July 21, 2014

U.S. Department of Energy (FE–34)
Attn: Addendum Comments
Office of Oil & Gas Global Security & Supply
Office of Fossil Energy
Forrestal Building, Room 3E–042,
1000 Independence Avenue SW., Washington, DC 20585

Dear Secretary Moniz:

Thank you and the Department of Energy's Office of Fossil Energy ("DOE/FE") for accepting these comments on the "Addendum to Environmental Review Documents Concerning Exports of Natural Gas from The United States" and the "Environmental Impacts of Unconventional Natural Gas Development and Production" report. We submit these comments on behalf of the Sierra Club, our millions of members and supporters, and Cascadia Wildlands, Otsego 2000, Inc., Columbia Riverkeeper, Stewards of the Lower Susquehanna, Inc., Friends of the Earth, Chesapeake Climate Action Network, Food and Water Watch, and Earthjustice.

## I. Introduction

DOE faces pending applications for authorization to export 33.75 billion cubic feet per day ("bcf/d") of natural gas as liquefied natural gas ("LNG").[1] 33.75 bcf/d represents more than 50 percent of total 2012 U.S. gas production.[2] Authorizing even a fraction of the proposed export projects will have severe environmental consequences, as this added source of gas demand will induce additional gas production and change the U.S. energy landscape.

On May 29, 2014, DOE released a package of four documents discussing the environmental impacts of gas production and consumption:

[1] DOE, Long Term Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of June 11, 2014), http://energy.gov/sites/prod/files/2014/06/f16/Summary%20of%20LNG%20Export%20Applications.pdf. Specifically, this total represents applications to export to countries without a free trade agreement with the U.S. requiring national treatment in natural gas. This total does not include the 2.2 bcf/d of exports to non-free trade agreement nations that received final authorization in *Sabine Pass Liquefaction, LLC*, DOE/FE Order. 2691-A.

[2] Energy Information Administration ("EIA"), 2014 Annual Energy Outlook. EIA estimates total US 2012 gas production at 24.06 trillion cubic feet, or 65.9 bcf/d. *Id.* at Table A14. EIA's figure for "Lower 48 onshore" production is 22.07 trillion cubic feet. *Id.*

- Addendum to Environmental Review Documents Concerning Exports of Natural Gas from The United States ("DOE Addendum")
- Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States ("Export LCA")
- Life Cycle Analysis of Natural Gas Extraction and Power Generation ("Gas LCA")
- Environmental Impacts of Unconventional Natural Gas Development and Production ("Unconventional Production Report")

These four documents provide useful information regarding the environmental impacts of proposed exports. However, DOE has more work to do. These documents understate the impacts of natural gas production and of potential U.S. exports, and they fail to provide the full analysis of the impacts of LNG exports that the National Environmental Policy Act[3] ("NEPA") and the Natural Gas Act[4] require.

We offer comments on these materials in this document and in the related comment addressing air emissions and climate impacts. We note, however, that while DOE has invited comment on this package of materials, DOE has structured the package in a way that complicates public review and participation.

These four documents provide overlapping, and often inconsistent, analyses. For example, all four of these documents discuss the greenhouse gas emissions of natural gas production, but they draw on different data sources and rest on different assumptions. Estimates of methane's global warming potential provide one example of this inconsistency: the Export LCA uses estimates from the most recent Intergovernmental Panel on Climate Change ("IPCC") report, but the Gas LCA and Unconventional Production Report uses earlier and outdated estimates, and the DOE Addendum, although it acknowledges the recent data, appears to use older data in tables expressing methane emissions in carbon dioxide equivalents. Commenters have no way of knowing which of these conflicting documents represents the agency's conclusion on the matter. DOE has not, for example, identified any one of these documents as controlling. In other circumstances commenters might assume that the most recent agency publication represented the agency's current opinion, but all four of these documents have the same date. DOE must resolve these inconsistencies by presenting a clear statement of its analysis, the supporting evidence, and its conclusions. DOE could provide this clarification by unifying the analysis into a single document, or by using separate documents with more clearly delineated roles and interrelationships.

Even where these documents are not inconsistent with one another, their fragmented analysis makes public comment difficult. For example, NETL states that, including NETL's own work, there are "five major studies that . . . represent the breadth of all natural gas lifecycle [greenhouse

[3] 42 U.S.C. § 4332 *et seq.*
[4] 15 U.S.C. § 717b.

gas emission] work."[5] Yet the discussion of these "five major [life cycle] studies" does not occur in either of the package's two documents that have "life cycle" in their titles and that specifically address climate impacts, nor do the two life cycle documents indicate that this issue is discussed in the other documents.[6] Indeed, only two of the four non-NETL "major" lifecycle studies are even cited in the two NETL life cycle reports.[7] Because DOE invited public comment on each document individually, a member of the public concerned with climate impacts might review the two climate documents without realizing that those documents represented only a portion of DOE's analysis of this issue.

Finally, because all of these documents save the DOE Addendum were authored by DOE's National Energy Technology Laboratory ("NETL") and published on the same date, the documents' practice of simply using "NETL 2014" to refer to one another creates needless confusion. The DOE Addendum refers to the Unconventional Production Report as "NETL 2014," but the Unconventional Production Report and the Export LCA both use "NETL 2014" to refer to the Gas LCA. Public review of this integrated package of documents would have been aided had DOE and NETL taken the simple measure of adopting and consistently using unique shorthand names for the individual documents constituting this package.

Despite these difficulties, we offer comments in this document and in the separately-filed comment on climate impacts. This document principally addresses the DOE Addendum and Unconventional Production Report. Our separate comment on climate impacts principally addresses the Export LCA and Gas LCA, but it also addresses the discussion of air pollution emission rates and methane global warming potential found in the DOE Addendum and Unconventional Production Report.

## II. Procedural Concerns

Separate from the substance of the May 29 materials, we have several concerns regarding the process DOE proposes for discussing environmental impacts, which we explain below. Most importantly, examination of the environmental impacts of LNG exports, including effects of induced gas production, must occur within the NEPA framework. In addition, absent formal programmatic environmental review under NEPA, DOE must ensure that these materials are included in the individual dockets for every export application.

[5] Unconventional Production Report at 2 and 39; *see also* DOE Addendum at 40 (summarizing the conclusions of four of these studies).
[6] The Gas LCA does briefly discuss two of these studies. Gas LCA at 70.
[7] *Id.*

## A. NEPA

NEPA requires federal agencies to consider and disclose the environmental impacts of their proposed actions, and NEPA mandates that this disclosure be made in an "environmental impact statement" where the proposed major federal action may "significantly affect[] the quality of the human environment." 42 U.S.C. § 4332(C). DOE acknowledges, as it must, that NEPA applies to DOE decisions to authorize exports to non-free trade agreement countries, and in the particular dockets where DOE has taken action to date, DOE has stated that it will comply with NEPA by cooperating with the Federal Energy Regulatory Commission's review of related applications regarding construction, siting, and operation of liquefaction facilities and export terminals.

The environmental review required by NEPA must include discussion of "indirect" and "cumulative" effects.[8] LNG exports' inducement of gas production, the environmental impacts of that production, and the other environmental impacts described in these comments all plainly fall within these rubrics. DOE's assertions that by discussing these issues it "is going beyond what NEPA requires," and that "The analysis in this Addendum is not required by NEPA"[9] are wrong on both the law and facts.

Under NEPA, Direct effects are "caused by the action and occur at the same time and place."[10] Indirect effects are also "caused by the action" but:

> are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effect on air and water and other natural systems, including ecosystems.[11]

Cumulative impacts, finally, are not causally related to the action. Instead, they are:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.[12]

[8] 40 C.F.R. §§ 1508.8(b), 1508.7.
[9] DOE Addendum at 2, 3.
[10] 40 C.F.R. § 1508.8(a).
[11] 40 C.F.R. § 1508.8(b).
[12] 40 C.F.R. § 1508.7.

DOE's mistaken contention that the Addendum and related reports go beyond what NEPA requires rests solely on foreseeability.

DOE first argues that it is uncertain whether, even if DOE authorizes the export of LNG, this will cause LNG exports to actually occur.[13] DOE correctly notes that the volume of LNG imported into the U.S. has been much less than what DOE authorized. Nonetheless, DOE cannot premise its authorization of an action on the assumption that the action will not occur. When confronted with an application to export specific volumes of LNG, DOE must consider the environmental consequences of the proposed volume of exports. NEPA does not require DOE to look beyond the reasonably foreseeable consequences of the authorized action, but this foreseeability threshold does not extend to the authorized action itself.

Even if DOE is permitted to look to whether exports, if authorized, will actually occur, the best available evidence indicates that they will. As DOE acknowledges,[14] the Energy Information Administration's ("EIA") 2014 Annual Energy Outlook predicts that, in the "Reference case," the U.S. will become a net exporter of LNG, with net exports increasing by 9.6 bcf/d by 2030 and continuing at that rate through 2040.[15] DOE does not criticize this forecast, nor does DOE argue that, if DOE authorizes this level of exports or more, this level of exports is not likely to occur. Although this forecast, like all forecasts, is uncertain, "[r]easonable forecasting and speculation is . . . implicit in NEPA, and [courts] must reject any attempt by agencies to shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as 'crystal ball inquiry.'" *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n*, 481 F.2d 1079, 1092 (D.C. Cir. 1973). The fact that predicted LNG imports were not realized does not excuse DOE from considering future impacts entirely. This is especially true because the shift from imports to exports is the result of the kind of technological shift—development of shale gas extraction—that is as infrequent as it is hard to anticipate.

If exports do occur, they will induce significant additional natural gas production, as DOE concedes.[16] According to EIA forecasts, "across all cases, an average of 63 percent of increased export volumes would be accounted for by increased domestic production. Of that 63 percent, EIA projected that 93 percent would come from unconventional sources (72 percent shale gas, 13 percent tight gas, and 8 percent coalbed methane [CBM]) (EIA 2012)."[17] DOE explicitly endorses this forecast.[18] Despite this forecast, DOE states that it "cannot meaningfully estimate where, when, or by what method any additional natural gas would be produced."[19] The professed impossibility of meaningfully predicting "by what method" additional gas would be produced flies in the face of DOE's own statements on the previous page, to say nothing of the EIA

[13] DOE Addendum at 1 (discussing the "early release overview" of the 2014 Annual Energy Outlook).
[14] DOE Addendum at 42.
[15] EIA 2014 Annual Energy Outlook, MT-22 (predicting a net increase of 3.5 trillion cubic feet per year).
[16] DOE Addendum at 1, 4.
[17] DOE Addendum at 4.
[18] DOE Addendum at 1.
[19] DOE Addendum at 2.

predictions of the breakdown of particular unconventional types. DOE states that "DOE *believes* those LNG export volumes would be offset by some combination of increased domestic production of natural gas *(principally from unconventional sources)*" and adjustments to consumption and trade.[20] DOE offers no explanation as to why, for a given volume of additional production, meaningful predictions regarding the time or place of production are impossible. Indeed, the same tool underlying the EIA's predictions regarding induced production can be used to estimate the regions in which this production will occur.

The predictions in EIA's *Effect of Increased Natural Gas Exports on Domestic Energy Markets* study were derived from EIA's core analytical tool, the National Energy Modeling System ("NEMS"). NEMS models the economy's energy use through a series of interlocking modules that represent different energy sectors on geographic levels.[21] Notably, the "Natural Gas Transmission and Distribution" module models the relationship between U.S. and Canadian gas production, consumption, and trade, specifically projecting U.S. production, Canadian production, imports from Canada, *etc*.[22] For each region, the module links supply and demand annually, taking transmission costs into account, in order to project how demand will be met by the transmission system.[23] Importantly, the Transmission Module is *already* designed to model LNG imports and exports, and contains an extensive modeling apparatus allowing it to do so on the basis of production in the U.S., Canada, and Mexico.[24] At present, the Module focuses largely on LNG imports, reflecting U.S. trends up to this point, but it also already links the Supply Module to the existing Alaskan *export* terminal and can project exports from that site and their impacts on production.[25]

Similarly, EIA's "Oil and Gas Supply" module models individual regions and describes how production responds to demand across the country. Specifically, the Supply Module is built on detailed state-by-state reports of gas production curves across the country.[26] As EIA explains, "production type curves have been used to estimate the technical production from known fields" as the basis for a sophisticated "play-level model that projects the crude oil and natural gas supply from the lower 48."[27] The module distinguishes coalbed methane, shale gas, and tight gas from other resources, allowing for specific predictions distinguishing unconventional gas

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[20] DOE Addendum at 1 (emphases added).
[21] EIA, *The National Energy Modeling System: An Overview*, 1-2 (2009), attached as Exhibit 1, available at http://www.eia.gov/oiaf/aeo/overview/pdf/0581(2009).pdf.
[22] *Id.* at 59.
[23] EIA, *Model Documentation: Natural Gas Transmission and Distribution Module of the National Energy Modeling System*, 15-16 (2012), attached as Exhibit 2, *available at* http://www.eia.gov/FTPROOT/modeldoc/m062(2011).pdf.
[24] *See id.* at 22-32.
[25] *See id.* at 30-31.
[26] EIA, *Documentation of the Oil and Gas Supply Module*, 2-2 (2011), attached as Exhibit 3, *available at* http://www.eia.gov/FTPROOT/modeldoc/m063(2011).pdf.
[27] *Id.* at 2-3.

supplies from conventional supplies.[28] The module further projects the number of wells drilled each year, and their likely production.[29] In short:

> [the supply module] includes a comprehensive assessment method for determining the relative economics of various prospects based on future financial considerations, the nature of the undiscovered and discovered resources, prevailing risk factors, and the available technologies. The model evaluates the economics of future exploration and development from the perspective of an operator making an investment decision.[30]

Thus, for each play in the lower 48 states, the EIA is able to predict future production based on existing data. The model is also equipped to evaluate policy changes that might impact production; according to EIA, "the model design provides the flexibility to evaluate alternative or new taxes, environmental, or other policy changes in a consistent and comprehensive manner."[31] Thus, there is no technical barrier to modeling where exports will induce production going forward.

We note that EIA is not unique in its ability to anticipate the location of future gas production. Deloitte Marketpoint has provided similar discussion of the ways exports will induce domestic production.[32] Deloitte explains that its "World Gas Model" includes details of global gas resources, including modeling of "575 plays in the US alone."[33] For this model, "Within each major region are very detailed representations of many market elements: production, liquefaction, transportation, market hubs, regasification and demand by country or sub area."[34] This includes modeling individual "producers, pipelines, refineries, ships, distributors, and consumers." *Id*. Deloitte has applied this model to one of the individual export proposal before DOE, and predicted specific volumes of production increases in five distinct shale gas plays.[35] We offer no opinion at this time about the strengths or weaknesses of Deloitte's models relative to EIA's. We simply note that multiple tools exist which allow predictions of how and where production will respond to exports. DOE offers no explanation as to why the predictions available through use of these models are so "meaningless" as to fall outside the scope of NEPA analysis.

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[28] *Id*. at 2-7.
[29] *See id.* at 2-25 to 2-26.
[30] *Id*. at 2-3.
[31] *Id*.
[32] Deloitte MarketPoint, Analysis of Economic Impact of LNG Exports from the United States, at 14 (originally filed as Appendix F to Excelerate Liquefaction Solutions I, LLC, Application for Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas to Non-Free Trade Agreement Countries, DOE/FE Dkt. 12-146-LNG (Oct. 5, 2012)), attached as Exhibit 4.
[33] *Id*. at 25.
[34] *Id*. at 24.
[35] *Id*.

Finally, as DOE acknowledges, uncertainty as to the location of induced gas production provides minimal impediment to assessment of the climate impact of export-induced gas production.[36] Yet DOE does qualify its statement that the DOE Addendum goes "beyond what NEPA requires" as applying only to non-climate impacts.

Performing environmental review under the NEPA rubric, rather than in a separate process, is not a mere formality. NEPA provides important standards for the scope and substance of review, as well as procedures to ensure that the public has a meaningful opportunity to participate and that public comments are considered.

## B. Relationship with Individual Export Application Dockets

DOE must clarify the relationship between the various materials released on May 29 and the dozens of individual LNG export dockets.

DOE's web page describing the Export and Gas LCAs states that "The [Export] LCA . . . and comments received will be included in the dockets of the 25 pending applications for which Notices of Application have been issued seeking authorization to export LNG by LNG tanker from large-scale liquefaction facilities in the lower-48 states to non-FTA nations."[37] The Federal Register notice for the Export LCA enumerates these dockets. As of June 11, 2014, DOE had issued opened dockets for 32 distinct non-FTA applications.[38] DOE should include these materials in *all* non-FTA export dockets—both the additional seven pending dockets and any other dockets opened in the future. With the prior NERA Macroeconomic study, DOE has confusingly only filed that study and comments received thereon in the dockets of fifteen applications that were open at the time. DOE staff has communicated to Sierra Club that the DOE will *not* itself act to include these materials in dockets beyond these fifteen. This surprising policy of explicitly including these documents in some dockets but not in others has compelled Sierra Club to, in an abundance of caution, re-file its comments on the NERA Study, and the NERA Study itself, in the excluded dockets in order to ensure that these documents are considered part of the pertinent administrative records. For both the NERA Study and the current environmental documents, DOE could avoid the burdens the formality of refilling imposes on DOE staff, project applicants, and members of the public by simply clarifying that all of these materials are considered part of the record of all export applications.

[36] DOE Addendum at 2.
[37] http://www.energy.gov/fe/life-cycle-greenhouse-gas-perspective-exporting-liquefied-natural-gas-united-states.
[38] DOE, Long Term Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of June 11, 2014), *supra* n.1.

While DOE includes the climate lifecycle analysis in 25 dockets, the Federal Register notice for the DOE Addendum lists only thirteen.[39] These issues, however, are plainly pertinent to all LNG export applications, and should be included in each export docket.

To ensure thorough environmental review of all export applications, and to minimize burdens on DOE staff, export applicants, and the interested public, DOE should state that the four May 29, 2014 documents, the documents cited as references therein, and the public comments received thereon will all be treated as part of the administrative record for all pending LNG export applications and for further applications received in the foreseeable future.

Finally, although this type of broad environmental review provides information useful to the review of individual export applications, it does not eliminate the need for project-specific analysis of the climate and other impacts. When reviewing individual projects, DOE will have more specific information regarding the size of the project, the type and efficiency of the liquefaction equipment to be used (and thus, the total gas demand for the volume of exports and the project's air emissions), and the likely destination countries (and thus, transport distances and potential effects on end-use energy markets). In this project-specific review, DOE must use this information to take a hard look at the air and water impacts discussed below and in the DOE Addendum, as well as impacts to the species and landscapes.

## III. Impacts to Water

### A. Water Quantity

As DOE acknowledges, shale gas production is a water-intensive process, with drilling and hydraulically fracturing a well requires an average of 2 to 6 million gallons of water. DOE likely understates this quantity: the author of the more recent of the two studies informing DOE's estimates, Jean-Philippe Nicot, has published more recent work that concludes increased estimates of water consumption.[40]

The Addendum nonetheless fails to adequately discuss the context and impact of unconventional gas development's water use, for two reasons. The Addendum's discussion of the impact of water use begins by comparing shale gas with other forms of energy in terms of water intensity,

[39] Also unlike the Export LCA, DOE's website for the DOE Addendum does not discuss which dockets the DOE Addendum will be included in.

[40] Addendum at 11 (citing NETL Unconventional Production); NETL Unconventional Production at 74-75, 79 (citing Nicot, J-P and Scanlon, B.R., *Water Use for Shale Gas Production in Texas*, U.S. Environmental Science and Technology, 46 American Chemical Society 3580 (Mar. 2, 2012); Jean-Philippe Nicot, *et al.*, *Oil & Gas Water Use in Texas: Update to the 2011 Mining Water Use Report*, 11 (Sept. 2012) (explaining that, because of a change in calculations, the new study concludes that shale production is more water intensive than the authors' prior estimates that were contemporaneous with their ACS publication), available at http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0904830939_2012Update_MiningWaterUse.pdf, attached as Exhibit 5.

*i.e.*, gallons of water demand per mmBtu.[41] DOE concludes that after conventional gas, shale gas is the least water intensive fossil fuel.[42] For purposes of assessing the water impacts of proposed LNG exports, however, this comparison is potentially misleading. The increased gas production that will be induced by LNG exports will occur in addition to, rather than in place of, production of other energy. The key question is whether American communities and ecosystems will be able to tolerate the additional water demand created by the added gas production. If the answer is no, then there will be little comfort in the fact that, if an equivalent amount of some other energy production had been added instead, the water demand would have been even higher.

The Addendum further obscures the water impact of shale production by comparing it with less consumptive uses. The Addendum emphasizes that the water volumes needed for shale gas production are smaller than those used for municipal, irrigation, and electricity generation purposes, such that "In most cases, shale gas production uses less than one percent of the total water demand."[43] Shale gas's water demand is significantly different than these other uses, however, in that shale gas extraction is largely a consumptive use that removes water from the usable water cycle. After water has been used for irrigation or municipal purposes, for example, much of that water is treated and redischarged into surface water or percolates through the soil and recharges usable groundwater aquifers. The majority of water used for shale gas production, however, either remains in the shale formation or, after it is returned to the surface, is disposed of in underground injection wells where it is permanently removed from the usable water cycle.[44] NETL explains that "By far, the preferred [water] disposal method for the oil and gas industry as a whole is underground injection," and that "In 2007," the only year for which NETL provides a nationwide estimate, "more than 98 percent of produced water from on-shore wells was injected underground."[45] The SEAB Shale Gas Subcommittee has recognized "significant concerns about consumptive water use for shale gas development."[46] Thus, the water withdrawn from the aquifer will be used in a way that provides no opportunity to percolate back down to the aquifer and recharge it. Because shale gas development uses water more consumptively than other forms of water demand, the impact of shale gas development on local water supplies is greater than the mere percentages provided by DOE acknowledges.

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[41] Addendum at 11. This table provides values for "conventional" and "shale" gas, but not "tight" gas, coalbed methane, or other forms of "unconventional" production.
[42] *Id.* This chart also includes two biofuels—irrigated corn ethanol and irrigated soy biodiesel—but omits renewables such as wind, solar, or geothermal power.
[43] Addendum at 11-12.
[44] NETL Unconventional Production at 99.
[45] NETL Unconventional Production at 99-100.
[46] Secretary of Energy Advisory Board (SEAB), Shale Gas Production Subcommittee: Ninety Day Report. [Online] U.S. Department of Energy, Washington, DC (Aug. 11, 2011), at 19 ("[I]n some regions and localities there are significant concerns about consumptive water use for shale gas development.").

## B. Water Quality

Gas production, and unconventional gas production in particular, can also harm water quality, primarily by contaminating surface or ground water with chemicals added to fracturing fluid or chemicals naturally occurring in the formation.[47]

DOE's materials briefly summarize the use of chemical additives in hydraulic fracturing fluid, and provide a few examples of specific chemical additives and their purposes.[48] DOE's materials do not contain any discussion, however, of these chemicals' safety. As one recent survey explained, many of the chemicals used present health risks.

> Examples [of fracking fluid additives] include methanol, ethylene glycol, naphthalene, xylene, toluene, ethylbenzene, formaldehyde, and sulfuric acid, some of which are known to be toxic, carcinogenic, and associated with reproductive harm. Many of these compounds are also regulated in other industries under the Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA) as hazardous water pollutants. [¶] Many of the chemical compounds used in the process lack scientifically based maximum contaminant levels (MCLs), which render a quantification of their public health risks more difficult. . . . [¶] At certain concentrations or doses, more than 75% of the chemicals identified are known to negatively impact the skin, eyes, and other sensory organs, the respiratory system, the gastrointestinal system, and the liver; 52% have the potential to negatively affect the nervous system; and 37% of the chemicals are candidate endocrine disrupting chemicals.[49]

One of the most troubling additives is diesel. The SEAB Shale Gas Subcommittee has singled out diesel as a fracturing fluid additive for its harmful effects, recommending a ban on use of diesel in fracturing fluid.[50] The minority staff of the House Committee on Energy and Commerce has determined that, despite diesel's risks, "between 2005 and 2009, oil and gas service

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[47] Diminution of water quantity can also adversely affect water quality, as when reduced in-stream flows make streams less able to tolerate other sources of contamination.
[48] Addendum at 18, NETL Unconventional Production at 88.
[49] Seth B. Shonkoff, et al., *Environmental Public Health Dimensions of Shale and Tight Gas Development*, Environmental Health Perspectives , 9-10 (April 16, 2014), http://dx.doi.org/10.1289/ehp.1307866 (internal citations omitted), attached as Exhibit 6.
[50] DOE, Shale Gas Production Subcommittee First 90-Day Report, at 25.

companies injected 32.7 million gallons of diesel fuel or hydraulic fracturing fluids containing diesel fuel in wells in 20 states."[51]

In addition to chemicals added to fracturing fluid, harmful chemicals naturally occur in the target formations, and these chemicals can be mobilized by the shale gas production process. DOE generally states that, in addition to chemicals introduced into the fracturing fluid, wastewater can contain "total dissolved solids (TDS), salts, metals, organics, [and] naturally occurring radioactive materials (NORM)."[52] DOE does not acknowledge that the organic chemicals can include particularly harmful compounds such as benzene, toluene, ethylbenzene, and xylene.[53] Unconventional gas production can also introduce methane into water supplies, creating a safety hazard.

Shale gas production can introduce these harmful contaminants into surface and groundwater through a number of pathways: spills and leakages at the well pad, through a failure of the well casing or cement, or through other underground migration.[54] For underground migration, DOE describes contamination as occurring through the assistance of some conduit, such as an existing well or natural fault. One recent geological model, however, concluded that even in the absence of such a conduit, hydraulic fracturing could drive contaminants into aquifers in less than ten years.[55] This result is particularly troubling because, while a careful operator can reduce the risk of intersection with a fault or existing well, it is unclear whether any steps could be taken to avoid this contamination vector. More broadly, although DOE concludes that best practices can minimize the risks of contamination through other pathways,[56] DOE provides no analysis of the rate of industry adherence to these practices, or of the residual risk that exists despite the exercise of due care.

Despite DOE's optimism about the possibility of minimizing risks, numerous studies demonstrate that contamination occurs in practice. In addition to the studies cited in the NETL Unconventional Production report, a review of drilling in Colorado found that gas drilling correlated with increasing thermogenic methane and chloride levels in groundwater wells.[57] In addition, EPA has concluded that unconventional production likely led to groundwater

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[51] Letter from Reps. Waxman, Markey, and DeGette to EPA Administrator Lisa Jackson, 2 (Oct. 25, 2011), available at http://democrats.energycommerce.house.gov/sites/default/files/documents/Jackson-EPA-Hydraulic-Fracturing-2011-10-25.pdf, attached as Exhibit 7.
[52] Addendum at 18; *see also* NETL Unconventional Production at 94-95.
[53] Shonkoff 2014, *supra* n.49, at 19.
[54] Addendum at 14, 18; *see also* NETL Unconventional Production 83-93.
[55] Tom Myers, *Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers* (Apr. 17, 2012), attached as Exhibit 8.
[56] Addendum at 19 ("Unconventional gas production, when conforming to regulatory requirements, implementing best management practices, and administering pollution prevention concepts, may have temporary, minor impacts to water resources.").
[57] Geoffrey Thyne, *Review of Phase II Hydrogeologic Study* (2008), prepared for Garfield County, Colorado, *available at* http://cogcc.state.co.us/Library/Presentations/Glenwood_Spgs_HearingJuly_2009/(1_A)_ReviewofPhase-II-HydrogeologicStudy.pdf, attached as Exhibit 9.

contamination in Pavillion, Wyoming and Dimock, Pennsylvania. In the Pavillion investigation, EPA's draft report concludes that "when considered together with other lines of evidence, the data indicates likely impact to ground water that can be explained by hydraulic fracturing."[58] EPA tested water from wells extending to various depths within the range of local groundwater. At the deeper tested wells, EPA discovered inorganics (potassium, chloride), synthetic organic (isopropanol, glycols, and tert-butyl alcohol), and organics (BTEX, gasoline and diesel range organics) at levels higher than expected.[59] At shallower levels, EPA detected "high concentrations of benzene, xylenes, gasoline range organics, diesel range organics, and total purgeable hydrocarbons."[60] EPA determined that surface pits previously used for storage of drilling wastes and produced/flowback waters were a likely source of contamination for the shallower waters, and that fracturing likely explained the deeper contamination.[61] The U.S. Geological Survey, in cooperation with the Wyoming Department of Environmental Quality, also provided data regarding chemicals found in wells surrounding Pavillion.[62] Although the USGS did not provide analysis regarding the likely source of the contaminants found, an independent expert who reviewed the USGS and EPA data at the request of Sierra Club and other environmental groups concluded that the USGS data supports EPA's findings.[63] EPA recently stated that it would turn further investigation of contamination of Pavillion over to Wyoming, such that EPA will not finalize its draft report, but that EPA "stands behind its work and data" in the draft report.[64]

EPA also identified elevated levels of hazardous substances in home water supplies near Dimock, Pennsylvania.[65] EPA's initial assessment concluded that "a number of home wells in the Dimock area contain hazardous substances, some of which are not naturally found in the environment," including arsenic, barium, bis(2(ethylhexyl)phthalate, glycol compounds, manganese, phenol, and sodium.[66] Arsenic, barium, and manganese were present in five home

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[58] EPA, Draft Investigation of Ground Water Contamination near Pavillion, Wyoming, at xiii (2011), available at http://www.epa.gov/region8/superfund/wy/pavillion/EPA_ReportOnPavillion_Dec-8-2011.pdf, attached as Exhibit 10.
[59] *Id.* at xii.
[60] *Id.* at xi.
[61] *Id.* at xi, xiii.
[62] USGS, *Groundwater-Quality and Quality-Control Data for two Monitoring Wells near Pavillion, Wyoming, April and May 2012*, USGS Data Series 718 p.25 (2012), attached as Exhibit 11.
[63] Tom Myers, *Assessment of Groundwater Sampling Results Completed by the U.S. Geological Survey* (Sept. 30, 2012), attached as Exhibit 12. Another independent expert, Rob Jackson of Duke University, has stated that the USGS and EPA data is "suggestive" of hydraulic fracturing as the source of contamination. Jeff Tollefson, *Is Fracking Behind Contamination in Wyoming Groundwater?*, Nature (Oct. 4, 2012), attached as Exhibit 13. *See also* Tom Myers, *Review of DRAFT: Investigation of Ground Water Contamination near Pavillion Wyoming* (April 30, 2012) (concluding that EPA's initial study was well-supported), attached as Exhibit 14.
[64] http://www2.epa.gov/region8/pavillion (last accessed Aug. 2, 2013), attached as Exhibit 15.
[65] EPA Region III, Action Memorandum - Request for Funding for a Removal Action at the Dimock Residential Groundwater Site (Jan. 19, 2012), available at http://www.epaosc.org/sites/7555/files/Dimock%20Action%20Memo%2001-19-12.PDF, attached as Exhibit 16; EPA, *EPA Completes Drinking Water Sampling in Dimock, Pa.* (Jul. 25, 2012), attached as Exhibit 17.
[66] EPA Region III Action Memorandum, *supra* n.65, at 1, 3-4.

wells "at levels that could present a health concern."[67] Many of these chemicals, including arsenic, barium, and manganese, are hazardous substances as defined under CERCLA section 101(14).[68] EPA's assessment was based in part on "Pennsylvania Department of Environmental Protection (PADEP) and Cabot Oil and Gas Corporation (Cabot) sampling information, consultation with an EPA toxicologist, the Agency for Toxic Substances and Disease Registry (ATSDR) Record of Activity (AROA), issued, 12/28/11, and [a] recent EPA well survey effort."[69] The PADEP information provided reason to believe that drilling activities in the area led to contamination of these water supplies. Drilling in the area began in 2008, and was conducted using the hazardous substances that have since been discovered in well water. Shortly thereafter methane contamination was detected in private well water. The drilling also caused several surface spills. Although EPA ultimately concluded that the five homes with potentially unsafe levels of hazardous substances had water treatment systems sufficient to mitigate the threat, [70] the Dimock example indicates the potential for gas development to contaminate groundwater.

Records obtained by The Scranton Times-Tribune further document that oil and gas development damaged at least 161 Pennsylvania water supplies between 2008 and the fall of 2012.[71] Of the 969 records examined, 17 percent resulted in contamination or disruption so severe that the oil and gas companies responsible were required to replace the water source. As explained by The Sunday Times, these documents do not provide a full picture of contamination, and do not determine the specific role of hydraulic fracturing, for several reasons:

1. What the PA Department of Environmental Protection ("DEP") considers one "incident" may actually affect multiple individual water wells or springs.

2. DEP does not have a system for tracking or filing water contamination incident records, meaning that the records obtained by the Sunday Times may not be complete.

3. Prior to 2011, water contamination incidents that were resolved between the water user and the oil and gas operator did not have to be reported to the DEP.

This evidence of contamination may paint only a partial picture, because some instances of contamination are not made public. Where drinking water contamination claims are settled privately between the water user and the gas operator, crucial scientific data regarding such incidents is often withheld from the public and academics due to confidentiality agreements.

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[67] *EPA Completes Drinking Water Sampling in Dimock, Pa.*, *supra* n.65.
[68] *See* 42 U.S.C. § 9604(a); 40 C.F.R. § 302.4.
[69] EPA Region III Action Memorandum, *supra* n.65, at 1.
[70] *EPA Completes Drinking Water Sampling in Dimock, Pa.*, *supra* n.65.
[71] Legere, Laura. (2013) "Sunday Times review of DEP drilling records reveals water damage, murky testing methods." The Scranton Times Tribune [Scranton, PA] 19 May 2013, Retrieved from http://thetimes-tribune.com/news/sunday-times-review-of-dep-drilling-records-reveals- water-damage-murky-testing-methods-1.1491547, attached as Exhibit 18.

Finally, we address a different vector for water contamination: sediment loading resulting from construction and other earth disturbances caused by gas production. DOE states that the Clean Water Act, particularly the National Pollutant Discharge Elimination System, regulates storm water runoff from gas production.[72] The Clean Water Act regulates "stormwater," defined as water flowing off a site as a result of rain or other precipitation.[73] Stormwater can cause pollution by carrying dirt, sediment, and toxic materials, such as oil residue, away from an industrial site and into a waterway, where it can harm fisheries and degrade water quality. Under the Clean Water Act, "industrial" activity—including land clearing, excavation, and ground-disbursing activity—requires a water permit that includes a Stormwater Pollution Prevention Plan.[74] But because of exemptions enacted in 1987[75] and expanded in 2005,[76] gas production is largely exempt from this rule. As EPA interprets this loophole, gas exploration and production does not require a stormwater permit for stormwater discharges containing only sediment.[77] Although gas production still requires a permit when its stormwater discharge carries oil, hazardous substances, or other pollutants,[78] the loophole for sediment means that often, there is no permit in place and no mechanism for monitoring whether stormwater is carrying these other substances. Thus, DOE overstates the extent to which federal authority limits potential stormwater pollution from gas production.

## IV. Air Impacts

As noted in the introduction above, the discussion of the air emissions from gas production (both conventional and unconventional production) is fragmented between the four May 29, 2014 documents. We provide comments on the *amount* of air pollution caused by gas production, and the climate impact of that pollution, in our separate comment focused on the Export LCA and Gas LCA. Those comments focus on quantities of methane pollution, but as DOE notes, methane emissions are significantly correlated with emissions of other pollutants.

Here, we address the non-climate impacts of the air pollution that would result from export-induced gas production. Although the 2012 New Source Performance Standard for oil and gas production will lead to important reductions in the per-well and per-mmBtu impacts of gas production, gas production will continue to have serious health impacts. While these rules will, as DOE states, help "protect against"[79] the many harmful impacts of air pollution from gas production, this protection is only partial. DOE discusses many of these impacts, but DOE does not fully address the extent to which gas production is likely to contribute to unhealthy levels of ground-level ozone pollution, and DOE does not acknowledge recent science regarding the harmful effects of proximity to gas wells on fetal health.

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[72] Addendum at 13.
[73] 33 U.S.C. § 1342(p).
[74] 40 C.F.R. § 122.26(b)(14)(x) and (15).
[75] 33 U.S.C. § 1342(l)(2).
[76] 33 U.S.C. § 1362(24).
[77] 71 Fed. Reg. 33628-01, 33630.
[78] 40 C.F.R. § 122.26(a)(2)(ii), (c)(1)(i).
[79] DOE Addendum at 21.

In addition, DOE does not address non-health-related environmental impacts of natural gas production's air pollution, such as impacts to visibility.

### A. Ozone Impacts

As DOE recognizes, "Air emissions from natural gas development may create new or expanded ozone non-attainment areas and possibly complicate implementation plans for bringing current non-attainment areas into compliance," and "development of gas resources in or near areas currently in attainment of ozone standards could jeopardize the continued attainment status of those areas."[80]

DOE appears to inappropriately downplay the importance of these impacts by stating that "Development activities at individual well sites are generally considered to be short-term activities" and by identifying pollution control requirements generally do not apply to gas production. While development of an individual well may be short term, LNG exports would induce additional production requiring development of thousands of wells throughout the life of the projects. Numerous studies have demonstrated that the "short term" impacts of developing individual wells, in aggregate, lead to significant impacts on ozone levels. Several studies have specifically modeled significant gas development's contributions to 8-hour ozone levels:

> Kemball-Cook et al. (2010)[[81]] modeled ozone precursor emissions (VOCs and NOx) in the Haynesville shale play that lies beneath the Northeast Texas/Northwest Louisiana border. Photochemical modeling showed increases in 2012 8-hour ozone design values of up to 5 parts per billion (ppb) which, along with the amount of projected emissions, give cause for concern about future atmospheric concentrations of ozone in Texas and Louisiana (Kemball-Cook et al. 2010). Olaguer (2012)[[82]] used The Houston Advanced Research Center (HARC) neighborhood air quality model to simulate ozone formation near a hypothetical natural gas processing facility, using estimates based on both regular and non-routine (e.g. flaring) emissions (Olaguer 2012). This model predicted that under average conditions using regular emissions associated with compressor engines may significantly increase

[80] Addendum at 27, 28.
[81] Kemball-Cook S, Bar-Ilan A, Grant J, Parker L, Jung J, Santamaria W, et al. 2010. Ozone Impacts of Natural Gas Development in the Haynesville Shale. Environ. Sci. Technol. 44(24):9357–9363, attached as Exhibit 19.
[82] Olaguer EP. 2012. The potential near-source ozone impacts of upstream oil and gas industry emissions. J. Air Waste. Manag. Assoc. 62:966–977. available at http://www.tandfonline.com/doi/pdf/10.1080/10962247.2012.688923, attached as Exhibit 20.

ambient ozone in the Barnett Shale formation (> 3ppb 2 km downwind from facility) (Olaguer 2012).[83]

In addition to these Texas analyses, studies have found that gas development is a major contributor to unsafe ozone levels in Wyoming, Utah, Colorado, and New Mexico. On July 20, 2012, the US EPA designated Wyoming's Upper Green River Basin as a marginal nonattainment area for ozone.[84] In an extended assessment, the Wyoming Department of Environmental Quality ("WDEQ") found that ozone pollution was "primarily due to local emissions from oil and gas . . . development activities: drilling, production, storage, transport, and treating."[85] In the winter of 2011, the residents of Sublette County suffered thirteen days with ozone concentrations considered "unhealthy" under EPA's current air-quality index, including days when the ozone pollution levels exceeded the worst days of smog pollution in Los Angeles.[86] In 2013, a Wyoming Department of Health study linked elevated levels of ozone pollution to increased visits at two local health clinics for respiratory-related complaints.[87] In the past, residents have faced repeated warnings regarding elevated ozone levels and the resulting risks of going outside[88] and WDEQ has drafted a plan, which includes weather forecasting, public updates and short-term ozone emission reduction measures, in anticipation of elevated ozone levels in 2014.[89]

Gas production is causing ozone problems in other Rocky Mountain states as well. In recent years Northeastern Utah's Uintah Basin has experienced severe ozone pollution. In the winter of 2012 to 2013, this region suffered over fifty days where air quality monitors measured ozone in excess of federal standards and some days where ozone levels were almost twice the federal

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[83] Shonkoff 2014, *supra* n.49, at 15.

[84] EPA, *Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards*, 77 Fed. Reg. 30088, 30157 (May 21, 2012), attached as Exhibit 21; *see also* Schnell, R.C, et al. (2009), *"Rapid photochemical production of ozone at high concentrations in a rural site during winter,"* Nature Geosci. 2 (120 – 122). DOI: 10.1038/NGEO415, attached as Exhibit 22**.**

[85] Wyoming Department of Environmental Quality, Technical Support Document I for Recommended 8-hour Ozone Designation of the Upper Green River Basin (March 26, 2009) at viii, *available at* http://deq.state.wy.us/out/downloads/Ozone%20TSD_final_rev%203-30-09_jl.pdf, attached as Exhibit 23.

[86] EPA, *Daily Ozone AQI Levels in 2011 for Sublette County, Wyoming, available at* http://www.epa.gov/cgi-bin/broker?msaorcountyName=countycode &msaorcountyValue=56035&poll=44201&county=56035&msa=-1&sy=2011&flag=Y &_debug=2&_service=data&_program=dataprog.trend_tile_dm.sas, attached as Exhibit 24; *see also* Wendy Koch, *Wyoming's Smog Exceeds Los Angeles' Due to Gas Drilling*, USA Today, *available at* http://content.usatoday.com/communities/greenhouse/post/ 2011/03/wyomings-smog-exceeds-los-angeles-due-to-gas-drilling/1, attached as Exhibit 25.

[87] State of Wyoming, Department of Health, *Associations of Short-Term Exposure to Ozone and Respiratory Outpatient Clinic Visits — Sublette County, Wyoming, 2008–2011* (Mar. 1, 2013) at 3, available at http://www.health.wyo.gov/phsd/ehl/index.html and attached as Exhibit 26.

[88] *See, e.g.*, 2011 DEQ Ozone Advisories, Pinedale Online! (Mar. 17, 2011), http://www.pinedaleonline.com/news/2011/03/OzoneCalendar.htm (documenting ten ozone advisories in February and March 2011), attached as Exhibit 27; Wyoming Department of Environmental Quality, Ozone Advisory for Monday, Feb. 28, Pinedale Online! (Feb. 27, 2011), http://www.pinedaleonline.com/news/2011/02/OzoneAdvisoryforMond.htm, attached as Exhibit 28.

[89] *DEQ plans for the 2014 winter ozone season*, Pinedale Online! (Dec. 19, 2013), available at http://www.pinedaleonline.com/news/2013/12/DEQplansforthe2014wi.htm and attached as Exhibit 29.

standard.[90] The Utah Department of Environmental Quality has determined that "Oil and gas operations were responsible for 98-99 percent of volatile organic compound (VOC) emissions and 57-61 percent of nitrogen oxide (NOx) emissions," the primary chemical contributors to ozone formation.[91] The Bureau of Land Management (BLM) has similarly identified the multitude of oil and gas wells in the region as the primary cause of the ozone pollution.[92]

Rampant oil and gas development in Colorado and New Mexico is also leading to high levels of VOCs and $NO_x$. In 2008, the Colorado Department of Public Health and Environment concluded that the smog-forming emissions from oil and gas operations exceed vehicle emissions for the entire state.[93] Moreover, significant additional drilling has occurred since 2008. Colorado is now home to more than 51,000 wells.[94] On July 20, 2012, the US EPA designated the metropolitan Denver and the North Front Range area in Colorado as a marginal nonattainment area for ozone.[95] Additionally, portions of Colorado's Western Slope now qualify as a nonattainment area because the three year average ozone value is above the NAAQS.[96] Monitoring also shows that many other areas of the state have ozone pollution levels that exceed levels EPA has recognized as having significant health impacts.[97] In 2013, the Colorado Department of Public Health and Environment issued 42 advisories, cautioning active children and adults, older adults, and people with asthma to reduce prolonged or heavy outdoor exertion, for the Front Range region due to ozone levels that had been exceeded or were expected to be exceeded.[98]

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[90] *See, e.g.*, Utah Dept. of Environmental Quality, *Utah's Environment 2013: Planning and Analysis: Uintah Basin Ozone Study* (updated Jan. 17, 2014), *available at* http://www.deq.utah.gov/envrpt/Planning/s12.htm and attached as Exhibit 30.

[91] Utah Dept. of Environmental Quality, *Uinta Basin: Ozone in the Uinta Basin* (Updated Jan. 28,2014), *available at* http://www.deq.utah.gov/locations/uintahbasin/ozone.htm, attached as Exhibit 31.

[92] BLM, *GASCO Energy Inc. Uinta Basin Natural Gas Development Draft Environmental Impact Statement* ("GASCO DEIS"), at 3-13, *available at* http://www.blm.gov/ut/st/en/fo/vernal/planning/nepa_/gasco_energy_eis.html, attached as Exhibit 32.

[93] Colo. Dept. of Public Health & Env't, Air Pollution Control Division, Oil and Gas Emission Sources, Presentation *for the Air Quality Control Commission Retreat*, at 3-4 (May 15, 2008), attached as Exhibit 33.

[94] Colorado Oil & Gas Conservation Commission, *Colorado Weekly & Monthly Oil and Gas Statistics*, at 11 (Jan. 7, 2014), available at http://cogcc.state.co.us/ (library—statistics—weekly/monthly well activity), attached as Exhibit 34.

[95] EPA, *Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards*, 77 Fed. Reg. at 30110, *supra* n.84.

[96] Colorado Air Quality Control Commission, 2013 Summer Ozone Season Review (Oct. 17, 2013) slides at 5, available at http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheadername1=Content-Disposition&blobheadername2=Content-Type&blobheadervalue1=inline%3B+filename%3D%22Review+of+the+2013+Ozone+Season+%2822+pages%29.pdf%22&blobheadervalue2=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251896466011&ssbinary=true and attached as Exhibit 35.

[97] *Id.* at 2-11.

[98] Colorado Department of Public Health and the Environment, Forecasting Air Quality in Colorado (May 16, 2013) at slides 2-3, 5, available at http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheadername1=Content-Disposition&blobheadername2=Content-Type&blobheadervalue1=inline%3B+filename%3D%22Forecasting+Air+Quality+in+Colorado+-+15+pgs.pdf%22&blobheadervalue2=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251854889571&ssbinary=true and attached as Exhibit 36.

There is also significant development in the San Juan Basin in southeastern Colorado and northwestern New Mexico, with approximately 35,000 wells in the Basin. As a result of this development and several coal-fired power plants in the vicinity, the Basin suffers from serious ozone pollution.[99] This pollution is taking a toll on residents of San Juan County. The New Mexico Department of Public Health has documented increased emergency room visits associated with high ozone levels in the County.[100]

DOE observes that the Clean Air Act imposes limits on ozone precursor emissions, but many of the requirements DOE describes have little applicability to gas production. DOE explains that "In nonattainment areas, companies must use the lowest achievable emissions rate (LAER) standards, . . . with no consideration of cost. In order for new sources to be permitted in a nonattainment area, companies must obtain offsets for existing emitters to compensate for the estimated new emissions."[101] Both of these requirements only apply to "major" sources of emissions,[102] but the majority of gas development's emissions come from sources that fall below the major source thresholds.

### B. Local Health Impacts

In addition to the regional effects on ozone pollution, gas production has been found to emit air pollutants adversely affecting persons living in close proximity to wells. As DOE recognizes, research from the Colorado School of Public Health found that residents living within a half mile of wells "were at an increased risk of acute and subchronic respiratory, neurological, and reproductive effects" from exposure to hydrocarbons, including BTEX compounds, emitted by gas production.[103] This same study also found that nearby residents suffered elevated cancer risks.

A recent working paper finds that, even at greater distances (up to 2.5 km), living near an active gas well correlates with working paper found a correlation between low birth weight and mothers living within 2.5 km of an active gas well.[104] Although this is an area of ongoing research, DOE must take a hard look at the potential for this serious impact.

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[99] *See Four Corners Air Quality Task Force Report of Mitigation Options*, at vii (Nov. 1, 2007), *available at* http://www.nmenv.state.nm.us/aqb/4C/TaskForceReport.html, attached as Exhibit 37.
[100] Myers *et al.*, *The Association Between Ambient Air Quality Ozone Levels and Medical Visits for Asthma in San Juan County* (Aug. 2007), *available at* http://www.nmenv.state.nm.us/aqb/4c/Documents/SanJuanAsthmaDocBW.pdf, attached as Exhibit 38.
[101] Addendum at 28.
[102] 42 U.S.C. §§ 7502 and 7503.
[103] Addendum at 31 (discussing McKenzie, L., R. Witter, L. Newman, and J. Adgate. 2012. Human health risk assessment of air emissions from development of unconventional natural gas resources. Science of the Total Environment. 424 (2012) 79–87.).
[104] Elaine Hill, *Shale Gas Development and Infant Health: Evidence from Pennsylvania (Revision December 2013)*, Working Paper (Dec. 2013), *available at* http://dyson.cornell.edu/research/researchpdf/wp/2012/Cornell-Dyson-wp1212.pdf, attached as Exhibit 39.

### C. Visibility

VOC and $NO_x$ emissions from oil and gas development are also harming air quality in national parks and wilderness areas. Researchers have determined that numerous "Class I areas" – a designation reserved for national parks, wilderness areas, and other such lands[105] – are already likely to be impacted by increased ozone pollution as a result of oil and gas development in the Rocky Mountain region. Affected areas include Mesa Verde National Park and Weminuche Wilderness Area in Colorado and San Pedro Parks Wilderness Area, Bandelier Wilderness Area, Pecos Wilderness Area, and Wheeler Peak Wilderness Area in New Mexico.[106] These areas are all near concentrated oil and gas development in the San Juan Basin.[107] Increases in natural gas production will likely aggravate impacts in these or other Class I areas.

## V. Conclusion

The DOE Addendum recognizes two obvious facts: that LNG exports would induce additional gas production and that gas production has severe environmental consequences. Although DOE's survey of the literature documenting the latter requires some additions and corrections, the primary flaw in DOE's analysis is the refusal to link these two obvious facts and take a hard look at extent to which authorizing LNG export applications will cause significant marginal increases in each of these environmental harms. DOE's assertion that uncertainty prevents meaningful discussion of this linkage is factually and legally implausible.

NEPA requires DOE to take a hard look at the direct, indirect, and cumulative environmental impacts of the pending applications for LNG export authorization. The environmental harms exports would cause must be weighed in DOE's Natural Gas Act evaluation of whether the proposed exports are consistent with the public interest. The analysis provided here, whether on its own or in conjunction with analyses previously provided by DOE, falls short of what these statutes require.

Sincerely,

Nathan Matthews

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[105] *See* 42 U.S.C. § 7472(a).

[106] Rodriguez et al., *Regional Impacts of Oil and Gas Development on Ozone Formation in the Western United States*, 59 Journal of the Air and Waste Management Association 1111 (Sept. 2009), available at http://www.wrapair.org/forums/amc/meetings/091111_Nox/Rodriguez_et_al_OandG_Impacts_JAWMA9_09.pdf, attached as Exhibit 40.

[107] *Id.* at 1112.

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