EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

Wyoming Outdoor Council

April 13, 2015

Mr. Steven A. Dietrich
Administrator, DEQ/AQD
Herschler Building 2-E
122 W. 25th Street
Cheyenne, Wyoming, 82002
307-777-5616 (fax)

VIA Regular Mail and Facsimile

Re: Comments on February, 2015 Proposed Revisions to Department of Environmental Quality, Air Quality Division, Chapter Eight, Section Six Requirements for Existing Oil and Gas Production Facilities or Sources in the Upper Green River Basin.

Dear Mr. Dietrich:

Thank you for accepting these comments submitted by Environmental Defense Fund ("EDF"), the Wyoming Outdoor Council ("WOC"), and Citizens United for Responsible Energy Development ("CURED"). EDF is a national membership organization with over one million members residing throughout the United States who are deeply concerned about the pollution emitted from oil and natural gas sources. WOC is the State's oldest independent conservation organization and has worked for more than four decades to protect Wyoming's environment and quality of life for future generations. CURED is a Pinedale based advocacy group and member of the Upper Green River Basin Air Quality Citizens Advisory Task Force ("Ozone Task Force").

I. Introduction

EDF, WOC and CURED support the proposed ozone nonattainment area existing source rules and urge the Environmental Quality Council ("EQC") to approve them at the May 19 hearing in Pinedale. The rules represent commonsense, cost effective, and technologically practicable measures necessary to restore healthy air to the Upper Green River Basin ("UGRB" or "Basin") and its citizens.

As this proposal has made its way through the rulemaking process it has garnered the support of multiple stakeholders with an interest in restoring clean air to the UGRB. These voices include: local business owners and residents; including a former State legislator; local, State and national environmental groups; State and national public health groups, including the American Lung Association; and one of the largest natural gas producers in the Basin, Jonah Energy. The Petroleum Association of Wyoming ("PAW"), as well as individual companies with operations in the Basin, have also expressed general support for the need to reduce emissions from existing sources. Throughout the nearly yearlong stakeholder process the Air Division has endeavored to address many of the concerns raised with respect to specific aspects of the rules. In particular, the current proposal extends the compliance dates by a year over the initial proposal in direct response to industry concerns, while also extending regular leak detection inspections to compressor stations at the request of conservation and public health advocates. In this way, the proposal represents a balanced compromise and a reasonable set of rules.

The rules also satisfy the legal requirements of the Wyoming Environmental Quality Act ("EQA") in that they are necessary, reasonable and technically practicable.

Rigorous rules are necessary to reduce smog-forming emissions produced by the numerous oil and gas sources in the Basin. Oil and gas sources are the largest source of volatile organic compounds ("VOCs") and oxides of nitrogen ("NOx") in the UGRB, the primary precursors to ozone.[1] In 2011 14% of the VOC and approximately 28% percent of methane ("CH4") emitted from oil and gas activities in the State came from sources in the UGRB.[2] According to the most recent emissions data collected by the State, pneumatic devices and equipment leaks ("fugitives") were the largest sources of VOCs in 2011 and 2012.[3] Tanks and glycol dehydrators are the next largest sources. Dehydration units are also the largest source of air toxics in the UGRB ozone nonattainment area ("NAA"), responsible for 58% and 67%, in 2011 and 2012 respectively, of the hazardous air pollutants emitted from oil and gas sources.[4] Promulgating a rule to control emissions from existing sources was a key recommendation of the State's multi-stakeholder Ozone Task Force, and is an important element of the Air Division's Ozone Strategy for the UGRB.

Importantly, numerous studies suggest that actual emissions are likely higher. Three studies involving direct measurement of emissions at well sites and compressor stations found emissions from numerous sources subject to this proposal to be significantly higher than emission inventories suggest. Specifically, a University of Texas study found that nationally, fugitive emissions, pneumatic controller emissions, and chemical injection

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[1] Wyoming DEQ Inventory for the Upper Green River Basin (2011), (2012).
[2] We cite here to the 2011 inventory because this is the most recent statewide inventory available, and the AQD relied on this inventory when developing its proposal. *See* Memorandum to Air Quality Advisory Board from J. Cederle, et al., (July 13, 2014) ("Statement of Basis"). We calculated methane emissions by converting the VOC emissions reported to the DEQ to methane using standard EPA VOC to CH4 conversion factors.
[3] *See* WY DEQ 2011 and 2012 UGRB inventory.
[4] *Id.*

pump emissions were each 38%, 63% and 100% higher than reported in EPA's inventory.[5] A follow-up study focused specifically on emissions from pneumatic controllers similarly found that emissions from pneumatic controllers were 17% higher than the 2012 national estimate based on emissions inventories.[6] Importantly, both studies found that a small number of sources were responsible for the majority of emissions.[7] This finding was reiterated in a series of direct measurement studies focusing on emissions from compressor stations.[8] The findings of these studies strongly suggest the need for frequent site and equipment inspections in order to identify malfunctioning equipment and equipment leaks.

The rules are also reasonable and technically feasible as they extend control measures currently required for new and modified sources, and required in many other jurisdictions, to existing sources. The Department of Environmental Quality ("DEQ") has been a leader in implementing cost effective, rigorous controls to reduce VOC emissions from oil and gas activities in the Basin for over a decade. The current proposal is a logical outgrowth of the DEQ's demonstrated leadership in controlling emissions from new and modified sources. In this way, the Division will ensure "an even playing field" among operators while also cutting harmful emissions.

The proposed regulations are also highly cost effective. We have estimated the cost effectiveness of allowable compliance mechanisms[9] with the proposed requirements, expressed as $ per metric ton of VOC reduced, as follows:[10]

- 98% control of flash emissions from tanks and glycol dehydrators with 4 tons of emissions using a flare equipped with an auto-igniter ($1,688 assuming no credit for gas savings)
- 98% control of pneumatic pump emissions by replacing chemical injection pump with electric pump ($921 assuming no credit for gas savings. **Savings** of $42 assuming credit for recovered gas)
- 98% control of pneumatic pump emissions by replacing kimray pump with electric pump ($1,197 assuming no credit for gas savings. **Savings** of $980 assuming credit for recovered gas)
- Replacement of high-bleed continuous pneumatic device with low-bleed device ($377 assuming no credit for gas savings. **Savings** of $554 assuming credit for recovered gas)

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[5] Allen, D.T., et al, (2013) "Measurements of methane emissions at natural gas production sites in the United States," *Proc. Natl. Acad. Sci.* 2013, 110 (44), 17768-17773; DOI: 10.1073/pnas.1304880110.

[6] Allen, D.T., et al, (2014), "Methane Emissions from Process Equipment at Natural Gas Production Sites in the United States: Pneumatic Controllers," *Environ. Sci. Technol.*, 2015, 49 (1), pp 633-640.

[7] *Id.*

[8] Mitchell, A.L., et al (2015) "Measurements of Methane Emissions from Natural Gas Gathering Facilities and Processing Plants," *Environ. Sci. Technol*, http://pubs.acs.org/doi/abs/10.1021/es5052809.

[9] The rules afford operators flexibility in determining how to comply with the applicable requirements. We have not analyzed the cost effectiveness of all available compliance mechanisms. Rather, we analyzed the cost effectiveness of one available compliance mechanism for each requirement (e.g., the use of a flare to meet the 98% control requirement for flash emissions rather than the use of a vapor recovery unit).

[10] Exh. 1. EDF cost effectiveness calculations and methodology.

- Replacement of high-bleed intermittent device with low-bleed device ($1,071 assuming no credit for gas savings. $110 assuming credit for gas savings.)
- Quarterly inspections at well sites with 4 tons of VOCs ($1,442 assuming no credit for gas savings. $480 assuming credit for recovered gas)
- Quarterly inspections at gathering sector compressor stations with 4 tons of VOCs ($1,134 assuming no credit for gas savings. $173 assuming credit for recovered gas).
- Quarterly inspections at transmission sector compressor stations with 4 tons of VOCs ($3,761 assuming no credit for gas savings. **Savings** of $4,680 assuming credit for recovered gas).

As illustrated, many of the requirements will result in significant natural gas savings which further increases the cost effectiveness of the proposal. These savings equate to additional gas sales for operators, which in some instances are greater than the capital and operating compliance costs and also equate to greater revenues to the State and Federal governments from royalties. Notably, DEQ has found significantly higher compliance costs to be reasonable than those we estimate here. Specifically, in updating the permit guidance requirements for new and modified sources in the Basin in 2013, the DEQ determined average costs per ton of VOC reduced of $22,938 to control flash emissions and $21,706 to control glycol dehydrators to be economically reasonable.[11] This further underscores the reasonableness of this proposal.

For the above-stated reasons, we urge the EQC to adopt the rule package as formulated

II. There is a Need to Improve Air Quality In the Upper Green River Basin

As the Council is aware, air quality in the UGRB currently fails to meet Federal health-based standards for ozone.

A. Ozone Health and Welfare Effects

Ozone is a harmful pollutant that above certain concentrations is associated with serious health effects, including aggravated asthma, chronic bronchitis, and heart attacks, and in some cases premature death. Children, older adults, people who work or exercise outdoors, and those with pre-existing heart or lung conditions are particularly susceptible to the harmful effects of breathing ozone. Many of the citizens who commented on this proposal before the Air Quality Advisory Board ("AQAB") are active outdoorsmen and women who are concerned with the risk that breathing unhealthy levels of ozone poses.

Elevated levels of ozone in the UGRB are contributing to adverse health impacts. A study conducted in Sublette County by the Wyoming Department of Health compared ozone levels with clinic visits for adverse respiratory-related effects. The study found that

[11] Department of Environmental Quality, Division of Air Quality, Proposed Revisions to the Chapter 6, Section 2 Oil and Gas Production Facilities Permitting Guidance, Technical Support Document, 4, 6 (Sept. 2013).

for every 10 part per billion ("ppb") increase in ozone there was a 3 percent increase in local health clinic visits due to respiratory-related complaints the day following elevations of ozone.[12]

Ozone pollution also threatens the ecological health of natural resources such as National Parks, forests and important agricultural commodities. 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.[13] These adverse impacts can decrease crop yields.[14]

B. Methane and Hazardous Air Pollutant Health and Welfare Effects

In addition to contributing to elevated levels of ozone, venting, flaring and equipment leaks from oil and gas activities contribute significant methane emissions to the atmosphere. Methane is a potent greenhouse gas (GHG). On a 20-year timeframe, it is 84 times more effective at trapping heat than carbon dioxide.[15]

Besides contributing to climate change, methane emissions also play a role in ozone formation. Methane emissions convert over time to ozone, thereby causing an increase in background ozone levels.[16] In addition, climate change may adversely affect future ozone concentrations by contributing to warmer temperatures that are favorable to ozone formation.[17] Accordingly, studies have recognized that reducing U.S. methane emissions will have positive benefits relative to lowering ozone levels.[18] An important "co-benefit" of this existing source rule will be reductions in methane emissions due to the VOC emissions reductions that are required as many of the same technologies that reduce VOC emissions also reduce methane.

Lastly, methane emissions represent lost product, as well as pollution. Methane is the primary component in natural gas. Requirements that ensure that natural gas is captured, collected, and routed back to a process or a pipeline therefore can help operator's

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[12] Pride, K., Peel, J., Robinson, B., Busacker, A., Grandpre, J., Yip, F., Murphy, T. Associations of Short-Term Exposure to Ground-Level Ozone and Respiratory Outpatient Clinic Visits in a Rural Location — Sublette County, Wyoming, 2008–2011. *Environmental Research* 137(2015)1–7; see also N.M. Dep't of Health, Myers et. al., The Association between Ambient Air Quality Ozone Levels and Medical Visits for Asthma in San Juan County, 10 (2007), *available at* http://www.nmenv.state.nm.us/aqb/4C/Documents/SanJuanAsthmaDocBW.pdf (finding increased ozone concentrations increased odds of at least one asthma-related medical visit by 42% in the rural, high-desert area of San Juan County, New Mexico).

[13] 79 Fed. Reg. 75,319, 75,234 (Dec. 17, 2014).

[14] *Id.*

[15] *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.

[16] EPA, Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards, 2-12,2-27.

[17] 79 Fed. Reg. 75,234, 75,382 (Dec. 17, 2014).

[18] *Id.* at 75,241 (Dec. 17, 2014); Policy Assessment at 2-27, 2A-42.

bottom line while also protecting public health and the environment. These captured resources will also benefit State and Federal tax coffers.

Oil and gas activities also contribute hazardous air emissions, including benzene. Benzene is a known human carcinogenic. In 2012, oil and gas activities in the UGRB contributed 2,187 tons of HAPs, primarily from glycol dehydrators, including 369 tons of benzene. Certain controls that reduce VOC and methane emissions from oil and gas operations are anticipated to reduce exposure to these hazardous and toxic air pollutants as a co-benefit of this existing source rule.

III. Oil and Gas Emissions Are the Primary Cause of the UGRB's Unhealthy Air.

It is well understood that emissions from oil and gas activities in the Basin are the primary cause for the area's nonattainment designation.[19] Oil and gas development is the largest source of VOC and NO_x in the Basin, the primary precursor pollutants to ozone. Oil and gas activities are also a significant source of methane. In 2011 14% of the VOCs and approximately 28% percent of methane emitted from oil and gas activities in the state came from sources in the UGRB.[20] The leading causes of VOC emissions in the Basin were equipment leaks ("fugitives" in the inventory), pneumatic controllers and pumps, glycol dehydrators and tanks. The current proposal will result in emissions reductions from all of these sources.

Additionally, 2,187 tons of HAPs were emitted in the Basin, primarily from glycol dehydrators. The proposal to require 98% control of emissions from glycol dehydrators will help to reduce these toxic emissions.

Finally, 103,426 tons of methane were also lost to the atmosphere from production venting, flaring and equipment leaks in the Green River Basin in 2013. This is equivalent to approximately $21 million of lost natural gas. The controls and measures required by the proposal before you will also significantly reduce methane emissions and losses, as many of the same practices and equipment that reduce VOCs also reduce methane emissions.

IV. The EQC Has Clear Authority, and a Responsibility, to Adopt the Proposal, and Should Adopt it as Proposed.

It is a policy of the State to "to enable the state to prevent, reduce and eliminate pollution; to preserve, and enhance the air...to plan the...preservation and enhancement of the air...[and] to retain for the state the control over its air..."[21]

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[19] Letter to Ms. Carol Rushin, Acting Regional Administrator from Governor Dave Freudenthal (March 12, 2009).

[20] DEQ 2011 inventory. VOCs converted to methane using standard EPA VOC to CH4 conversion factors.

[21] Wyo. Stat. Annon. § 35-11-109(a)(i), (iii); 35-11-110(a).

The Wyoming legislature has entrusted the EQC with a duty to "promulgate rules and regulations necessary for the administration of the Act [Wyoming Environmental Quality Act--EQA], after recommendation from the director of the department, the administrators of the various divisions and their respective advisory boards."[22]

The Director of the DEQ, Administrator of the Air Division, and the Air Quality Advisory Board all recommend that the EQC adopt the rules that are before you as proposed. We agree. The rules are "necessary to prevent, abate, or control pollution"[23] as oil and gas activities are the largest source of VOCs in the Basin. In addition, the DEQ and Air Division have met their obligations "to consider all the facts and circumstances bearing upon the reasonableness of the emissions involved" including the "technical practicability and economic reasonableness of reducing or eliminating the pollution."[24] As noted above, and discussed in more detail below, the rules represent a reasonable approach to curtailing pollution from the primary sources of ozone precursors in the Basin, and are highly cost effective. Therefore, these rules should be adopted as proposed.

A. The Proposed Rules Are Necessary to Restore Healthy Air to the UGRB and its Citizens and are Based on Reasonable, Cost Effective Solutions

The current rule package represents a necessary, reasonable and balanced set of requirements for industry. Adoption of these rules by the EQC will ensure that Wyoming remains a leader when it comes to commonsense yet rigorous air pollution requirements for the oil and gas industry.

At present, there are no rules to address emissions from existing oil and gas sources, despite the fact that oil and gas activities are the primary contributor to the current nonattainment designation. Notably, the first two recommendations of the Ozone Task Force were to regulate existing sources. The current proposal fulfills these recommendations. If adopted in its current form, the proposal will remove harmful pollutants from the atmosphere that will help ensure the restoration of healthy air.

In addition, adoption of the proposal will ensure that Wyoming retains its longstanding status as a national leader on sensible air quality controls for the oil and gas industry. As the Council is aware, the Environmental Protection Agency ("EPA") and the Bureau of Land Management ("BLM") are considering proposing requirements that would limit emissions of VOCs and methane from oil and gas activities. A proposal from each agency is expected sometime this spring or summer. In the past, EPA has modeled its

[22] *Id.* at § 35-11-113(a)(i).
[23] *Id.* at § 35-11-202(a).
[24] *Id.* at § 202(b). The other specifically enumerated factors are: the social and economic value of the source of pollution; the priority of location in the area involved; and the social welfare and aesthetic value.

national regulations, in part, on existing requirements in Wyoming. Under the Clean Air Act ("CAA"), States such as Wyoming may continue to enforce their own rules, provided they are more stringent than Federal equivalents. It is likely that a BLM venting and flaring rule would also allow Federal land managers to enforce a State's air requirement, provided it is as stringent as the Federal rule.[25] Accordingly, promulgation of this rule now will help ensure the State retains control of air quality requirements in the UGRB, per the policy of the EQA.[26]

The proposal has the support of members of the oil and gas industry, as well as citizen and environmental groups. This is a testament to its inherent reasonableness, as well as to efforts of the Air Division during the nearly year-long stakeholder process. At the December AQAB hearing in Pinedale, one of the largest producers in the UGRB, Jonah Energy, expressed its unequivocal support for the rule.[27] According to the Air Division, of the eighteen comments submitted to the AQAB last December, all but four were supportive of the proposal as proposed.[28] Notably, since then the Division has addressed additional industry concerns in the text of the proposal. One of the key requests of various industry companies, including the PAW, was the extension of the compliance deadline. The DEQ has extended the compliance deadline by one year, in direct response to this concern, and also made a number of other clarifying revisions to the proposal in response to industry concerns. In addition, it extended the leak detection and repair ("LDAR") requirement to compressor stations, per the request of environmental and local community groups and citizens, including WOC, EDF and CURED.

At present, the proposal represents a reasonable set of requirements that all members of industry can comply with. Owners and operators of new and modified oil and gas well sites and compressor stations already comply with very similar pollution control measures. The rules are, therefore, technically practicable and reasonable.

The proposed rule is also highly cost effective. Indeed, the value of the recovered or saved gas exceeds the capital and operating costs for operators retrofitting high-bleed continuous pneumatic controllers, replacing natural gas fired pumps with electrical ones, and conducting quarterly instrument-based inspections at compressor stations in the transmission segment.[29] And, as illustrated above, controlling emissions from all sources subject to the requirement is also highly cost effective, even when the gas savings do not exceed the compliance costs.

For all of these reasons we urge the EQC to adopt the proposal presented before you at the May 19, 2015 hearing.

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[25] See e.g., BLM Final Rule "Hydraulic Fracturing on Federal and Indian Lands," 80 Fed. Reg. 16128 (March 26, 2015) providing a mechanism whereby states and tribes may enforce their own requirements provided the BLM determines the state or tribal provision is at least as stringent as the equivalent federal requirement.

[26] *See* Wyo. Stat. Annon at § 35-11-202(a).

[27] Jonah Energy Comments to WY DEQ (Dec. 10, 2014).

[28] WY DEQ Comment Response Concurring the Proposed Wyoming Air Quality Standards and Regulations, Chapter 8, Section 6, Nonattainment Area Regulations, 4 (Feb. 27, 2015).

[29] See Exh. 1.

V. Further Action is Required to Protect Public Health

While we urge the EQC to adopt the UGRB rule package as presented, there is more work to be done to protect the public health in the UGRB, and elsewhere in the State. Air quality in other parts of the State that are home to significant oil and gas development is also teetering on the edge of nonattainment with a stronger ozone standard that is under consideration by the EPA.

The EPA has proposed to implement a revised eight-hour National Ambient Air Quality Standard ("NAAQS") for ozone in the range of 65 to 70 parts per billion (ppb). The current standard is 75 ppb. It is considering comments on a 60 ppb standard as well, and EDF and WOC both submitted comments in support of such a standard. Depending on the specific standard promulgated, anywhere between 6 and 2 additional counties in Wyoming will fail to meet this standard.[30]

To ensure that healthy air is maintained or restored to such areas expeditiously, we respectfully request the EQC recommend the DEQ initiate the following steps within one year of adoption of these rules:

(1) Update the current permit guidance for new and modified sources located across Wyoming to track with the strong, sensible standards the DEQ has developed for the UGRB;

(2) Begin a rulemaking that extends the current UGRB existing source proposal to existing sources located across Wyoming; and

(3) Implement the Phase II emissions budget approach for existing sources that has been announced by the Air Division for the UGRB.

As a part of each of these actions, we suggest the DEQ consider the following: (1) lowering the threshold for requiring LDAR, in order to ensure that smaller sources also implement frequent instrument-based inspections; (2) extending the same control requirements that apply at well sites to compressor stations. As discussed in our December 1 comments, both of these actions can be accomplished cost effectively. Extending quarterly inspections to existing well sites with 2 tons of fugitive emissions will capture an additional approximately 20% of facilities and 30% more emissions.[31]

Regarding our second suggestion, we have submitted information to the record in this matter showing that storage tanks, glycol dehydrators, and pneumatic devices are sources of emissions at compressor stations in addition to equipment leaks.[32] The current proposal focuses exclusively on controlling equipment leaks. Per the information we have provided, the costs to require control of these sources are the same regardless of whether

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[30] Specifically, if EPA adopts a standard of 60 ppb, all of Sublette, Sweetwater, Fremont, Laramie, Teton, Uinta, Campbell, and Carbon counties will be nonattainment. If EPA adopts a standard of 65, all of Sweetwater, Fremont, and Laramie counties will fail to meet the NAAQS. Based on 2011-2013 Design Values.

[31] *Id.* at 7.

[32] See EDF/WOC/CURED December 1, 2014 comments.

they are located at a well site or compressor station.[33] In addition, other jurisdictions require, and have proposed, to apply the same controls at well sites and compressor stations.[34]

In terms of consideration of expanding the geographic scope of these rules, we strongly recommend the DEQ both update the permitting requirements for new and modified oil and gas sources and implement a rulemaking for existing sources located outside of the UGRB. Operations in other parts of the State are not subject to the same leading practices or standards as operations in the UGRB. While the DEQ revised the permit guidance for new and modified sources located in the UGRB in November 2013, it last revised the guidance for operators located elsewhere in the State in 2010. In addition, uniform rules to address emissions from existing sources outside the UGRB are lacking.

Other parts of the State are seeing massive increases in oil and gas development. For example, of the 7,504 new oil and gas wells permitted in Wyoming since January 1, 2013, 76 percent were permitted in the eastern half of the State.[35] Since the start of 2014 more than 80 percent of the wells were approved in the eastern half of the State—mostly in Converse, Laramie, and Campbell Counties.[36] There is clearly a need to extend the strong air pollution control requirements in effect in the UGRB to other parts of the State.

VI. Recommendations

To accomplish the above suggestions, we suggest the Council include the following language **in bold** in the Statement of Principal Reasons for Adoption of the rules:

The Council finds that these regulations are reasonable and necessary to accomplish the policy and purpose of the Act, as stated in W.S. 35-11-102, and that they have been promulgated in accordance with rulemaking provisions of the Wyoming Administrative Procedures Act. The Council additionally **recommends the Wyoming Department of Environmental Quality initiate an update to its permit guidance for new and modified sources, a rulemaking for existing oil and gas sources located statewide, and implement the Phase II Emissions Budget approach for existing sources in the UGRB by May 19, 2016.**

VII. Conclusion

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[33] *Id.* at 5-6.

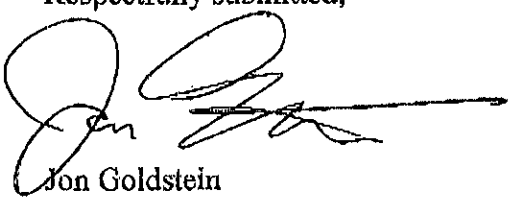
[34] Specifically, Colorado requires the identical control requirements for existing high-bleed pneumatic controllers, storage tanks, glycol dehydrators and fugitive emissions located at compressor stations as those at well sites, 5 C.C.R. 1001-9, CO Reg. 7, §§ §§ XVII.C., XVII.D.3, XVIII, XVII.F. (Feb. 24, 2014). Pennsylvania requires leak detection and repair inspections for both well sites and compressor stations, Exemption 38 and General Permit 5. The California Air Resources Board has proposed a suite of controls that would apply for sources involved in the production, processing, storage and transmission of natural gas. See ARB's Oil and Natural Gas Methane Regulation, Public Workshop (Dec. 9, 2014), at http://www.arb.ca.gov/cc/oil-gas/meetings/Workshop_Presentation_12-9-14.pdf.

[35] Wyoming Outdoor Council, Winter 2014 Frontline at 2-5.

[36] *Id.*

Thank you for considering these comments and we look forward to remaining involved with the air quality protection work of the Air Division, DEQ, and the EQC.

Respectfully submitted,



Jon Goldstein
Elizabeth Paranhos
Environmental Defense Fund

And on behalf of:

Bruce Pendery
Wyoming Outdoor Council

Dottie Bentley
CURED

Exhibit 1

ALL COST CALCULATIONS ASSUME THE FOLLOWING:
[1] All cost calculations based on the March 2014 ICF methane cost curve report, except for the analysis for flaring emissions from tanks or dehydrators with 4 tpy VOCs, which is based on the Colorado Cost-Benefit Analysis for Proposed Revisions to AQCC Regulations No. 3 and 7 (February 7, 2014).
[2] Assumes 3.6 CH4/VOC ratio at well pads and gathering/boosting.
[3] Assumes 36.2 CH4/VOC ratio for transmission.
[4] Assumes 0.019 mt CH4/Mcf CH4.

- **LDAR at well sites with 4 tpy of fugitives:**

Credit	Parameter	Cost ($4/Mcf Gas)
W/O GAS CREDIT	$/Mcf CH4	$7.61
	$/mt CH4	$400.43
	$/mt VOC	$1,441.53
W/ GAS CREDIT	$/Mcf CH4	$2.53
	$/mt CH4	$133.26
	$/mt VOC	$479.74

[1] Assumes 76.8% CH4 in natural gas at well pads.
[2] Assumes quarterly, 4.6-hour inspections.

- **LDAR at compressor stations with 4 tons of fugitives:**

Gathering/Boosting - 4 tpy VOCs

Credit	Parameter	Cost ($4/Mcf Gas)
W/O GAS CREDIT	$/Mcf CH4	$5.99
	$/mt CH4	$315.12
	$/mt VOC	$1,134.42
W/ GAS CREDIT	$/Mcf CH4	$0.91
	$/mt CH4	$47.95
	$/mt VOC	$172.63

[1] Assumes 78.8% CH4 in natural gas gathering/boosting.
[2] Assumes quarterly, 3.6-hour inspections.

Transmission- 4 tpy VOCs

Credit	Parameter	Cost ($4/Mcf Gas)
W/O GAS CREDIT	$/Mcf CH4	$1.97
	$/mt CH4	$103.88
	$/mt VOC	$3,760.52
W/ GAS CREDIT	$/Mcf CH4	-$2.46
	$/mt CH4	-$129.29
	$/mt VOC	-$4,680.12

[1] Assumes 90.3% CH4 in natural gas in transmission.
[2] Assumes quarterly, 12-hour inspections.

- **Replacement of chemical injection pumps with electric pumps (1 tpy VOC reduced)**

Credit	Parameter	Cost ($4/Mcf Gas)
W/O GAS CREDIT	$/Mcf CH4	$4.86
	$/mt CH4	$255.79
	$/mt VOC	$920.84
W/ GAS CREDIT	$/Mcf CH4	-$0.22
	$/mt CH4	-$11.58
	$/mt VOC	-$41.68

[1] Represents costs for assumed reduction of 180 Mcf CH4 (1 tpy VOCs).

- **Replacement of kimray pumps with electric pumps:**

4 tpy VOC - fugitive
4 tpy VOC reduced (100%)
14.4 tpy CH4 reduced (3.6 CH4/VOC)
720 Mcf CH4 reduced/yr
$10,000 capital cost
$2,000 O&M cost (grid electricity)

Credit	Parameter	Cost ($4/Mcf Gas)
W/O GAS CREDIT	$/Mcf CH4	$6.32
	$/mt CH4	$332.60
	$/mt VOC	$1,197.37
W/ GAS CREDIT	$/Mcf CH4	$5.17
	$/mt CH4	$272.19
	$/mt VOC	$979.88

[1] Actual reduction capability: 5,000 Mcf CH4 reduction (27.8 tpy VOC).

- **Replacement of intermittent pneumatic devices and high-bleed continuous devices with low-bleed**

Replace High-Bleed with Low-Bleed

Credit	Parameter	Cost ($4/Mcf Gas)
W/O GAS CREDIT	$/Mcf CH4	$1.99
	$/mt CH4	$104.74
	$/mt VOC	$377.05
W/ GAS CREDIT	$/Mcf CH4	-$3.08
	$/mt CH4	-$162.11
	$/mt VOC	-$583.58

Replace Intermittent with Low-Bleed

Credit	Parameter	Cost ($4/Mcf Gas)
W/O GAS CREDIT	$/Mcf CH4	$5.65
	$/mt CH4	$297.37
	$/mt VOC	$1,070.53
W/ GAS CREDIT	$/Mcf CH4	$0.58
	$/mt CH4	$30.58
	$/mt VOC	$109.89

- **Installation of a flare to control storage tank emissions (with 4 tpy of VOCs), or to control dehydrator emissions (with 4 tpy of VOCs):**

Flare control device with auto-igniter
$6,287 annualized cost
4 tpy VOC - fugitive
3.92 tpy VOC reduced (98%)
14.112 tpy CH4 reduced (3.6 CH4/VOC)
706 Mcf CH4 reduced/yr
$8.91 $/Mcf CH4 reduced
$468.56 $/mt CH4
$1,688.24 $/mt VOC

[1] Utilizes CO Cost Analysis annualized cost for a flare control device with auto-igniter. Cost allocated to VOC and CH4 reductions based on conversion assumptions.
[2] Actual reduction capability: 2,000 Mcf CH4 reduction (11.1 tpy VOC).