western red bat. As best we can ascertain, the DEIS makes no attempt to quantify water depletions from the Green or Colorado Rivers that will result from oil and gas and potash development under the RMPA. As the Fish and Wildlife Service noted in a recent Biological Opinion for another Utah BLM oil and gas project:

[t]he cumulative effect of water depletions, including from this action, adversely affects the four listed fish by further reducing the amount of water available to them, increasing the likelihood of water quality issues, increasing their vulnerability to predation, and reducing their breeding opportunities by shrinking the amount of breeding habitat within their range. Water depletions also reduce the ability of the river to create and maintain the primary constituent elements that define critical habitat.<sup>172</sup>

Moreover, there is no analysis of the effects of foreseeable spills from oil and gas activities on water quality and habitat, nor of the efficacy of various proposed buffer distances in mitigating foreseeable spills. Once again, the Fish and Wildlife Service's 2012 adverse effect finding for BLM oil and gas project on the Green and White Rivers discusses the likelihood and effect of spills:

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<sup>170</sup> DEIS 4-168.

<sup>171</sup> See Fish and Wildlife Service, Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo, 79 Fed. Reg. 48,548, 48,568 (Aug. 15, 2014) (Units 63 and 64).

<sup>172</sup> U.S. Fish and Wildlife Service, Final Biological Opinion for the Kerr McGee Oil & Gas Onshore LP's Proposed Greater Natural Buttes Environmental Impact Statement/Biological Assessment 24 (May 8, 2012) (FWS 2012).

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 and White Rivers 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 and White Rivers 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 White and Green Rivers increases, thus increasing the potential of harm to native fish populations.

While applicant-committed measures will reduce the chance for spills or leaks of contaminants, accidental releases can and do still occur. According to the National Response Center, there have been at least 219 spills and releases within Carbon, Duchesne, and Uintah Counties from January 1991 through August, 2011 due to oil and gas development and related activities affecting water, land and air.

Spill incidences reviewed in Utah include corrosion and leakage of surface and buried pipelines, broken well rods, valve and gasket failures, wellhead pressure buildups, shutoff alarm malfunctions, leakage of trace systems, loss of formation water to the surface during drilling, and vehicular related traffic accidents. Releases have included crude oil, natural gas, hydrochloric acid, condensate, salt water, ethylene glycol, and produced water in various quantities.

Releases of harmful agents into floodplain habitats could result in significant adverse impacts to the endangered fish and their designated critical habitat. One of the constituent elements of the designated critical habitat for the four Colorado River fish is contaminant-free water. Any release of contaminants into the floodplain will result in degradation of critical habitat and could result in take of individual fish, including downstream impacts to larvae and juveniles.

The Green and White Rivers are large to medium-sized rivers with variable dilution factors based on seasonal flows. However, contaminants are likely to accumulate in backwater/depressional areas that have reduced dilution and less flushing capacity (Woodward et al. 1985). Colorado pikeminnow and razorback sucker use these sites downstream, which provide cover and a food source, for overwinter survival and rearing areas.

The proposed action includes applicant committed measures to minimize and reduce the potential for contaminants to be released into the natural systems. However, oil and gas related accidents can be severe and have serious consequences to fish and wildlife resources.

Although most incidents are relatively small in size, large scale spills do occur. If large-scale breaks occur in sensitive resource areas, the results can be catastrophic to fish and wildlife resources. 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 breaches, the 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.

The severity of the impacts from larger spills will be dependent on the time of year, the river flows, presence of endangered fish, and the volume of the contaminant plume. Immediate effects of small leaks to fish populations are difficult to ascertain but will likely become evident in future reproductive or growth issues.<sup>173</sup>

The DEIS lacks any substantive analysis or even discussion of these spill-related impacts on the four Colorado River listed fish, or other listed and sensitive species that utilize riparian areas along the Colorado, Green, and Dolores Rivers.

BLM proposes to initiate ESA § 7 consultation “when the proposed MLP for the Final EIS is determined.”<sup>174</sup> This does not, however, relieve BLM of the NEPA obligation to take a hard look at the impacts of the proposed plan and alternatives on threatened, endangered, and sensitive species in the FEIS.

## **8. 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.

### ***H. BLM Has the Authority to Ban Unconventional Well Stimulation Methods***

BLM can end the dangerous practice of hydraulic fracturing within the planning area not only through an end to new leasing, but also through a ban of this practice on existing leases. A lessee’s right to extract leased minerals is subject to BLM’s duty and authority to protect environmental resources and any regulation that BLM deems necessary and proper.

The Mineral Leasing Act charges the Secretary of the Interior with the protection of environmental values in its oversight of federal mineral extraction. It directs the Secretary of the Interior to “regulate all surface-disturbing activities conducted pursuant to any lease issued under this chapter,” and to “determine reclamation and other actions as required in the interest of

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<sup>173</sup> *Id.* 24-25.

<sup>174</sup> DEIS 5-3.

conservation of surface resources.”<sup>175</sup> The MLA further dictates that, “[n]o permit to drill on an oil and gas lease...may be granted without the analysis and approval” by the Secretary of Interior “of a plan of operations covering proposed surface-disturbing activities within the lease area.”<sup>176</sup>

BLM has broad discretion in how it carries out these duties. The MLA authorizes the Secretary “to prescribe necessary and proper rules and regulations and to do any and all things necessary to carry out and accomplish the purposes of this chapter ...”<sup>177</sup> Similarly, under FLPMA, BLM has discretion to “manage the public lands under principles of multiple use and sustained yield[,]”<sup>178</sup> and “by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands.”<sup>179</sup>

Accordingly, BLM has issued regulations to protect the environment from mineral extraction. Key among them are BLM’s regulations providing that leasehold rights are subject to “such reasonable measures as may be required by the authorized officer to minimize adverse impacts to other resource values,”<sup>180</sup> and that operators “shall conduct operations in a manner which protects the mineral resources, other natural resources, and environmental quality.”<sup>181</sup> Thus, new operations on existing leases may be subject to reasonable measures to protect the environment post-lease.

Here, BLM has ample evidence of numerous environmental and public health harms of hydraulic fracturing and other unconventional well stimulation methods. In other respects, the safety of these practices is completely unknown. BLM should use its power to “do any and all things necessary” to protect local communities and the environment by banning new fracking and other unconventional well stimulation methods within the planning area. Such a ban may apply to all existing leases, and not just new leases that post-date a revised RMP. BLM regulations provide that all site-specific actions (presumably including drilling permit issuance) shall conform to the governing Resource Management Plan.<sup>182</sup> Similar requirements exist for National Forest System lands.<sup>183</sup> Since land use planning and plan consistency is specific and mandatory under FLPMA, BLM can require operators with existing leases to comply with the proposed fracking ban once it is adopted under a revised RMP.

## I. Potash

The development of potash resources in Grand County remains speculative largely because of the difficulties to obtain adequate water supplies for solution mining practices. For example,

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<sup>175</sup> 30 U.S.C. § 226(g).

<sup>176</sup> 30 U.S.C. § 226(g).

<sup>177</sup> 30 U.S.C. § 189.

<sup>178</sup> 43 U.S.C. § 1732(a).

<sup>179</sup> *Id.* at (b) (emphasis added).

<sup>180</sup> 43 C.F.R. § 3101.1-2

<sup>181</sup> *Id.* at § 3162.5-1.

<sup>182</sup> 43 C.F.R. § 1610.5-3(a) (“All future resource management authorizations and actions, as well as budget or other action proposals to higher levels in the Bureau of Land Management and Department, and subsequent more detailed or specific planning shall conform to the approved plan.”).

<sup>183</sup> *See* 16 U.S.C. § 1604(i) (“Resource plans and permits, contracts, and other instruments for the use and occupancy of National Forest System lands shall be consistent with the land management plans. Those resource plans and permits, contracts, and other such instruments currently in existence shall be revised as soon as practicable to be made consistent with such plans. When land management plans are revised, resource plans and permits, contracts, and other instruments, when necessary, shall be revised as soon as practicable.”)

according to Pinnacle Potash International's (PPI) business plan, the company requires 20,000 acre-feet per of production water per year. The original plan was to extract this amount from groundwater. However, the Utah Division of Water Rights determined this withdrawal amount would impact the springs of Arches National Park. Consequently PPI is in search of a water right by contract with the federal government for a prescribed release from Flaming Gorge Reservoir, which would then be intercepted by mechanical pumps along the Green River in Grand County.

This amount of water, compounded by however many potash leases the BLM may approve in the future, will be a very significant withdrawal from the Colorado River basin. According to the ongoing Colorado River Basin Supply and Demand Study, and prepared by the Bureau of Reclamation, the demand for Colorado River water is presently greater than the supply. This study modestly predicts the gap between supply and demand in the next 50 years will widen between 3 and 4 million acre-feet.

The state of Utah will of course approve the water right applications from the potash companies. Utah assumes their remaining entitlement to river water is 400,000 acre-feet. However, it is not certain that the Bureau of Reclamation will approve a federal contract to release water from Flaming Gorge Dam, because the federal government has obligations to existing contracts with the seven states, 29 tribes, the Republic of Mexico, programs to recover endangered species, and salinity control programs. The purpose of the "Basin Study" is to avoid the Secretary of Interior from declaring a water shortage in the Lower Basin states. Additionally, in times of shortage, the contents of Flaming Gorge Reservoir may be necessary to fulfill obligations to the holders of Present Perfected Water Rights in both the upper and lower basins. Of course, there are other shortage scenarios that could be identified here, but in the interest of saving time will not be detailed.

Since water supplies are not presently secure in the Colorado River basin, except in the minds of speculators, neither are they secure for the potash industry. In this atmosphere of water insecurity, the potential of bankruptcy for the potash industry is therefore quite high. Logically, potash leasing should be omitted entirely from the MLP process to reduce the dangerous position that industry and the state of Utah is placing upon the established obligations of the federal government.

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Oil and gas development not only fuels the climate crisis but entail significant public health risks and harms to the environment. Accordingly, a revised EIS should thoroughly analyze the alternative of no new fossil fuel leasing and no fracking or other unconventional well stimulation methods within the Moab planning area.

Sincerely,

**/s/ Michael Saul**

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*Attachments:*

Appendix A: Dustin Mulvaney et al., The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels (August 2015).

Appendix B: Center for Biological Diversity, Review of Impacts of Oil and Gas Exploration and Development on Wildlife (June 15, 2015)