BEFORE THE COLORADO AIR QUALITY CONTROL COMMISSION

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

IN THE MATTER OF PROPOSED REVISIONS TO COLORADO AIR QUALITY CONTROL COMMISSION REGULATIONS NUMBER 3, PARTS A, B, AND C; REGULATION NUMBER 6, PART A; AND REGULATION NUMBER 7

OIL AND GAS RULEMAKING

ENVIRONMENTAL DEFENSE FUND

PREHEARING STATEMENT

I. Executive Summary

To address the air quality challenges posed by rapidly increasing oil and gas development and production in Colorado, Environmental Defense Fund ("EDF"), Noble Energy, Inc. ("Noble") Anadarko Petroleum Corporation ("Anadarko") and Encana Oil & Gas (USA) Inc. Corporation worked together to outline a set of practical and cost-effective recommendations that, if adopted, will substantially reduce emissions from the oil and gas sector. The Air Pollution Control Division ("Division") has utilized these recommendations to help inform the proposed rules that are the subject of this proceeding. EDF supports the Division's proposal.

The production and development of crude oil and natural gas in Colorado generates air emissions that can impact human health and the environment. Vented and leaked hydrocarbon emissions can contribute to pollution associated with serious human health effects and adverse environmental consequences including ground-level ozone or "smog," particulate pollution, toxic air pollution, climate-disrupting pollution, and the haze that obscures scenic vistas in national parks and wilderness areas.

Recent field measurements in Colorado and elsewhere suggest that emissions from oil and gas production may be higher than stated in the state and federal inventories. Moreover, oil and gas development continues to grow rapidly due to advances in technology, and that growth is projected to

continue far into the future. The emissions from this increase in development justify the adoption of additional controls to reduce the risks associated increased emissions from the oil and gas sector.

Fortunately, there are readily implementable practices and technologies that can significantly reduce these emissions. In fact, many leading companies in Colorado and across the country are already implementing measures to do just that. Three of these industry leaders – Noble, Anadarko and Encana Oil & Gas (USA) Inc. -- played a key role in the development of recommendations that are reflected in the proposed rules that have been submitted to the Commission for consideration. These companies, along with EDF, have endeavored to find common sense solutions that will enhance environmental and public health protections while minimizing the economic impact on the oil and gas industry. Those efforts are reflected in the Division's draft rule.

The Division's proposal, which consists of a series of common sense, cost effective practices and technologies, is projected to remove on the order of 90,000 tons of volatile organic compounds ("VOCs") and 110,000 tons of climate-altering methane emissions from the atmosphere per year. These control measures include leak detection and repair using instrument based methods ("LDAR"), best management practices to limit venting during well maintenance (such as associated with blow-downs), improve the controls on storage tanks, require replacement of high bleed pneumatic devices, improve controls on glycol dehydrators and control the venting of associated gas from new wells. Many of the proposed technologies and practices are already required in other jurisdictions or are being implemented on a voluntary basis by leading companies in order to maximize production and enhance efficiency and safety. The proposed monitoring, recordkeeping and reporting requirements, in conjunction with other rule requirements, will promote compliance, enhance transparency and help build public trust.

The Air Quality Control Commission ("AQCC" or "Commission") has clear authority to adopt the rules as proposed, including the regulation of hydrocarbons such as methane. Reducing methane emissions, a highly potent greenhouse gas, is critical to combating both climate change and, to a lesser extent, ozone pollution. The AQCC also has clear authority to adopt regulations to reduce smog-forming VOCs. Coloradans are already feeling the effects of a rapidly warming climate and continue to be exposed to harmful smog levels. Immediate reductions in hydrocarbons, such as those that will result from the controls proposed by the Division, are necessary to protect Coloradan's health and environment.

EDF supports the proposed amendments, which will reduce methane, VOC and hazardous air other emissions from oil and gas activities. If the Commission adopts the suite of proposed changes, Coloradans can breathe easier knowing their state has the most protective rules in the nation to limit methane and VOC emissions from oil and gas activities.

General Position. EDF supports the Division's proposal and encourages its adoption by the Commission.

Legal and Factual Testimony and Exhibits. EDF, in this prehearing statement and accompanying reports, will offer evidence and argument that support the Division's proposal. EDF reserves the right to respond to information and arguments submitted by other parties. Exhibits

offered into the record include expert reports by Tammy Thompson, an expert on air pollution and air modeling issues, and WZI Inc. by Jesse Frederick and Mary Jane Wilson, experts on air pollution control issues associated with oil and gas production activities. Exhibits also include technical documents referenced in those reports and this prehearing statement.

Estimate of Time Necessary for Presentation. EDF estimates that the time needed to present its direct testimony, conduct cross-examination, and provide rebuttal testimony is three hours. However, EDF reserves the right to request additional time based on information presented by other parties.

Witnesses. EDF anticipates offering the following witnesses for the hearing. These witnesses may refer to their expert reports or exhibits thereto, as applicable:

- Thomas A. Bloomfield, presenting facts and legal arguments in support of the proposed rule
- Elizabeth D. Paranhos, presenting facts and legal arguments in support of the proposed rule
- David S. Schimel, an expert on climate change, who will provide testimony regarding climate change issues. A CV from Dr. Schimel is Exhibit AA to this Prehearing Statement (EDF PHS-EXH AA).
- Tammy M. Thompson, an expert on atmospheric chemistry and air pollution, who will provide testimony regarding atmospheric chemistry, impacts of oil and gas operations on air quality and public health effects associated with such emissions, as well as other topics described in her expert report, and in response to points raised by others in connection with those issues. A CV from Dr. Thompson is attached as exhibit RR to her report (EDF-TT-EXH RR).
- Mr. Jesse Frederick and Mary Jane Wilson from WZI Inc., experts in air pollution control issues associated with oil and gas production activities, who will provide testimony about the controls proposed by the Division and other topics addressed in their report and raised by other parties in connection with those issues. CVs from Mr. Jesse Frederick and Mary Jane Wilson are attached as Appendix I to the WZI Expert Report (EDF-WZI-APPENDIX I).
- Any witness identified by any other party.
- Any other witnesses that may be needed for rebuttal or impeachment purposes.

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II. Colorado Oil and Gas Production is a Large and Rapidly Growing Source of Air Emissions

The production and development of crude oil and natural gas generates air emissions in Colorado that can impact human health and the environment. Vented and leaked hydrocarbon emissions contain volatile organic compounds ("VOCs"), methane ("CH_4") and hazardous air pollutants ("HAPs"). These airborne contaminants can contribute to pollution associated with serious human health effects and adverse environmental consequences including ground-level ozone or "smog," particulate pollution, toxic air pollution, climate-disrupting pollution, and the haze that obscures scenic vistas in national parks and wilderness areas.

Oil and gas development is expanding swiftly in Colorado. The number of wells alone has increased from 27,500 in 2006 to more than 51,600 in 2013, an 88% increase.[1] During this time, Colorado has implemented a number of regulations intended to reduce emissions from oil and gas production. These regulations have resulted in important emission reductions from the oil and gas sector. However, rapid growth in oil and gas production has outpaced the protections provided by the current regulatory framework, leading to a net increase in pollution from oil and gas operations in Colorado. The oil and gas industry today is the single largest source of anthropogenic VOCs in Colorado, and a significant contributor of methane emissions. Based on the Division's emission inventory of VOCs in 2011, the industry emitted 325,349 tons (296,068 metric tons) of methane into the atmosphere.[2] This is equivalent to the annual greenhouse gas emissions from 1,295,298 passenger vehicles.[3]

It is possible that actual emissions from oil and gas industry activities may be higher. Ambient air measurements indicate higher levels of emissions than reported in national and state inventories. According to some studies, inventories may underestimate actual emissions by a factor of 1.5 to 3.[4]

These emissions adversely affect air quality in both urban and rural areas. The Denver Front Range continues to fail to meet national health-based standards for ozone (the National Ambient Air Quality Standards). Just this past winter a monitor in Western Colorado violated the ozone standard.[5] Wintertime ozone problems have been identified in rural parts of Wyoming and Utah home to significant oil and gas development. The ability of Colorado to meet federal

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[1] EDF-PHE-EXH A. Conservation Commission, Colorado Weekly and Monthly Oil & Gas Statistics 12/06/13 at 11 (COGCC 2013), available at http://cogcc.state.co.us/Library/Statistics/CoWklyMnthlyOGStats.pdf.
[2] WZI, Expert Report: Evaluation of LDAR and Other Control Strategies as Proposed by the Colorado Department of Public Health and the Environment for Oil and Gas Sources, November 2013 ("WZI report").
[3] EDF-PHS-EXH-B. EPA's GHG Equivalencies Calculator, http://www.epa.gov/cleanenergy/energy-resources/calculator.html). Short tons were controverted to metric tons by multiplying by 0.91.
[4] Tammy M. Thompson, PhD, The potential human and environmental health impacts of emissions from Oil and Gas activities in Colorado ("Thompson report").
[5] EDF-PHE-EXH- EXH C. CDPHE Briefing to the Colorado AQCC re 2013 Summer Ozone Season Pre-Review, May 16, 2013.

ozone standards is even more challenging due to increasing global background levels of ozone.[6] Those background levels are elevated in part due to elevated methane concentrations, which as explained below, contribute to the formation of global background ozone levels.

Oil and gas development is predicted to continue to expand and emissions to increase. The U.S. Energy Information Administration ("EIA") predicts production in the U.S. will climb by 84% between 2013 and 2040. Oil production in Colorado is up more than 26% between 2011 and 2012.[7] Gas production is also trending up.[8] Modeling by the Division suggests 2018 emissions will surpass 2008 emissions by more than 50%, absent additional controls.[9]

While industry leaders are implementing practices and technologies to minimize emissions from oil and gas development, currently-required air pollution controls are insufficient to address the significant and increasing emissions associated with the sector in Colorado. A recent peer reviewed article discussing the effect of current AQCC regulations on natural gas emissions in the Northern Front Range concluded that "continued development of natural gas resources in the region has offset the gains achieved and resulted in greater overall VOC emissions from the region."[10]

III. The AQCC Has Clear Legal Authority to Adopt the Rules as Proposed, Including the Authority to Regulate Hydrocarbons

The AQCC has a legal duty and clear authority to reduce the harmful emissions of smog-forming, toxic, and climate-altering hydrocarbons emitted from oil and gas activities throughout the state.

It is the policy of the state to achieve "the maximum practical degree of air purity in every portion of the state" and "to attain and maintain the national ambient air quality standards" in order "to foster the health, welfare, convenience, and comfort of the inhabitants of the state of Colorado and to facilitate the enjoyment and use of the scenic and natural resources of the state."[11] To this end, the Air Pollution Prevention and Control Act requires "the use of all available practical methods which are technologically feasible and economically reasonable so as to reduce, prevent, and control air pollution throughout the state of Colorado".[12]

The legislature entrusted the Air Quality Control Commission with the duty to

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[6] Thompson at 6.
[7] EDF-PHS- EXH-D. COGCC 2013 at 15, available at http://cogcc.state.co.us/Library/Statistics/CoWklyMnthlyOGStats.pdf.
[8] *Id.*
[9] EDF-PHS- EXH-E. DRAFT CDPHE Methodology for Developing Projected 2018 Oil & Gas Emissions for the Northern Front Range NAA & Remainder of the State (9/30/2013), table 2.
[10] EDF-TT- EXH-F. Swarthout, R.F., Russo, R.S., Zhou, Y., Hart, A.H., Sive, B.C., 2013. Volatile organic compound distributions during the nachtt campaign at the Boulder Atmospheric Observatory: Influence of urban and natural gas sources: volatile organic compounds during nachtt. Journal of Geophysical Research: Atmospheres 118, 10,614, 10,635; *see also* Thompson at 4.
[11] 25 C.R.S. § 25-7-102.
[12] *Id.*

promulgate emission control regulations to further the state's goal of ensuring clean air.[13] The Commission must promulgate emission control regulations for "each significant source or category of significant sources of air pollutants" and "each type of facility, process, or activity which produces or might produce significant emissions of air pollutants."[14] There is no question that the oil and gas industry is a significant source of air pollutants.

The Act provides clear and explicit authority for the Commission to regulate hydrocarbons. Section 109 of the Act lists those specific air pollutants for which the Commission has authority to regulate.[15] Hydrocarbons are one such air pollutant. Furthermore, the capacious definition of "air pollutant" encompasses methane: "any fume, smoke, particulate matter, vapor, or gas or any combination thereof which is emitted into or otherwise enters the atmosphere, including, but not limited to, any physical, chemical, biological, radioactive (including source material, special nuclear material, and by-product material) substance or matter." C.R.S. § 25-7-103(1.5). Additional support for the Commission's authority lies in the legislature's delegation of "maximum flexibility" to the Commission to develop "an effective air quality control program" to protect and enhance the state's air quality.[16]

IV. The Oil and Gas Industry Emits Significant Amounts of Methane, which is a Highly Potent Greenhouse Gas and Also a Source of Global Background Ozone Levels

The science of climate change continues to advance, and as more data is developed, the scientific consensus around climate change continues to grow. In 2013, the Intergovernmental Panel on Climate Change updated its findings on climate change science. That consensus document concludes that it is "virtually certain" (a 99% to 100% probability) that human influence has warmed the climate (emphasis in original):

> Human influence has been detected in the major assessed components of the climate system. Taken together, the combined evidence increases the level of confidence in the attribution of observed climate change, and reduces the uncertainties associated with assessment based on a single climate variable. From this combined evidence it is *virtually certain* that human influence has warmed the global climate system.[17]
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> Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere

[13] *Id.* at § 25-7-105(1).
[14] *Id.* at § 25-7-109(1)(a).
[15] *Id.* at § 25-7-109(2)(c).
[16] *Id.* at § 25-7-106.
[17] EDF-PHS- EXH-G. *Working Group I Contribution To The IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis* Final Draft Underlying Scientific-Technical Assessment at page 10-7, *available at* http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_Chapter10.pdf.

and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.[18]

As discussed below in section B, methane is a potent greenhouse gas that contributes directly and indirectly to climate change.[19]

A. Oil and Gas Activities Emit Significant Emissions of Methane

Emissions from oil and gas activities contribute to atmospheric levels of methane. The Division VOC estimate indicates that Colorado oil and gas activities produced approximately 325,000 tons of methane in 2011.[20] It is possible, however, that the actual emissions however may be larger. Studies based on ambient air samples taken from locations in the Northern Front Range indicate that actual emissions may be 50% to 300% larger than inventories suggest.[21] While the Division has made some adjustments to one element of the 2011 inventory (condensate tank emissions) to account for an undercounting of emissions from that source, the adjustments do not account for the gaps suggested by these field studies.

The proposed rule appropriately targets many of the largest sources of methane from the oil and gas sector, including equipment leaks (23% of the 2011 inventory), venting during well blow -down (24%), and continuous bleed pneumatic devices (21%).[22]

B. Rising Methane Emissions Contribute Directly and Substantially to Climate Change

Methane is a potent greenhouse gas that contributes directly to climate change, and its presence in the atmosphere is on the rise. These characteristics underscore the importance of smart policy action to secure immediate emission reductions from oil and gas activities.

Methane is relatively short-lived in the atmosphere (approximately 10 to 12 years) before breaking down into other chemicals (including CO_2).[23] However, it is a highly potent greenhouse gas. The IPCC indicates that over a 100-year period, methane has a warming potential at least 28 times that of carbon dioxide. However, when viewed over the short-term (20 years), methane is at least 84 times more effective at trapping heat than carbon dioxide.[24]

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[18] EDF-PHS- EXH-H. *WG1 Summary for Policy Makers, available at* http://www.climatechange2013.org/images/uploads/WGI_AR5_SPM_brochure.pdf
[19] *Id.* at 12.
[20] WZI at 3.
[21] Thompson at 2, 4-5.
[22] Based on percentage of source emissions from entire oil and gas industry. See WZI Table 3.1-1 at 4.
[23] EDF-PHS-EXH I. Stacy C. Jackson, "Parallel Pursuit of Near-Term and Long-Term Climate Mitigation", 326 SCIENCE 526 (Oct. 23, 2009).
[24] EDF-PHS-EXH G. *Working Group Contribution to the IPCC Fifth Assessment Report Climate Change 2013: the Physical Science Basis, Final Draft Underlying Scientific-Technical Assessment,* Chapter 8, Table 8.7, page 8-58, available at http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_Chapter08.pdf.

This means that reducing methane emissions can have important near-term benefits to the climate. Because of this, a number of prominent health and scientific experts have delineated a two-pronged climate approach that calls for reductions of methane as well as CO_2. According to such experts, "[A]ggressive policies directed towards carbon dioxide reduction, although necessary for the long term, are by themselves insufficient to reduce the rate of warming in the next few decades because of the long atmospheric lifetime of this gas. Thus, governments will need to reduce warming from short-lived greenhouse gas pollutants when considering climate change mitigation policies." [25]

C. Methane Emissions Contribute Indirectly to Climate Change by Contributing to Background Ground-Level Ozone Pollution; Thus, Reducing Methane Emissions Helps Reduce Background Levels of Ozone.

In addition to being a highly potent greenhouse gas, methane is a volatile organic compound. It is not highly reactive, though, and is not believed to contribute to episodic ground-level ozone formation at the local/regional level (and is not currently regulated by the U.S. EPA as a VOC). As a "nonreactive" VOC, however, it does contribute to formation of global background levels of ground-level ozone.[26] Indeed, one study on the relationship of methane emissions to ground-level ozone concludes that "tropospheric O3 [ozone] responds approximately linearly to changes in CH_4 [methane] emissions over a range of anthropogenic emissions...."[27]

Ground-level ozone, in turn, is itself also greenhouse gas.[28] Thus, by reducing methane emissions, we can achieve both an indirect benefit to the climate by reducing global background levels of ground-level ozone and, at the same time, a benefit to air quality from a health perspective. As documented by an extensive report from the U.S. Climate Change Science Program, "[D]ecreases in methane emissions lead to reduced levels of lower atmospheric ozone, thereby improving air quality."[29]

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[25] EDF-PHS-EXH-J at 64. Kirk R. Smith, Hiram Levy II *et al*., U.S. Climate Change Science Programs Synthesis and Assessment Product 3.2, Climate Projections Based on Emissions Scenarios for Long-Lived and Short Lived Radiatively Active Gases and Aerosols 64 (Sept. 2008); EDF-PHS-I.
[26] Thompson at 3.
[27] EDF-TT-EXH-Z (Fiore 2008)
[28] EDF-PHS-EXH G at 10-28; EDF-PHS-EXH-K (U.S. Global Change Research Program, Draft 2013 report, *available at* http://ncadac.globalchange.gov/download/NCAJan11-2013-publicreviewdraft-fulldraft.pdf); EDF-PHS-EXH-L at 14 (U.S. Global Change Research Program, *Climate Change Impacts of the United States, The Potential Consequences of Climate Variability and Change*, 91 (2009), http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf); Thompson at 5.
[29] EDF-PHS-EXH-J at 64.

D. Climate Change is Advancing Rapidly so Action is Urgently Needed

The impacts caused by unprecedented atmospheric levels of greenhouse gases are happening at an alarmingly rapid pace. A peer-reviewed report by the U.S. Global Change Research Program[30] demonstrates that impacts already are occurring today across the United States including in the Intermountain west. While it is difficult to tie individual events (e.g. a particular wildfire) to climate change, there is no question that climate change causes certain types of adverse impacts. These, and future projected impacts, include:

- Impacts to human health due to increased extreme precipitation events and flooding; deteriorating air quality including potential worsening ozone pollution; increased diseases and heat waves;
- Impacts to welfare including increased forest fires, loss of native forests due to insect infestation such as pine and spruce beetles, reduced snowpack, strains on water resources and biodiversity losses.

V. Oil and Gas Activities Emit Significant Amounts of VOCs.

Information presented by the Division during the stakeholder process demonstrates that oil and gas activities result in a significant portion of the anthropogenic VOCs emitted in Colorado. Venting from condensate storage tanks is the largest source of oil and gas VOCs, accounting for 64% of VOC emissions. Condensate emissions are particularly high in the D.J. Basin where they account for 75% of all VOCs emitted from oil and gas sources in the Basin. Equipment leaks are the second largest source of statewide VOCs, contributing more than 20,000 tons of VOCs in 2011, followed by pneumatic devices (contributing approximately 18,777 tons of VOCs).[31]

A. The Significant Amount of VOCs Emitted from Oil and Gas Emissions Are Contributing to Elevated Ozone Concentrations in Colorado

These emissions are taking a toll on air quality. Two recent peer reviewed papers found elevated levels of VOCs in the Front Range from natural gas operations at levels higher than those found in some of the most polluted North American urban areas. This past winter the Rangely monitor in Western Colorado recorded ozone levels in excess of the current standard.[32] Rural parts of Wyoming and Utah have experienced similar wintertime ozone problems, due in part to oil and gas activities in the Uintah and Green River Basins.[33]

Some of those opposing the changes proposed by the Division may argue that VOCs associated with oil and gas are not a primary driver to ozone formation because many are not as

[30] EDF-PHS-EXH-K; EDF-PHS-EXH-L.
[31] WZI at 25.
[32] EDF-PHS-EXH-C.
[33] *Id*; EDF-PHS-EXH-M. *EPA, Technical Support Document, Wyoming Area Designations for the 2008 Ozone National Ambient Air Quality Standards* (2012) (Wyoming).

reactive as larger more complex VOC species. While it may be true that some of the VOCs associated with oil and gas are less reactive than some other sources, the data clearly demonstrates that the abundance of VOCs from oil and gas activities contributes to ozone pollution.[34] A recent study found that, even weighting for reactivity, more than half of the ozone forming potential in the Front Range (in winter) is due to oil and gas emissions.[35]

Oil and gas activity in one area of Colorado has the potential to impact air quality locally, and regionally through transport of both ozone and its precursors.[36] Models have demonstrated that rapid expansion of oil and gas activities in Southwest Colorado and Northern New Mexico are negatively impacting air quality in many of the state's pristine wilderness areas and National Parks.[37] While emission controls have been put in place since the time these models were run, the significant increase in development activities warrants remaining vigilant in protecting these important natural and recreational resources.

Data from other oil and gas development areas supports these conclusions. In recommending EPA designate the Upper Green River Basin as nonattainment with the 2008 ozone standard, the Wyoming Department of Environmental Quality concluded that the elevated ozone levels in the Upper Green River Basin were primarily due to the area's intensive oil and gas development activities.[38] EPA agreed.[39] Similarly, modeling suggests that emissions from the Haynesville Shale could create a nonattainment problem in Northeast Texas.[40]

A. Ozone is Harmful to Human Health and Welfare

The Commission is well aware that elevated ozone concentrations contribute to adverse health effects, including decreased lung function, particularly in children active outdoors; increased hospital admissions and emergency room visits; inflammation and possible long-term damage to the lungs; and premature mortality.[41] Children are highly susceptible to these risks

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[34] *Id*.
[35] Thompson at 6.
[36] *Id.*
[37] EDF-TT-EXH-V at 1111. Rodriguez, M.A.; Barna, M.G.; & Moore, T., Regional Impacts of Oil and Gas Development on Ozone Formation in the Western United States, 59 *J. Air & Waste Mgmt. Ass.*, 1111, 1111 (2009); *see also* Thompson at 6.
[38] EDF-PHS-EXH-N. Letter to Ms. Carol Rushin, Acting Regional Administrator from Governor Dave Freudenthal (March 12, 2009), available at http://deq.state.wy.us/AQD/Ozone/Gov%20Ozone%20to%20EPA%20(Rushin)_Final_3-12-09.pdf (noting the need to reduce Natural Gas emissions in order to address the ozone problem.)
[39] EDF-PHS-EXH-M. *EPA, Technical Support Document, Wyoming Area Designations for the 2008 Ozone National Ambient Air Quality Standards* (2012) (Wyoming) ("The AQD's analysis provided with its recommendation shows that elevated ozone at the Boulder monitor is primarily due to local emissions from oil and gas development activities: drilling, production, storage, transport and treating of oil and natural gas.")
[40] EDF-TT-EXH-U; Thompson at 6.
[41] EDF-PHS-EXH-O. Michelle L. Bell, Roger D. Peng, & Francesca Dominici, *The Exposure-response Curve for Ozone and Risk of Mortality and the Adequacy of Current Ozone Regulations*, 114 ENVIRON. HEALTH PERSPECT., 532-536 (2006); EDF-PHS-EXH-P. Michelle L. Bell, Aidan McDermott, Scott L. Zeger, Jonathan M. Samet, & Francesca Dominici, *Ozone and Short-term Mortality in 95 U.S. Urban Communities, 1987-2000*, 292 JAMA, 292,

because they have a higher respiratory rate in comparison to their size and often spend significant time outside in the summers.[42] In fact, studies have shown children with asthma are especially vulnerable to ozone[43] as are people engaged in vigorous outdoor activity.[44] In 2008, EPA completed a review of the ozone NAAQS, and revised the standard to 0.075 parts per million ("ppm"),[45] though studies included in the record showed ozone levels as low as 0.060 ppm caused breathing impairment.[46] Higher temperatures associated with climate change are likely to exacerbate ozone air pollution and related health problems.[47]

Ozone pollution also threatens the ecological health of natural resources such as National Parks, forests and important agricultural commodities. According to EPA, impacts associated with ozone pollution include: reduced root and tree growth; increased rates of senescence [aging]; decreased plant vitality and a greater susceptibility to disease and infestation; and visible leaf damage.[48] These adverse impacts can decrease crop yields by 40% percent.[49] Loss of forests may also exacerbate climate change because trees act as natural carbon sinks, absorbing carbon dioxide emissions through the process of photosynthesis, thereby reducing the amount of greenhouse gases in the atmosphere.[50] National Parks and other class one areas suffer from ozone pollution that can harm the park's natural resources.[51] Increased ozone pollution from concentrated gas fields causes damage to sensitive plant species in and around the park, and can cause acute respiratory problems for employees and visitors.[52]

2372, 2378 (2004); EDF-PHS-EXH-Q. Jonathan I. Levy, Susan M. Chemerynski, & Jeremy A. Sarnat, *Ozone Exposure and Mortality: An Empiric Bayes Metaregression Analysis*, 16 EPIDEMIOLOGY, 458, 468 (2005).

[42] EDF-PHS-EXH-R. National Ambient Air Quality Standards for Ozone, 75 Fed. Reg. 2938, 2948 (proposed Jan. 19, 2010).

[43] EDF-PHS-EXH-S. Janneane F. Gent, Elizabeth W. Triche, Theodore R. Holford, Kathleen Belanger, Michael B. Bracken, William S. Beckett, & Brian P. Leaderer, *Association of Low-Level Ozone and Fine Particles with Respiratory Symptoms in Children with Asthma*, 290 JAMA, 1859, 1867 (2003); *see also* EDF-PHS-R 75 Fed. Reg. at 2938.

[44] EDF-PHS-EXH-T. 75 Fed. Reg. at 2947.

[45] EDF-PHS-EXH-U. 73 Fed. Reg. 16,436 (Mar. 27, 2008).

[46] *See id.* at 16,454 (discussing Adams Chamber studies).

[47] EDF-PHS-EXH-J.

[48] *Id*.

[49] Thompson at 7; EDF-PHS-EXH-V. Fitzgerald L. Booker, Joseph E. Miller, & Edwin L. Fiscus, *The Ozone Component of Global Change: Potential Effects on Agricultural and Horticultural Plant Yield, Product Quality and Interactions with Invasive Species*, 51 J. *Integrative Plant Biology*, 337, 342-43 (2009).

[50] EDF-PHS-EXH-V; *See also* EDF-PHS-EXH-W Zack Parsons and Steven Arnold, Colorado Department of Health and Environment, *Ozone Transport in the West: An Exploratory Study* (July 2004), *available at* http://www.cdphe.state.co.us/ap/down/ozonetransport.pdf at 9.

[51] National Park Service, *Air Quality in National Parks, 2008 Annual Performance and Progress Report, 1* (Sept. 2009); EDF-PHS-EXH-X.

[52] *Id*.

C. Other Impacts of VOC Emissions

VOCs emitted from oil and gas sources can have other impacts as well, including a contribution to fine particulate matter and HAPs.

Measurements and research indicate that these emissions contribute to the formation of fine particulate matter. Fine particulate matter has been statistically linked to increased incidents of respiratory disease and death. It also contributes to regional haze that impairs visibility in scenic national parks and wilderness areas.[53]

Oil and gas exploration activities also emit a number of hazardous air pollutants including benzene, toluene, ethylbenzene, and xylenes as well as n-hexane.[54] Long-term exposure to benzene can cause cancer as well as blood disorders, and reproductive and developmental disorders. Exposure to benzene, as well as toluene, ethylbenzene, and xylenes also causes a host of non-cancer effects such as respiratory tract irritation, irritation to the skin, eyes, nose and throat, neurological problems, dizziness and headaches.[55]

Control of oil and gas emissions are anticipated to reduce exposure to particulate emissions and HAPs as a co-benefit.

VI. The Rule Amendments Proposed by the Division Apply Common Sense and Effective Approaches to Reduce Harmful Emissions from Oil and Gas Production Operations

The Division has proposed a suite of practical and technologically feasible measures to reduce the significant air pollutants emitted from oil and gas activities across the state. Many of the proposed requirements are already in place elsewhere or have been implemented by leading companies in Colorado and across the U.S. The rules are carefully tailored to facilitate compliance by all affected sources in the state, including where appropriate, the tiering of requirements based on volume of emissions as well as extended phase-in periods for smaller sources. A recent study using direct measurements campaign shows that the industry is capable of significantly reducing controlling emissions.[56] In fact, a number of the leading oil and gas producers in the state have endorsed and are supporting these rule changes, including Noble, Anadarko and Encana Oil & Gas (USA) Inc.

When fully implemented, the proposed controls will remove on the order of 90,000 tons of VOCs and more than one hundred and twelve thousand tons of methane per year.[57]

EDF supports and endorses the rule as proposed by the Division, and encourages its adoption at the February hearing. The balance of this prehearing statement outlines some of the

[53] Thompson at 8.
[54] EDF-TT-EXH-PP; Thompson at 8.
[55] *Id*.
[56] Thompson at 5.
[57] WZI at 26.

key elements of the proposed rule amendment, how those elements will reduce emissions in a manner that is effective and practical.

A. LDAR is a Practical and Effective Practice for Reducing Fugitive Emissions, which is both Necessary and Cost Effective

Leaks from oil and gas equipment (also known as fugitive emissions) are a key source of emissions from oil and gas production sites, equipment and compressor stations. These emissions arise from leaking components, such as flanges, valves, pumps, seals, rod-packing, open-ended lines and connectors. The emission inventory developed by the Division indicates that equipment leaks are the second largest source of statewide methane emissions and VOCs.[58] As such, effective controls are needed to reduce these emissions.

A common sense and effective way to reduce fugitive emissions is an instrument- based leak detection and repair program ("LDAR"). Wyoming, California and Pennsylvania require operators to implement LDAR at oil and gas production sites.[59] Pennsylvania also requires operators to implement LDAR at compression facilities.[60] Many leading companies, including those operating in Colorado, implement voluntary LDAR as a way to improve workplace safety, minimize natural gas losses and increase revenue. These programs are highly effective and cost effective, particularly given recent advances in technology, such as infrared cameras that permit inspection to be completed more quickly than prior methods.[61]

The Division has proposed an LDAR program that is carefully tailored to maximize the benefits of frequent inspections and minimize the burden on smaller sites. The sites with the largest emissions are subject to more frequent instrument-based inspections (monthly) and smaller sites are subject to less frequent inspections (either annual inspections or even a one-time inspection). In addition, the regulation provides for an extended phase-in period for existing facilities, so that smaller sites have many years to implement the LDAR program, while larger sites would implement the program sooner.

The analysis by the Division demonstrates that the program will be highly effective. LDAR at well sites and compressor stations will remove 15,180 tons of VOCs from the

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[58] WZI at 4.

[59] Wyoming Oil and Gas Production Facilities Chapter 6, Section 2 Permitting Guidance (Sept. 2013), http://deq.state.wy.us/aqd/Oil%20and%20Gas/September%202013%20FINAL_Oil%20and%20Gas%20Revision_UGRB.pdf; San Joaquin Valley Air Pollution Control District Rule 4409 §6.3 (2005), http://www.valleyair.org/rules/currntrules/r4409.pdf; South Coast Air Quality Management District Rule 1173(j) (1989), https://www.aqmd.gov/rules/download.html; Santa Barbara County Air Pollution Control District Rule 331(H) (1991), http://www.sbcapcd.org/rules/download/rule331.pdf; Ventura County Air Pollution Control District Rule 74.10(I) (1989), http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.10.pdf; Pennsylvania General Permit 5 (Feb. 2, 2013), http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-9747; Pennsylvania Category No. 38 of the Air Quality Permit Exemption List (Document No. 275-2101-003), http://www.dep.state.pa.us/dep/deputate/airwaste/aq/permits/gp/CURRENT_INTERNAL_IMPLEMENTATION_INSTRUCTIONS_FOR_EXEMPTION_CATEGORY_NO_38-August_15_2013.pdf.

[60] Pennsylvania General Permit 5 (Feb. 2, 2013).

[61] WZI at 22.

atmosphere annually.[62] Using EPA conversion factors, these controls should reduce methane emissions by more than 50,000 tons a year.[63] An additional 5,170 tons of VOCs (and more than 18,000 tons of methane using EPA conversion factors) will be removed from smaller sites that are subject only to a one time instrument-based inspection.[64] If one were to consider the reductions in both methane and VOCs, the LDAR program will reduce pollutants for $178.99 a ton.[65]

The effectiveness of this program (e.g. 40% reduction for annual LDAR, 60% reduction for quarterly LDAR and 80% reduction for monthly LDAR), as estimated by the Division, are based on standard methods developed by EPA and are technically reasonable and appropriate.[66]

The LDAR program will be highly cost effective. The Division developed its cost and effectiveness analysis using a reasonable approach, which provides an appropriate estimate of the anticipated costs to operators.[67]

B. Best Management Practices are Available to Reduce Venting During Well Maintenance in a Cost Effective Manner

Well maintenance activities designed to remove liquids building up in aging wells ("liquids unloading") are a large source of methane and VOCs. They comprise more than 11,000 tons of VOC from the 2011 inventory, which translates into more than 78,900 tons of methane.[68]

There are a number of cost-effective technologies and practices that are available to minimize the need for, and control venting, from liquids unloading.[69] These include plunger lifts, sucker rod pumps, electric submersible pumps, progressing cavity pumps, compression, gas lift, smaller diameter tubing (also known as velocity strings) and "smart" well automation.[70] Smart well automation systems monitor parameters such as tubing and casing pressure, well flow rate and plunger cycle frequency which helps reduce periodic venting that occurs when plunger lifts remove liquids.

Under the rule proposed by the Division, operators have flexibility to utilize the practice that is most appropriate for each site, since the rule would merely require the operator to utilize

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[62] Initial Economic Impact Analysis, Tables 24 and 26; WZI at 26.
[63] *Id*. at 25.
[64] CDPHE Initial Economic Impact Analysis page 19.
[65] This value is derived as follows: $818 per ton of VOC scaled by the ratio of VOC tons to VOC plus Methane tons: $818/(4.57 1 ton of VOC +3.57 tons of Methane (using VOC to Methane conversion of 0.28 per EPA TSD). See WZI at 22-23.
[66] WZI at 23.
[67] *Id*. at 22.
[68] WZI at 25.
[69] EDF-PHS-EXH-Y *See* EPA, Lessons Learned from Natural Gas STAR Partners: Installing Plunger Lift Systems in Gas Wells ("Plunger Lift Lessons Learned")(2006) at 1 (reporting a range of 1.82 to 55.38 tons of VOC per well); *See also* e.g. Susan Harvey *et al.*, *Leaking Profits* (2012) at 23, *available at* http://www.nrdc.org/energy/files/Leaking-Profits-Report.pdf. EDF-PHS-EXH-Z.
[70] *Id.*

best management practices to reduce the need for, and capture or control emissions from, venting during well maintenance. The rules also require the common sense requirement that operators be onsite during blow down events so that the duration of the blowdown can be minimized. Compliance with this requirement is cost effective and will reduce the estimated blowdown emissions by 25% or more.[71]

C. Cost Effective Practices are Available and Necessary to Reduce Venting from Access Points at Storage Tanks

Venting from access points such as thief hatches and pressure relief valves is the largest source of VOCs from oil and gas activities in the state. Some of this venting is caused by operator error (e.g. leaving hatches open after liquids are loaded out of a tank) while other is due to improper or inadequate design. Tank systems must be designed to handle fluctuations in pressure that occur when hydrocarbon liquids are dumped into atmospheric tanks from separators. Inadequate design can lead to over-pressurization of tanks which causes access points to open, therefore allowing air pollutants to escape uncontrolled into the atmosphere rather than being routed to control devices.[72]

The Division's proposal employs a three-pronged approach to reduce venting in a cost effective manner. First, the rule clarifies that operators must route all emissions to a control device unless venting is reasonably necessary for maintenance, tank gauging or safety. This practical, good practice is important to ensure that the vapors leaving the tank are managed properly.[73]

Second, operators must certify that their tank systems are designed to meet this requirement each year. The rule provides flexibility to operators by allowing operators to implement an individual or systematic protocol that meets the no-venting requirement of the rule. Periodic plan updates will provide the operators with a ready means of identifying certain needed changes in monitoring, equipment design and operating practices. The program will also provide a readily available on-site tool for personnel and for inspectors.

Third, operators must routinely check for open access points and nonfunctioning control devices during required instrument-based inspections. These practices are good management for any oil and gas operation and will address known problems that cause tanks to be a large source of emissions.[74]

Reducing impermissible venting from tanks is highly cost effective at $396 per ton of VOC reduced for existing tanks and $443 to $4,658 per ton of VOC reduced for new tanks, as estimated by the Division. The Division estimates in its Initial Economic Impact Analysis that these measures will remove 52,624 tons of VOCs from the atmosphere annually. These VOC

[71] WZI at 20.
[72] WZI at 9.
[73] *Id.* at 12.
[74] *Id.*

emissions translate into a reduction of more than 11,000 tons of methane per year (52,624/4.56), based on standard EPA conversion factors.[75] The analysis of the Division provides an appropriate estimate of the cost and estimated reduction in VOC emissions.[76]

D. Lowering the Storage Tank Control Threshold to Six Tons per Year is Cost Effective and Necessary to Reduce Emissions

The Division has proposed to require all storage tanks with actual uncontrolled emissions of six tons per year to control hydrocarbon emissions by 95%, and if a combustion device is used, it shall be designed with a 98% destruction efficiency if using a combustion device. Currently, only condensate tanks with at least 20 tons per year of VOCs must control emissions by 95%, while certain condensate tanks in the nonattainment area are also subject to seasonal ozone control requirements. Lowering the 20 ton per year threshold to 6 provides uniformity and certainty among new tanks subject to the NSPS and existing tanks. The proposed rule also extends controls to crude oil and produced water tanks, which is an important gap-filling measure in existing state rules. This change is particularly important given the significant increase in oil production. There are well-established approaches for controlling these emissions, and the analysis of the Division demonstrates that these measures are highly cost effective.[77] These measures will reduce VOC emissions by 5162 tons per year, as estimated by the Division.

E. Converting Pneumatic Devices from High Bleed to Low and No Bleed Will Greatly Reduce Emissions, Which is Necessary and is Cost Effective

Oil and gas operations utilize continuous bleed pneumatic devices, which by design bleed or leak natural gas. The emissions can be controlled by conversion to non-gas control systems or low-bleed control technology.

Existing state rules require operators within the Denver metropolitan ozone nonattainment area to retrofit high bleed devices with low bleed devices. However, there remain approximately 10,000 high-bleed devices in the rest of the state.[78]

Replacing high bleed devices is highly cost effective and has a very short payback period.[79] Retrofitting high-bleed devices with lower emitting equipment is a practical and cost effective way to reduce methane and VOC emissions in the state, and should be adopted. No-bleed and low-bleed devices are existing, well established technologies.[80]

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[75] Id. at 25.
[76] WZI at 13.
[77] WZI at
[78] WZI at 13.
[79] *Id*. at 15.
[80] *Id*.

F. Controlling Emissions from Glycol Dehydrators Will Reduce Emissions and is Cost Effective

Process emissions from glycol dehydrators emit methane and VOCs, including benzene., a known carcinogen.[81] Current AQCC rules require 90% control of VOCs from single or co-located glycol dehydrators with at least 15 tons per year of VOCs.

The Division's proposal lowers the applicability threshold to six tons per year of VOCs (existing dehydrators) and two tons per year of VOCs (new dehydrators and existing dehydrators located near designated public places) and increases the control efficiency to 95% (or 98% if a combustor is used). This cost effective, practical proposal will remove at least 1,472 tons of VOCs and 81 tons of methane from the atmosphere from the existing dehydrator population.[82]

G. Other Controls in Proposed Rule Are Necessary and Cost Effective

The proposed rule contains other provisions that are also practical and appropriate requirements to reduce oil and gas emissions. These include the requirements to capture and route to gas a control device if the gas cannot be routed to a sales line or otherwise used, to capture gas from a new tank during the first 90 days of operation outside of the non-attainment area (as this rule already applies in the non-attainment area), to install auto igniters on flares, among other things. These measures are sensible and cost effective approaches that are necessary to further control emissions from the oil and gas sector in Colorado.[83]

VII. Conclusion

The rule amendments proposed by the Division constitute a sound approach to addressing the critical air quality challenges posed by dramatically increasing oil and gas development and production in Colorado. The requirements of the amendments are readily implementable, cost effective and will greatly reduce current and future emissions in the state, helping to address ozone pollution, climate change and other air quality issues. EDF applauds the Division, industry leaders who support the proposed rule, and Governor for their leadership on these issues, and we strongly urge the Commission to adopt the rule amendments at the February hearing.

[81] *Id*. at 17.
[82] *Id*. at 25.
[83] *Id*. at 19, 20.

Respectfully submitted this 6th day of January, 2014.

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