

STATE OF NORTH CAROLINA  
BEFORE THE MINING AND ENERGY COMMISSION

In the Matter of the  
Blue Ridge Environmental Defense League, Inc.  
Petition to the North Carolina Mining and  
Energy Commission for a Rulemaking for  
Regulation of Sources of Air Emissions from Oil  
and Gas Operations

August 8, 2014

**PETITION FOR RULEMAKING  
FOR THE CONTROL OF AIR POLLUTANT EMISSIONS  
FROM OIL AND GAS OPERATIONS IN NORTH CAROLINA**

PURSUANT to N.C. Gen. Stat. § 150B-20 and 15A NCAC 02I .0501, now comes the Petitioner, the Blue Ridge Environmental Defense League, Inc. (BREDL), with a petition requesting a rulemaking for the control of air pollutant emissions from all oil and gas operations in North Carolina. In sum, Petitioner will show that the North Carolina Mining and Energy Commission (MEC) has failed its statutory duty to propose air pollution control rules to the Environmental Management Commission.

Specifically, Petitioner requests that the MEC apply the definition of "source" at 15A NCAC 02D.0103 (32) to oil and gas operations contained in a drilling unit through well completion, and to apply 15A NCAC 02Q.0704 to oil and gas operations through completion and during production by adding these definitions and associated monitoring and control activities to

15A NCAC 05H (Draft) <sup>1)</sup> Petitioner also requests that the MEC direct the Division of Air Quality (öDAQö) to require fenceline air monitoring at each site.

**(1) Text of the proposed rule conforming to the Codifier of Rules' requirements for publication of proposed rules in the North Carolina Register**

Petitioner is requesting that oil and gas facilities be brought under existing rules.

Petitioner requests that 15 NCAC 02D.0201 be amended at (b) to add this classification:

öincludes all sources of air emissions resulting from oil and gas exploration and development.ö

In addition Petitioner proposes the following fenceline and on-site monitoring requirements:

Fenceline and on-site monitoring provisions.

(1) The owner or operator shall conduct sampling onsite and along the facility property boundary and analyze the samples in accordance with approved EPA methods.

a. The target analytes are: speciated volatile organic compounds (VOCs), benzene, toluene, ethyl benzene, xylenes, hexanes, 2,2,4-trimethylpentane, styrene, Aldehydes formaldehyde, acetaldehyde, criteria Air Pollutants, sulfur dioxide, nitrogen oxides, ozone, particulate matter (PM 2.5), reduced sulfur compounds (RSC)\*, hydrogen sulfide and additional analytes as required by the Department.\* Complete list attached as EXHIBIT 1.

(2) The owner or operator shall determine passive monitor locations in accordance with Section 8.2 of EPA Method 325A . General guidance for siting passive monitors can

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<sup>1</sup> North Carolina Administrative Code Title 15A, Department of Environmental and Natural Resources, Divisions of Energy, Mineral, and Land Resources, Subchapter 5H Sections 0.0100, 0.0200, 0.0300, 0.0400, 0.0500, 0.0600, 0.0700, 0.0800, 0.0900, 0.1000, 0.1100, 0.1200, 0.1300, 0.1400, 0.1500, 0.1600, 0.1700, 0.1800, 0.1900, 0.2000, and 0.2100 Draft: 20/25March2014 1/10/17/21/22/23/25/28/29/30 April 2014 14 1/2/5/6/7/8May2014, found at: [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=812822fd-9e97-4359-8935-4f07e713f0b1&groupId=8198095](http://portal.ncdenr.org/c/document_library/get_file?uuid=812822fd-9e97-4359-8935-4f07e713f0b1&groupId=8198095)

be found in EPA-454/R-98-004, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Part 1: Ambient Air Quality Monitoring Program Quality System Development, August 1998.<sup>2)</sup>

(3) An on-site monitoring plan shall be submitted to the Division of Air Quality for approval.

**(2) Statutory authority for the agency to promulgate the rule**

Statutory authority is established at G.S. §§ 113-391(a) (1), 113-391(a) (3), 113-391(a)(4), and 143B-293.1. Additional statutory authority is established in Session Law 2014-4, Senate Bill 786-Ratified.

Further, under 15A NCAC 02I .0501, any person may petition an agency to adopt a rule by submitting to the agency a petition requesting the adoption. An agency granting Petitioner's request must initiate rule-making proceedings. Conversely, an agency denying a rule-making petition must send the Petitioner a written statement describing the reason(s) for denying the petition.

**(3) Statement of the reasons for adoption of the proposed rule**

The MEC has failed its statutory duty to make recommendations to the Environmental Management Commission (EMC) considering regulations. Session Law 2012-143 reconstituted the MEC and charged the Commission with responsibility for developing a modern regulatory program for the management of oil and gas exploration and development activities in the state. The fundamental purpose driving the adoption of SL-2012-143 was to develop a modern regulatory program. Here the law is unequivocal; MEC is required to do so.

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<sup>2</sup> "Quality Assurance Handbook for Air Pollution Measurement Systems," US Environmental Protection Agency. 1998.

Nowhere does the MEC's foundation statute contemplate ceding regulatory control to a federal agency. The act states:

AN ACT TO (1) RECONSTITUTE THE MINING COMMISSION AS THE MINING AND ENERGY COMMISSION, (2) REQUIRE THE MINING AND ENERGY COMMISSION AND OTHER REGULATORY AGENCIES TO DEVELOP A MODERN REGULATORY PROGRAM FOR THE MANAGEMENT OF OIL AND GAS EXPLORATION AND DEVELOPMENT ACTIVITIES IN THE STATE, INCLUDING THE USE OF HORIZONTAL DRILLING AND HYDRAULIC FRACTURING FOR THAT PURPOSE, (3) AUTHORIZE HORIZONTAL DRILLING AND HYDRAULIC FRACTURING, BUT PROHIBIT THE ISSUANCE OF PERMITS FOR THESE ACTIVITIES PENDING SUBSEQUENT LEGISLATIVE ACTION, (4) ENHANCE LANDOWNER AND PUBLIC PROTECTIONS RELATED TO HORIZONTAL DRILLING AND HYDRAULIC FRACTURING, AND (5) ESTABLISH THE JOINT LEGISLATIVE COMMISSION ON ENERGY POLICY.<sup>3)</sup>

Emphasis added. In the establishment of a modern regulatory program, Session law 2012-143 directs the MEC to ensure the program is "designed to protect public health and safety; protect public and private property; protect and conserve the State's air, water, and other natural resources." Further, session law directs MEC to make recommendations to the Environmental Management Commission concerning the development of rules the regulation of toxic air emissions. The relevant text states:

(a3) The Environmental Management Commission shall adopt rules, after consideration of recommendations from the Mining and Energy Commission, for all of the following purposes:  
(2) Regulation of toxic air emissions from drilling operations. In formulating appropriate standards, the Department shall assess emissions from oil and gas exploration and development activities that use horizontal drilling and hydraulic fracturing technologies, including emissions from associated truck traffic, in order to (i) determine the adequacy of the State's current air toxics program to protect landowners who lease their property to drilling operations and (ii) determine the impact on ozone levels in the area in order to determine measures needed to maintain compliance with federal ozone standards.

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<sup>3</sup> General Assembly of North Carolina. Session Law 2012-143. Senate Bill 820. <http://www.ncleg.net/Sessions/2011/Bills/Senate/PDF/S820v6.pdf>

Emphasis added. The linguistic construction “shall adopt” in the session law, *supra*, as ratified by the General Assembly and signed by the Governor leaves no alternative to the recommendation and implementation of air pollution rules by the MEC and the EMC.

The MEC has statutory authority to promulgate regulations more stringent than the US Environmental Protection Agency (“US EPA”). Session Law 2014-4 exempts the EMC, the Commission for Public Health, and the MEC from NCGS § 150B-19.3, which otherwise prohibits the bodies from adopting rules more stringent than those approved by the US EPA.

Further, federal standards are inadequate to protect public health and the environment. The DAQ has adopted by reference the federal New Source Performance Standards (NSPS) for oil and gas (“Green Completion”) at 15 NCAC 02D .524, and the federal National Emissions Standards for Hazardous Air Pollutants (NESHAPS) (part 63) at 15 NCAC 02D .1111. Federal “green completion” rules will go into effect in January 2015 exempting exploratory, wildcat or delineation wells from their requirements; which are largely the types of wells which will be drilled in North Carolina. Without the necessary infrastructure to take gas to market, operators are likely to use flaring at these sites. Additionally, the federal rules do not address fugitive emissions from waste pits, trucks and other ancillary equipment and activities which are a source of toxic air pollution.<sup>4)5)6)</sup> US EPA rules do not limit toxic air emissions from well sites.

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<sup>4</sup> Vick, Therese. “Something in the Air-Hydraulic Fracturing’s Impact on Air Quality.” Blue Ridge Environmental Defense League. Presented to the Lee County Environmental Review and Advisory Committee. January 2014. <http://www.bredl.org/pdf4/TVickBREDLSomethingintheAir.pdf>

<sup>5</sup> Dicataldo, Gennaro et.al. “Produced Water VOC, HAP Emissions Worry Rocky Mountain Regulators.” Oil and Gas Journal. July 2009.

<sup>6</sup> Geertsma, Marleah. “EPA Starts Clean-Up of Fracking Air Pollution.” Natural Resources Defense Council. 18 April 2012. [http://switchboard.nrdc.org/blogs/mgeertsma/epa\\_starts\\_clean\\_up\\_of\\_frackin.html](http://switchboard.nrdc.org/blogs/mgeertsma/epa_starts_clean_up_of_frackin.html)

Setbacks proposed by the MEC are not protective of public health. The MEC's proposed setback between a well head and an occupied dwelling/high occupancy building is 650 feet. And the distance between occupied dwellings and the well head can be reduced to 400 feet with a variance granted by the MEC. Children at home and at school will be particularly vulnerable as they spend more time outside, breathe faster and take in more air than adults. Their lungs are still developing throughout adolescence.<sup>7)</sup> This distance is inadequate to protect public health from the uncontrolled exposure to toxic emissions, and is less stringent than other oil and gas producing states. For example, in December 2013, the city of Dallas, Texas established setbacks from occupied buildings/dwellings and drilling sites at 1500 feet from occupied dwellings.<sup>8)</sup>

**(4) Statement of the effect on existing rules or orders**

Existing state rules describe air pollution sources to which the law applies. The existing rule encompasses the Production Facility and all equipment used on-site for development and production (to include diesel trucks); i.e. flaring equipment, lines including pipelines, pits, tanks and tank batteries, wells, well heads or any other potential source of emissions. See EXHIBIT 3: Definitions.

In fact, the definition of "source" at 15A NCAC 02 reads:

(32) "Source" means any stationary article, machine, process equipment, or combination thereof from which air pollutants emanate or are emitted, either directly or indirectly.

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<sup>7</sup> Ritz, Beate, MD, PhD. Wilhelm, Michelle, PhD. "Air Pollution Impacts on Infants and Children." Institute of the Environment and Sustainability. Fall 2008. <http://www.environment.ucla.edu/reportcard/article1700.html>

<sup>8</sup> Mosqueda, Priscilla. "Another Victory for Fracking Opponents in Texas." *Texas Observer*. 11 December 2013. <http://www.texasobserver.org/another-victory-fracking-opponents-dallas/>

The plain meaning of the definition here would apply to the various sources in oil and gas fracking operations known to emit toxic air pollution. Moreover, these gas fracking sources will all fall within the category of permitted "new facilities" *See* NCAC 02Q.0704.

**(5) Copies of any documents and data supporting the proposed rule**

Air emissions from hydraulic fracturing are affecting public health in other states. The recommendation and adoption of the Rule would protect the residents who may find themselves in proximity to gas fracking operations in North Carolina. The following documents support the acceptance of this Petition.

On July 14, 2014, Concerned Health Professionals of New York released the "Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Gas and Oil Extraction)." The Compendium lists over 50 reports, studies, and media articles concerning air pollution from hydraulic fracturing. EXHIBIT 3. What follows is a representative sample.

Public health professionals at the Southwest Pennsylvania Environmental Health Project reported significant recurrent spikes in the amount of particulate matter in the air inside of residential homes located near drilling and fracking operations. Captured by indoor air monitors, the spikes tend to occur at night when stable atmospheric conditions hold particulate matter low to the ground. Director Raina Ripple emphasized that spikes in airborne particulate matter are likely to cause acute health impacts in community members. She added, "What the long term

effects are going to be, we're not certain." At this writing, researchers from Yale University and the University of Washington are working to collect and analyze more samples.<sup>9)</sup>

A Texas jury awarded a family \$2.8 million because, according to the lawsuit, a fracking company operating on property nearby had "created a "private nuisance" by producing harmful air pollution and exposing [members of the affected family] to harmful emissions of volatile organic compounds, toxic air pollutants and diesel exhaust." The family's 11-year-old daughter became ill, and family members suffered a range of symptoms, including "nosebleeds, vision problems, nausea, rashes, blood pressure issues."<sup>10)</sup> Because drilling did not occur on their property, the family had initially been unaware that their symptoms were caused by activities around them.

Congenital heart defects and possibly neural tube defects in babies were associated with the density and proximity of natural gas wells within a 10-mile radius of mothers' residences in a study of almost 25,000 births from 1996-2009 in rural Colorado. The researchers note that natural gas development emits several chemicals known to increase risk of birth defects (teratogens).<sup>11)</sup>

As summarized by Bloomberg View Editorial Board's Mark Whitehouse, preliminary data from researchers at Princeton University, Columbia University and MIT showed elevated

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<sup>9</sup> McMahan, J. (2014, June 26). Air Pollution Spikes In Homes Near Fracking Wells. Forbes. Retrieved July 4, 2014, from <http://www.forbes.com/sites/jeffmcmahan/2014/06/26/air-pollution-spikes-in-homes-near-fracking-wells/>

<sup>10</sup> Morris, J. (2014, April 26). Texas family plagued with ailments gets \$3M in 1st-of-its-kind fracking judgment. CNN. Retrieved June 10, 2014, from <http://www.cnn.com/2014/04/25/justice/texas-family-wins-fracking-lawsuit/>

<sup>11</sup> McKenzie, L. M., Guo, R., Witter, R. Z., Savitz, D. A., Newman, L. S., & Adgate, J. L. (2014). Birth outcomes and maternal residential proximity to natural gas development in rural Colorado. *Environmental Health Perspectives*, 122, 412-417. doi: 10.1289/ehp.1306722



rates of low birthweight among infants born to mothers living near drilling and fracking operations during their pregnancies.<sup>12)</sup>

The summaries of these citations and their source are attached as Exhibit 3.

**(6) Statement of the effect of the proposed rule(s) on existing practices in the area involved, including cost factors for persons affected by the proposed rule**

The MEC, EMC, and the Commission for Public Health are exempt from the provisions of Chapter 150B of the General Statutes that require the preparation of fiscal notes for any rule proposed. *See* Ratified Bill 786, Session Law 2014-4 Section 2. (f) and SL 2013-365, Section 1.(b) as amended. Other than the incarceration notes prepared by the legislature's Fiscal Research Division, which assess the impacts of two criminal penalties created by the Energy Modernization Act, no legislative fiscal notes have been prepared during the course of ratification. Therefore, cost factors for persons affected by this rule cannot be reasonably estimated by the Petitioner.

**(7) Statement explaining the computation of the cost factors**

As stated *supra*, the legislature has exempted the MEC, the EMC, and the Commission for Public Health from the requirement to prepare fiscal notes for oil and gas exploration and development activities including hydraulic fracturing and horizontal drilling.

**(8) Description, including the names and addresses, if known, of those most likely to be affected by the proposed rule**

The names and addresses of the people who the proposed rule will affect are unknown at this time. However, the widespread exploration and development of hydraulic fracturing in North Carolina would affect many residents in the basins encompassing fourteen counties across the Piedmont, six counties in Southeastern part of the state, plus seven counties in westernmost North Carolina. A study of Lee County by the University of North Carolina Chapel Hill determined that hydraulic fracturing leases in North Carolina are disproportionately located in communities of color and low wealth. A principal

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<sup>12</sup> Whitehouse, M. (2014, January 4). Study shows fracking is bad for babies. Bloomberg. Retrieved June 10, 2014, from <http://www.bloombergview.com/articles/2014-01-04/study-shows-fracking-is-bad-for-babies>


finding: “Communities with more than 50% people of color were 4.2 times as likely to have hydraulic fracturing leases as those with <10% people of color.”<sup>13)</sup> These would be the persons most affected by the Petitioner’s requested rule.

**(9) Name and address of the petitioner**

Blue Ridge Environmental Defense League, Inc. PO Box 88, Glendale Springs, NC 28629. BREDL is a not-for-profit corporation under North Carolina law, with individual members and member groups across the state. The Blue Ridge Environmental Defense League is a regional, community-based, non-profit environmental organization. Our founding principles are earth stewardship, environmental democracy, social justice, and community empowerment.

**CONCLUSION**

The Blue Ridge Environmental Defense League has provided the MEC with studies and reports concerning toxic air pollution from hydraulic fracturing operations. BREDL has also repeatedly requested that the MEC abide by its statutory responsibility and develop recommendations concerning toxic air emissions; most recently on April 16 and May 16, 2014. See EXHIBIT 4. However, to date there have been no recommendations made by the MEC to the EMC. We hereby petition the MEC to adopt and recommend regulations to limit air pollution.

Respectfully submitted,  
  
Louis A. Zeller, Executive Director  
Blue Ridge Environmental Defense League, Inc.  
PO Box 88 Glendale Springs, NC 28629  
Phone: 336-982-2691

Exhibits 1 through 4 attached

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<sup>13)</sup> “Race, Poverty and Hydraulic Fracturing in North Carolina,” Emily Werder, MPH, University of North Carolina Chapel Hill, Gillings School of Global Public Health

**EXHIBIT 1:****BASELINE COMPOUNDS TO BE MONITORED BY THE NC DIVISION OF AIR QUALITY**

<b>Compounds that DAQ will be monitoring</b>	<b>CAS #</b>	<b>Method</b>
<b>Criteria Pollutants</b>		
Nitrogen dioxide (NO <sub>2</sub> )	10102-44-0	Chemiluminescence Nitrogen Oxides Analyzer with Photolytic Converter Automated Equivalent Method: EQNA-0512-200 <sup>(1)</sup>
Ozone (O <sub>3</sub> )	10028-15-6	UltraViolet Photometric Ambient Ozone Analyzer, Automated Equivalent Method: EQOA-0880-047 <sup>(1)</sup>
PM 2.5 (Particulate Matter)	not applicable	Beta Attenuation Monitor, Automated Equivalent Method: EQPM-0308-170 <sup>(1)</sup>
Sulfur dioxide (SO <sub>2</sub> )	7446-09-5	Pulsed Fluorescence Sulfur Dioxide Analyzer, Automated Equivalent Method: EQSA-0486-060 <sup>(1)</sup>
<b>Aldehydes</b>		
Acetaldehyde	75-07-0	TO-11 <sup>(2)</sup>
Acetone	67-64-1	TO-11 <sup>(2)</sup>
Benzaldehyde	100-52-7	TO-11 <sup>(2)</sup>
Butanal (butyraldehyde)	123-72-8	TO-11 <sup>(2)</sup>
Crotoaldehyde	123-73-9	TO-11 <sup>(2)</sup>
2,5-Dimethylbenzaldehyde	5779-94-2	TO-11 <sup>(2)</sup>
Formaldehyde	50-0-0	TO-11 <sup>(2)</sup>
Glutaraldehyde	111-30-8	TO-11 <sup>(2)</sup>
Hexaldehyde	66-25-1	TO-11 <sup>(2)</sup>
Isovaleraldehyde	590-86-3	TO-11 <sup>(2)</sup>
Pentanaldehyde	110-62-3	TO-11 <sup>(2)</sup>
Propionaldehyde	123-38-6	TO-11 <sup>(2)</sup>
Tolualdehydes (m,p & o)	1334-78-7	TO-11 <sup>(2)</sup>
<b>VOCs</b>		
Acetonitrile	75-05-8	TO-15 <sup>(3)</sup>
Acetylene	74-86-2	PAMS method <sup>(4)</sup>
Acrolein	107-02-8	TO-15 <sup>(3)</sup>
Benzene	71-43-2	TO-15 <sup>(3)</sup>
Benzyl chloride	100-44-7	TO-15 <sup>(3)</sup>
Bromodichloromethane	75-27-4	TO-15 <sup>(3)</sup>
Bromoform	75-25-2	TO-15 <sup>(3)</sup>

Bromomethane	74-83-9	TO-15 <sup>(3)</sup>
1,3-Butadiene	106-99-0	TO-15 <sup>(3)</sup>
n-Butane	106-97-8	PAMS method <sup>(4)</sup>
1-Butanol	71-36-3	TO-15 <sup>(3)</sup>
1-Butene	106-98-6	PAMS method <sup>(4)</sup>
cis-2-Butene	590-18-1	PAMS method <sup>(4)</sup>

<b>Compounds that DAQ will be monitoring</b>	<b>CAS #</b>	<b>Method</b>
trans-2-Butene	624-64-6	PAMS method <sup>(4)</sup>
Carbon disulfide	75-15-0	TO-15 <sup>(3)</sup>
Carbon tetrachloride	56-23-5	TO-15 <sup>(3)</sup>
Chlorobenzene	108-90-7	TO-15 <sup>(3)</sup>
Chloroethane	75-00-3	TO-15 <sup>(3)</sup>
Chloroform	67-66-3	TO-15 <sup>(3)</sup>
Chloromethane	74-87-3	TO-15 <sup>(3)</sup>
Cyclohexane	110-82-7	TO-15 <sup>(3)</sup>
Cyclopentane	287-92-3	TO-15 <sup>(3)</sup>
n-Decane	124-18-5	PAMS method <sup>(4)</sup>
Dibromoethane	106-93-4	TO-15 <sup>(3)</sup>
m-Dichlorobenzene	541-73-1	TO-15 <sup>(3)</sup>
o-Dichlorobenzene	95-50-1	TO-15 <sup>(3)</sup>
p-Dichlorobenzene	106-46-7	TO-15 <sup>(3)</sup>
1,1-Dichloroethane	75-34-3	TO-15 <sup>(3)</sup>
1,2-Dichloroethane	107-06-2	TO-15 <sup>(3)</sup>
1,2-Dichloroethene	156-60-4	TO-15 <sup>(3)</sup>
1,2-Dichloropropane	78-87-5	TO-15 <sup>(3)</sup>
cis-1,3-Dichloropropene	10061-01-5	TO-15 <sup>(3)</sup>
trans-1,3-Dichloropropene	10061-02-6	TO-15 <sup>(3)</sup>
m-Diethylbenzene	141-93-5	PAMS method <sup>(4)</sup>
p-Diethylbenzene	105-05-5	PAMS method <sup>(4)</sup>
2,2-Dimethylbutane	75-83-2	PAMS method <sup>(4)</sup>
2,3-Dimethylbutane	79-29-8	PAMS method <sup>(4)</sup>
2,3-Dimethylpentane	565-59-3	PAMS method <sup>(4)</sup>
2,4-Dimethylpentane	108-08-7	PAMS method <sup>(4)</sup>
1,4-Dioxane	123-91-1	TO-15 <sup>(3)</sup>
n-Dodecane	112-40-3	PAMS method <sup>(4)</sup>

Ethane	74-84-0	PAMS method <sup>(4)</sup>
Ethanol	64-17-5	TO-15 <sup>(3)</sup>
Ethylbenzene	100-41-4	TO-15 <sup>(3)</sup>
Ethylene	74-85-1	PAMS method <sup>(4)</sup>
Ethyl propyl ketone	589-38-8	TO-15 <sup>(3)</sup>
m-Ethyltoluene	620-14-4	PAMS method <sup>(4)</sup>
o-Ethyltoluene	611-14-3	PAMS method <sup>(4)</sup>
p-Ethyltoluene	622-96-8	PAMS method <sup>(4)</sup>
Freon 11	75-69-4	TO-15 <sup>(3)</sup>

<b>Compounds that DAQ will be monitoring</b>	<b>CAS #</b>	<b>Method</b>
Freon 12	75-71-8	TO-15 <sup>(3)</sup>
Freon 22	75-45-6	TO-15 <sup>(3)</sup>
Freon 113	76-13-1	TO-15 <sup>(3)</sup>
Freon 114	76-14-2	TO-15 <sup>(3)</sup>
n-Heptane	142-82-5	PAMS method <sup>(4)</sup>
Hexane	110-54-3	TO-15 <sup>(3)</sup>
1-Hexene	592-41-6	PAMS method <sup>(4)</sup>
Isobutane	75-28-5	PAMS method <sup>(4)</sup>
Isobutene	115-11-7	TO-15 <sup>(3)</sup>
Isopentane	78-78-4	PAMS method <sup>(4)</sup>
Isoprene	78-79-5	TO-15 <sup>(3)</sup>
Isopropyl alcohol	67-63-0	TO-15 <sup>(3)</sup>
Isopropylbenzene	98-82-8	PAMS method <sup>(4)</sup>
Methacrolein	78-85-3	TO-15 <sup>(3)</sup>
Methane	74-82-8	PAMS method <sup>(4)</sup>
Methyl butyl ketone	591-78-6	TO-15 <sup>(3)</sup>
Methylcyclohexane	108-87-2	PAMS method <sup>(4)</sup>
Methylcyclopentane	96-37-7	PAMS method <sup>(4)</sup>
Methylene chloride	75-09-2	TO-15 <sup>(3)</sup>
Methyl ethyl ketone (MEK)	78-93-3	TO-15 <sup>(3)</sup>
2-Methylheptane	592-27-8	PAMS method <sup>(4)</sup>
3-Methylheptane	589-81-1	PAMS method <sup>(4)</sup>
2-Methylhexane	591-76-4	PAMS method <sup>(4)</sup>
3-Methylhexane	589-34-4	PAMS method <sup>(4)</sup>

Methyl iodide	75-11-6	TO-15 <sup>(3)</sup>
Methyl isobutyl ketone	108-10-1	TO-15 <sup>(3)</sup>
2-Methylpentane	107-83-5	PAMS method <sup>(4)</sup>
3-Methylpentane	96-14-0	PAMS method <sup>(4)</sup>
MTBE (Methyl tert-butyl ether)	1634-04-4	TO-15 <sup>(3)</sup>
Methyl vinyl ketone	78-94-4	TO-15 <sup>(3)</sup>
n-Nonane	111-84-2	PAMS method <sup>(4)</sup>
n-Octane	111-65-9	PAMS method <sup>(4)</sup>
n-Pentane	109-66-0	TO-15 <sup>(3)</sup>
2-Pentanone	107-87-9	TO-15 <sup>(3)</sup>
3-Pentanone	96-22-0	TO-15 <sup>(3)</sup>
1-Pentene	109-67-1	PAMS method <sup>(4)</sup>
cis-2-Pentene	627-20-3	PAMS method <sup>(4)</sup>

<b>Compounds that DAQ will be monitoring</b>	<b>CAS #</b>	<b>Method</b>
trans-2-Pentene	646-04-8	PAMS method <sup>(4)</sup>
Propane	74-98-6	PAMS method <sup>(4)</sup>
Propene	115-07-1	TO-15 <sup>(3)</sup>
n-Propylbenzene	103-65-1	PAMS method <sup>(4)</sup>
Styrene	100-42-5	TO-15 <sup>(3)</sup>
1,1,2,2-Tetrachlorethane	79-34-5	TO-15 <sup>(3)</sup>
Tetrachloroethylene	127-18-4	TO-15 <sup>(3)</sup>
Toluene	108-88-3	TO-15 <sup>(3)</sup>
1,2,4-Trichlorobenzene	120-82-1	TO-15 <sup>(3)</sup>
1,1,1-Trichloroethane	71-55-6	TO-15 <sup>(3)</sup>
1,1,2-Trichloroethane	79-00-5	TO-15 <sup>(3)</sup>
Trichloroethylene	79-01-6	TO-15 <sup>(3)</sup>
1,2,3-Trimethylbenzene	526-73-8	TO-15 <sup>(3)</sup>
1,2,4-Trimethylbenzene	95-63-6	TO-15 <sup>(3)</sup>
1,3,5-Trimethylbenzene	108-67-8	TO-15 <sup>(3)</sup>
2,2,4-Trimethylpentane	540-84-1	PAMS method <sup>(4)</sup>
2,3,4-Trimethylpentane	565-75-3	PAMS method <sup>(4)</sup>
n-Undecane	1120-21-4	PAMS method <sup>(4)</sup>
Vinyl acetate	108-05-4	TO-15 <sup>(3)</sup>
Vinyl chloride	75-01-4	TO-15 <sup>(3)</sup>
Vinylidene chloride	75-35-4	TO-15 <sup>(3)</sup>

m,p-Xylenes	108-38-3 & 106-42-3	TO-15 <sup>(3)</sup>
o-Xylene	95-47-6	TO-15 <sup>(3)</sup>
<b>Sulfur compounds</b>		
Hydrogen sulfide	7783-06-4	Jerome meter screening (tentative)
<b>Meteorology</b>		<b>EPA Meteorological Monitoring Guidance<sup>(5)</sup></b>
wind speed	not applicable	Instrumental - Electronic or Machine Average
wind direction	not applicable	Instrumental - Electronic or Machine Average
temperature	not applicable	Instrumental - Electronic or Machine Average
relative humidity	not applicable	Instrumental - Electronic or Machine Average
<b>Reference links to methods:</b>		
<a href="http://www.epa.gov/ttn/amtic/files/ambient/criteria/reference-equivalent-methods-list.pdf">http://www.epa.gov/ttn/amtic/files/ambient/criteria/reference-equivalent-methods-list.pdf</a>		
<a href="http://www.epa.gov/ttnamti1/files/ambient/airtox/to-11ar.pdf">http://www.epa.gov/ttnamti1/files/ambient/airtox/to-11ar.pdf</a>		
<a href="http://www.epa.gov/ttnamti1/files/ambient/airtox/to-15r.pdf">http://www.epa.gov/ttnamti1/files/ambient/airtox/to-15r.pdf</a>		
<a href="http://www.epa.gov/ttnamti1/files/ambient/pams/newtad.pdf">http://www.epa.gov/ttnamti1/files/ambient/pams/newtad.pdf</a>		
<a href="http://www.epa.gov/ttn/amtic/files/ambient/met/Volume%20IV_Meteorological_Measurements.pdf">http://www.epa.gov/ttn/amtic/files/ambient/met/Volume%20IV_Meteorological_Measurements.pdf</a>		

SOURCE: [http://www.ncair.org/news/shale/Shale\\_Gas\\_Development\\_Compound\\_List.pdf](http://www.ncair.org/news/shale/Shale_Gas_Development_Compound_List.pdf)

**EXHIBIT 2:**

**TERMS OF REFERENCE AND DEFINITIONS**

The terms used in this Section shall have the definitions assigned by GS 113-389. In addition, the words defined in this Section shall have the following meanings:

- (1) API numberö means a unique, permanent, American Petroleum Institute numeric identifier assigned to each well drilled for oil or gas production.
- (2) öApplicantö means the person who submits an initial Oil or Gas Well Permit Application.
- (3) öAppraisal wellö means wells drilled after hydrocarbon presence has been identified with the drilling of the wildcat well, to define the reservoir or delineate the geology (also referred to as delineation wells) *API*
- (4) öBlowout preventer (BOP)ö means one or more valves installed at the wellhead to prevent the escape of pressure from the annular space or the escape of pressure from the open or cased hole:
  - (A) öAnnular blowout preventerö means a large valve that forms a seal in the annular space between the pipe and wellbore.
  - (B) öShear ram blowout preventerö means a closing element fitted with hardened tool steel blades designed to cut the drill pipe when closed.
- (5) öChemical(s)ö means any element, chemical compound, or mixture of elements or compounds that has its own specific name or identity such as a Chemical Abstracts Service Registry Number.
- (6) öChemical Abstracts Serviceö is a division of the American Chemical Society.
- (7) öChemical Abstracts Service Registry Numberö or öCAS Registry Numberö means the unique, unmistakable identification number assigned to a chemical by the Chemical Abstracts Service.
- (8) öChemical classificationö means a grouping that relates a chemical to others with similar features.
- (9) öCommissionö as defined in G.S. 143-212(2)
- (10) öCompletionö means the activities that render a well capable of producing oil or gas through the wellhead equipment from a producing zone after the production string has been set.
- (11) öDepartmentö as defined in G.S. 113-389(1b).
- (12) öDevelopment wellsö means wells drilled according to a predetermined pattern to maximize production from the hydrocarbon reservoir, within economic limits, over a reasonable lifetime of production. Drilling is based on the reservoir development plan as prepared from information



obtained during various exploration processes such as seismic surveys, geologic analysis, and from drilling the wildcat and appraisal wells. These development wells include not only producing oil and gas wells, but also wells such as gas and water injection wells which may be used to enhance recovery of the hydrocarbon. Within the development plan, selected producing wells may be converted to injection wells at specified times during the production history of the reservoir. *(API)*

(13) "Director" means the Director of the division of Air Quality of the Department of Environment and Natural Resources.

(14) "Division" as defined in 15A NCAC 02D .101 (13)

(15) "Exploration and production (E & P) waste" means wastes associated with the exploration, development, and production of oil or gas, which are not regulated by the provisions of the Federal Resource Conservation and Recovery Act Subtitle C, and may include the following: produced brine, sand, and water; drill cuttings; water-based drilling fluids; flowback fluids; stormwater in secondary containment and pits at the well site; and any other deposits or residuals from exploration and production activities.

(16) "Flowback fluid" means any of a number of liquids, and mixtures thereof, consisting of drilling fluid, silt, sand and other proppants, debris, water, brine, oil, paraffin, produced water, or other materials that are removed from the wellbore during the completion or recompletion of a well, other additives that flow from a well following well stimulation, or during production of a well.

(17) "Green completion" means a well completion following fracturing or refracturing where gas flowback that is otherwise vented is captured, cleaned, and routed to the flow line or collection system, re-injected into the well or another well, used as an on-site fuel source, or used for other useful purpose that a purchased fuel or raw material would serve, with no direct release to the atmosphere.

(18) "Hydraulic fracturing" means the oil or gas well stimulation by the application of hydraulic pressure using fluids, proppants, and additives under pressure to create artificial fractures or to open existing fracture networks in the formation for the purpose of improving the capacity to produce hydrocarbons.

(19) "Master valve" means a large valve located on the Christmas tree and used to control the flow of oil or gas from a well.

(20) "Pit" means any natural or man-made depression in the ground used for storage of fluids.

(21) "Produced water" means the water that exists in subsurface formations and is brought to the surface during oil or gas production.

- (22) "Production facility" means all storage, separation, treating, dehydration, artificial lift, power supply, compression, pumping, metering, monitoring, flowline, and other equipment directly associated with production at oil or gas wells.
- (23) "Residuals" means any solid, semisolid, or liquid waste, other than effluent or residues from agricultural products and processing, generated from a wastewater treatment facility, water supply treatment facility, or air pollution control facility permitted under the authority of the Environmental Management Commission.
- (24) "Tank" means a stationary vessel that is used to contain fluids constructed of non-earthen materials.
- (25) "Tank battery" means a group of tanks that are connected to receive production fluids from a well or a producing lease.
- (26) "Well" as defined in G.S. 87-85(14).
- (27) "Wellhead" means the upper terminal of the well including adapters, ports, valves, seals, and other attachments.
- (28) "Well pad" means the area that is cleared or prepared for the drilling of one or more oil or gas wells.
- (29) "Well site" means the areas that are directly disturbed during the drilling and subsequent operation of any oil or gas well and its associated well pad.
- (30) "Wildcat well" means the first well to be drilled in a geographic region. The extent of that region will be based on available information. (*API*)

### **EXHIBIT 3:**

#### **REPORT BY CONCERNED HEALTH PROFESSIONALS OF NEW YORK**

#### **Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Gas And Oil Extraction)**

**July 10, 2014**

#### **Air pollution**

June 26, 2014 ó Public health professionals at the Southwest Pennsylvania Environmental Health Project reported significant recurrent spikes in the amount of particulate matter in the air inside of residential homes located near drilling and fracking operations. Captured by indoor air monitors, the spikes tend to occur at night when stable atmospheric conditions hold particulate matter low to the ground. Director Raina Ripple emphasized that spikes in airborne particulate matter are likely to cause acute health impacts in community members. She added, "What the long term effects are going to be, we're not certain." At this writing, researchers from Yale University and the University of Washington are working to collect and analyze more samples.<sup>14</sup>

May 21, 2014 ó Raising questions about possible links to worsening air pollution from the Uintah Basin's 11,200 oil and gas wells, health professionals reported that infant deaths in Vernal, Utah, rose to six times the normal rate over the past three years. Physician Brian Moench said, "We know that pregnant women who breathe more air pollution have much higher rates of virtually every adverse pregnancy outcome that exists. And we know that this particular town is the center of an oil and gas boom that's been going on for the past five or six years and has uniquely high particulate matter and high ozone."<sup>15</sup> With air quality that was formerly pristine, Uintah County, Utah received a grade "F" for ozone in the American Lung Association's 2013 State of the Air Report, with 27.3 more high ozone days than 2007.<sup>16</sup>

May 8, 2014 ó Researchers at the National Oceanic and Atmospheric Administration (NOAA) found high levels of methane leaks as well as benzene and smog-forming volatile organic compounds in the air over oil and gas drilling areas in Colorado. Researchers found methane emissions three times higher than previously estimated and benzene and volatile organic compound levels seven times higher than estimated by government agencies. The Denver Post noted that Colorado's Front Range has failed to meet federal ozone air quality standards for years.<sup>17</sup>

April 26, 2014 ó A Texas jury awarded a family \$2.8 million because, according to the lawsuit, a fracking company operating on property nearby had "created a private nuisance" by producing harmful

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<sup>14</sup> McMahon, J. (2014, June 26). Air Pollution Spikes In Homes Near Fracking Wells. Forbes. Retrieved July 4, 2014, from <http://www.forbes.com/sites/jeffmcmahon/2014/06/26/air-pollution-spikes-in-homes-near-fracking-wells/>

<sup>15</sup> S Schlanger, Z. (2014, May 21). In Utah boom town, a spike in infant deaths raises questions. Newsweek. Retrieved June 10, 2014, from <http://www.newsweek.com/2014/05/30/utah-boom-town-spike-infant-deaths-raises-questions-251605.html>

<sup>16</sup> American Lung Association. (2013). American Lung Association state of the air 2013. Retrieved June 10, 2014, from <http://www.stateoftheair.org/2013/states/utah/uintah-49047.html>

<sup>17</sup> Finley, B. (2014, May 8). Scientists flying over Colorado oil boom find worse air pollution. The Denver Post. Retrieved June 10, 2014, from [http://www.denverpost.com/environment/ci\\_25719742/scientists-flying-over-colorado-oil-boom-find-worse](http://www.denverpost.com/environment/ci_25719742/scientists-flying-over-colorado-oil-boom-find-worse)

air pollution and exposing [members of the affected family] to harmful emissions of volatile organic compounds, toxic air pollutants and diesel exhaust. The family's 11-year-old daughter became ill, and family members suffered a range of symptoms, including nosebleeds, vision problems, nausea, rashes, blood pressure issues.<sup>18</sup> Because drilling did not occur on their property, the family had initially been unaware that their symptoms were caused by activities around them.

April 16, 2014 – Reviewing the peer-review literature to date of direct pertinence to the environmental public health and environmental exposure pathways, a U.S. team of researchers concluded: “[a] number of studies suggest that shale gas development contributes to levels of ambient air concentrations known to be associated with increased risk of morbidity and mortality.”<sup>19</sup>

April 11, 2014 – A modeling study commissioned by the state of Texas made striking projections about worsening air quality in the Eagle Ford Shale. Findings included the possibility of a 281 percent increase in emissions of volatile organic compounds (VOCs). Some VOCs cause respiratory and neurological problems; others, like benzene, are also carcinogens. Another finding was that nitrogen oxides—which react with VOCs in sunlight to create ground-level ozone, the main component of smog—increased 69 percent during the peak ozone season.<sup>20</sup>

March 29, 2014 – Scientists warn that current methods of collecting and analyzing emissions data do not accurately assess health risks. Researchers with the Southwest Pennsylvania Environmental Health Project showed that methods do not adequately measure the intensity, frequency or durations of community exposure to the toxic chemicals routinely released from drilling and fracking activities. They found that exposures may be underestimated by an order of magnitude, mixtures of chemicals are not taken into account, and local weather conditions and vulnerable populations are ignored.<sup>21</sup>

March 27, 2014 – University of Texas research pointed to “potentially false assurances” in response to community health concerns in shale gas development areas. Dramatic shortcomings in air pollution monitoring to date include no accounting for cumulative toxic emissions or children’s exposures during critical developmental stages, and the potential interactive effects of mixtures of chemicals. Chemical mixtures of concern include benzene, toluene, ethylbenzene, and xylenes.<sup>22 23</sup>

March 13, 2014 – Volatile organic compounds (VOCs) emitted in Utah’s heavily drilled Uintah Basin led to 39 winter days exceeding the EPA’s eight-hour National Ambient Air Quality Standards level for ozone pollutants the previous winter. “Levels above this threshold are considered to be harmful to human health, and high levels of ozone are known to cause respiratory distress and be responsible for an

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<sup>18</sup> Morris, J. (2014, April 26). Texas family plagued with ailments gets \$3M in 1st-of-its-kind fracking judgment. CNN. Retrieved June 10, 2014, from <http://www.cnn.com/2014/04/25/justice/texas-family-wins-fracking-lawsuit/>

<sup>19</sup> Shonkoff, S. B., Hays, J., & Finkel, M. L. (2014). Environmental public health dimensions of shale and tight gas development [Abstract]. *Environmental Health Perspectives*. doi: 10.1289/ehp.1307866

<sup>20</sup> Morris, J., Song, L., & Hasemayer, D. (2014, April 11). Report: Air quality to worsen in Eagle Ford shale. *The Texas Tribune*. Retrieved June 10, 2014, from <http://www.texastribune.org/2014/04/11/report-air-quality-worsen-eagle-ford-shale/>

<sup>21</sup> Brown, D., Weinberger, B., Lewis, C., & Bonaparte, H. (2014). Understanding exposure from natural gas drilling puts current air standards to the test. *Reviews on Environmental Health*, 0(0). doi: 10.1515/reveh-2014-0002

<sup>22</sup> Rawlins, R. (2013). Planning for fracking on the Barnett shale: Urban air pollution, improving health based regulation, and the role of local governments. *Virginia Environmental Law Journal*, 31, 226-306. Retrieved June 10, 2014, from [http://www.velj.org/uploads/1/2/7/0/12706894/2.\\_rawlins\\_-\\_barnett\\_shale.pdf](http://www.velj.org/uploads/1/2/7/0/12706894/2._rawlins_-_barnett_shale.pdf)

<sup>23</sup> University of Texas at Austin. (2014, March 27). Air pollution and hydraulic fracturing: Better monitoring, planning and tracking of health effects needed in Texas. Retrieved June 10, 2014, from <http://www.utexas.edu/news/2014/03/27/hydraulic-fracturing-texas/>

estimated 5,000 premature deaths in the U.S. per year, according to researchers at the University of Colorado. Their observations reveal a strong causal link between oil and gas emissions, accumulation of air toxics, and significant production of ozone in the atmospheric surface layer.<sup>24</sup> Researchers estimated that total annual VOC emissions at the fracking sites are equivalent to those of about 100 million cars.<sup>25</sup>

March 3, 2014 In a report summarizing the current understanding of local and regional air quality impacts of natural gas extraction, production, and use, a group of researchers from the NOAA, Stanford, Duke, and other institutions described what is known and unknown with regard to air emissions including greenhouse gases, ozone precursors (volatile organic compounds and nitrogen oxides), air toxics, and particulates. Crystalline silica was also discussed, including as a concern for people living near well pads and production staging areas.<sup>26</sup>

February 18, 2014 An eight-month investigation by the Weather Channel, Center for Public Integrity and InsideClimate News into fracking in the Eagle Ford Shale in Texas revealed that fracking is releasing a toxic soup of chemicals into the air. They noted very poor monitoring by the state of Texas and reported on hundreds of air complaints filed relating to air pollution associated with fracking.<sup>27</sup>

January 28, 2014 Congenital heart defects and possibly neural tube defects in babies were associated with the density and proximity of natural gas wells within a 10-mile radius of mothers' residences in a study of almost 25,000 births from 1996-2009 in rural Colorado. The researchers note that natural gas development emits several chemicals known to increase risk of birth defects (teratogens).<sup>28</sup>

January 4, 2014 As summarized by Bloomberg View Editorial Board's Mark Whitehouse, preliminary data from researchers at Princeton University, Columbia University and MIT showed elevated rates of low birthweight among infants born to mothers living near drilling and fracking operations during their pregnancies.<sup>29</sup>

December 18, 2013 An interdisciplinary group of researchers in Texas collected air samples in residential areas near shale gas extraction and production, going beyond previous Barnett Shale studies by including emissions from the whole range of production equipment. They found that most areas had atmospheric methane concentrations considerably higher than reported urban background concentrations, and many toxic chemicals were strongly associated with compressor stations.<sup>30</sup>

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<sup>24</sup> Helmig, D., Thompson, C. R., Evans, J., Boylan, P., Hueber, J., & Park, J. (2014). Highly elevated atmospheric levels of volatile organic compounds in the Uintah Basin, Utah [Abstract]. *Environmental Science & Technology*, 48(9), 4707-4715. doi: 10.1021/es405046r

<sup>25</sup> Lockwood, D. (2014, March 25). Harmful air pollutants build up near oil and gas fields. *Chemical & Engineering News*. Retrieved June 10, 2014, from <http://cen.acs.org/articles/92/web/2014/03/Harmful-Air-Pollutants-Build-Near.html>

<sup>26</sup> Moore, C. W., Zielinska, B., Petron, G., & Jackson, R. B. (2014). Air impacts of increased natural gas acquisition, processing, and use: A critical review. *Environmental Science & Technology*. doi: 10.1021/es4053472

<sup>27</sup> Morris, J., Song, L., & Hasemayer, D. (2014, February 18). Fracking the Eagle Ford Shale. *The Weather Channel*. Retrieved June 10, 2014, from <http://stories.weather.com/fracking/17>

<sup>28</sup> McKenzie, L. M., Guo, R., Witter, R. Z., Savitz, D. A., Newman, L. S., & Adgate, J. L. (2014). Birth outcomes and maternal residential proximity to natural gas development in rural Colorado. *Environmental Health Perspectives*, 122, 412-417. doi: 10.1289/ehp.1306722

<sup>29</sup> Whitehouse, M. (2014, January 4). Study shows fracking is bad for babies. *Bloomberg*. Retrieved June 10, 2014, from <http://www.bloombergvew.com/articles/2014-01-04/study-shows-fracking-is-bad-for-babies>

<sup>30</sup> Rich, A., Grover, J. P., & Sattler, M. L. (2014). An exploratory study of air emissions associated with shale gas development and production in the Barnett Shale. *Journal of the Air & Waste Management Association*, 64(1), 61-72. doi: 10.1080/10962247.2013.832713

December 10, 2013 ó Health department testing at fracking sites in West Virginia revealed dangerous levels of benzene in the air. Wheeling-Ohio County Health Department Administrator Howard Gamble stated, "The levels of benzene really pop out." The amounts they were seeing were at levels of concern. The concerns of the public are validated."<sup>31</sup>

October, 2013 ó A preliminary 2013 Cornell University study of the health impacts of oil and gas extraction on infant health in Colorado found that proximity to wells ó linked with air pollutants from fracking operations ó was associated with reductions in average birthweight and length of pregnancy as well as increased risk for low birthweight and premature birth.<sup>32</sup> A study by the same author, currently under review, analyzed births to Pennsylvania mothers residing close to a shale gas well in Pennsylvania from 2003-2010 also identified increased risk of adverse effects. This includes low birth weight, as well as a 26% increase in APGAR scores under 8 (APGAR ó or American Pediatric Gross Assessment Record ó is a measure of newborn responsiveness. Scores of less than 8 predict an increase in the need for respiratory support).<sup>33</sup>

October 11, 2013 ó Air sampling before, during, and after drilling and fracking of a new natural gas well pad in rural western Colorado documented the presence of the toxic solvent methylene chloride, along with several polycyclic aromatic hydrocarbons (PAHs) at ó concentrations greater than those at which prenatally exposed children in urban studies had lower developmental and IQ scores.ö<sup>34</sup>

September 19, 2013 ó In Texas, air monitoring data in the Eagle Ford Shale area revealed potentially dangerous exposures of nearby residents to hazardous air pollutants, including cancer-causing benzene and the neurological toxicant, hydrogen sulfide.<sup>35</sup>

September 13, 2013 ó A study by researchers at the University of California at Irvine found dangerous levels of volatile organic compounds in Canada's "Industrial Heartland" where there are more than 40 oil, gas and chemical facilities. The researchers noted high levels of hematopoietic cancers (leukemia and non-Hodgkin's lymphoma) in men who live closer to the facilities.<sup>36</sup>

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<sup>31</sup> Junkins, C. (2013, December 10). Health dept. concerned about benzene emissions near local gas drilling sites. *The Intelligencer*, Wheeling News-Register. Retrieved June 10, 2014, from <http://www.theintelligencer.net/page/content.detail/id/593209/Health-Dept--Concerned-About-Benzene-Emissions-Near-Local-Gas-Drilling-Sites.html?nav=510>

<sup>32</sup> Hill, E. L. (2013, October). The impact of oil and gas extraction on infant health in Colorado. Retrieved June 10, 2014, from <http://www.elainehill.com/research>

<sup>33</sup> Hill, E.L. (2013, December). Shale Gas Development and Infant Health: Evidence from Pennsylvania (under review). Retrieved June 23, 2014 from <http://www.elainehill.com/research>.

<sup>34</sup> Colborn, T., Schultz, K., Herrick, L., & Kwiatkowski, C. (2014). An Exploratory Study of Air Quality Near Natural Gas Operations. *Human and Ecological Risk Assessment: An International Journal*, 20(1), 86-105. doi: 10.1080/10807039.2012.749447

<sup>35</sup> Wilson, S., Sumi, L., & Subra, W. (2013, September 19). Reckless endangerment while fracking the Eagle Ford shale. *Earthworks*. Retrieved June 10, 2014, from [http://www.earthworksaction.org/library/detail/reckless\\_endangerment\\_in\\_the\\_eagle\\_ford\\_shale#.UkGi-4Y3uSo](http://www.earthworksaction.org/library/detail/reckless_endangerment_in_the_eagle_ford_shale#.UkGi-4Y3uSo).

<sup>36</sup> Blake, D. R. Air quality in the Industrial Heartland of Alberta, Canada and potential impacts on human health. *Atmospheric Environment*, 702-709. Retrieved June 16, 2014, from <http://concernedhealthny.org/wp-content/uploads/2013/07/Simpson2013-AE-in-press.pdf>

August 26, 2013 ó Medical experts at a rural clinic in heavily drilled Washington County, PA reported case studies of 20 individuals with acute symptoms consistent with exposure to air contaminants known to be emitted from local fracking operations.<sup>37,38</sup>

May 2, 2013 ó Reports of symptoms commonly linked to exposure to elevated levels of ground-level ozone associated with gas drilling have been documented in shale-heavy states. In Pennsylvania in 2012, a study of more than 100 state residents living near gas facilities found that reported health symptoms closely matched the scientifically established effects of chemicals detected through air and water testing at those nearby sites, and that those negative health effects occurred at significantly higher rates in households closer to the gas facilities than those further away.<sup>39</sup> Indicative of the growing prevalence of such health impacts in the state, a poll showed that two-thirds of Pennsylvanians support a moratorium on fracking because of concern about negative health impacts.<sup>40</sup>

April 29, 2013 ó Using American Lung Association data, researchers with the Environmental Defense Fund determined that air quality in rural areas with fracking was worse than air quality in urban areas.<sup>41</sup>

March, 2013 ó A review of regional air quality damages in parts of Pennsylvania in 2012 from Marcellus Shale development found that air pollution was a significant concern, with regional damages ranging from \$7.2 to \$32 million dollars in 2011.<sup>42</sup>

February 27, 2013 ó In a letter from Concerned Health Professionals of New York to Governor Andrew Cuomo, a coalition of hundreds of health organizations, scientists, medical experts, elected officials and environmental organizations noted serious health concerns about the prospects of fracking in New York State, making specific note of air pollution.<sup>43</sup> Signatory organizations included the American Academy of Pediatrics of New York, the American Lung Association of New York and Physicians for Social Responsibility. The New York State Medical Society, representing 30,000 medical professionals, has issued similar statements.<sup>44</sup>

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<sup>37</sup> Abrams, L. (2013, August 26). Fracking's real health risk may be from air pollution. Salon. Retrieved June 10, 2014, from [http://www.salon.com/2013/08/26/frackings\\_real\\_health\\_risk\\_may\\_be\\_from\\_air\\_pollution/](http://www.salon.com/2013/08/26/frackings_real_health_risk_may_be_from_air_pollution/)

<sup>38</sup> Dyrzka, L., Nolan, K., & Steingraber, S. (2013, August 27). Statement on preliminary findings from the Southwest Pennsylvania Environmental Health Project study. Press release. Concerned Health Professionals of NY. Retrieved June 10, 2014, from <http://concernedhealthny.org/statement-on-preliminary-findings-from-the-southwest-pennsylvania-envir...>

<sup>39</sup> Steinzor, N., Subra, W., & Sumi, L. (2013). Investigating Links between Shale Gas Development and Health Impacts Through a Community Survey Project in Pennsylvania. *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*, 23(1), 55-83. doi: 10.2190/NS.23.1.e

<sup>40</sup> Phillips, S. (2013, May 14). Poll shows support for a drilling moratorium in Pennsylvania. StateImpact. Retrieved June 10, 2014, from <http://stateimpact.npr.org/pennsylvania/2013/05/14/poll-shows-support-for-a-drilling-moratorium-in-pennsylvania/>

<sup>41</sup> Grossman, D. (2013, April 29). Clean air report card: CO, WY Counties get F's due to oil and gas pollution. Environmental Defense Fund. Retrieved June 10, 2014, from <http://blogs.edf.org/energyexchange/2013/04/29/clean-air-report-card-co-wy-counties-get-fs-due-to-oil-and-gas-pollution/#sthash.FXRv6Nxi.dpuf>

<sup>42</sup> Litovitz, A., Curtright, A., Abramzon, S., Burger, N., & Samaras, C. (2013). Estimation of regional air-quality damages from Marcellus Shale natural gas extraction in Pennsylvania. *Environmental Research Letters*, 8(1). doi: 10.1088/1748-9326/8/1/014017

<sup>43</sup> Concerned Health Professionals of NY. (2013, February 27). Letter to Governor Cuomo. Retrieved June 10, 2014, from <http://concernedhealthny.org/letters-to-governor-cuomo/>

<sup>44</sup> Campbell, J. (2013, April 17). Fracking roundup: Gas prices up; Medical society wants moratorium. Politics on the Hudson. Retrieved June 10, 2014, from <http://polhudson.lohudblogs.com/2013/04/17/fracking-roundup-gas-prices-up-medical-society-wants-moratorium/>

January 2, 2013 ó A NOAA study identified emissions from oil and gas fields in Utah as a significant source of pollutants that contribute to ozone problems.<sup>45</sup> Exposure to elevated levels of ground-level ozone is known to worsen asthma and has been linked to respiratory illnesses and increased risk of stroke and heart attack.<sup>46</sup>

December 3, 2012 ó A study linked a single well pad in Colorado to more than 50 airborne chemicals, 44 of which have known health effects.<sup>47</sup>

July 18, 2012 ó A study by the Houston Advanced Research Center modeled ozone formation from a natural gas processing facility using accepted emissions estimates and showed that regular operations could significantly raise levels of ground-level ozone (smog) in the Barnett Shale in Texas and that gas flaring further contributed to ozone levels.<sup>48</sup>

March 19, 2012 ó A Colorado School of Public Health study found air pollutants near fracking sites linked to neurological and respiratory problems and cancer.<sup>49,50</sup> The study, based on three years of monitoring at Colorado sites, found a number of potentially toxic petroleum hydrocarbons in the air near gas wells including benzene, ethylbenzene, toluene and xylene. Lisa McKenzie, PhD, MPH, lead author of the study and research associate at the Colorado School of Public Health, said, "Our data show that it is important to include air pollution in the national dialogue on natural gas development that has focused largely on water exposures to hydraulic fracturing."<sup>51</sup>

December 12, 2011 ó Cancer specialists, cancer advocacy organizations, and health organizations summarized the cancer risks posed by all stages of the shale gas extraction process in a letter to New York Governor Andrew Cuomo.<sup>52</sup>

October 5, 2011 ó More than 250 medical experts and health organizations reviewed the multiple health risks from fracking in a letter sent to New York Governor Andrew Cuomo.<sup>53</sup>

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<sup>45</sup> Tollefson, J. (2013). Methane leaks erode green credentials of natural gas. *Nature*, 493(7430), 12-12. doi: 10.1038/493012a

<sup>46</sup> American Lung Association. (2013). American Lung Association state of the air 2013 - Ozone pollution. Retrieved June 10, 2014, from <http://www.stateoftheair.org/2013/health-risks/health-risks-ozone.html>

<sup>47</sup> Song, L. (2012, December 3). Hazardous air pollutants detected near fracking sites. *Bloomberg*. Retrieved June 10, 2014, from <http://www.bloomberg.com/news/2012-12-03/hazardous-air-pollutants-detected-near-fracking-sites.html>

<sup>48</sup> Olaguer, E. P. (2012). The potential near-source ozone impacts of upstream oil and gas industry emissions. *Journal of the Air & Waste Management Association*, 62(8), 966-977. doi: 10.1080/10962247.2012.688923

<sup>49</sup> Kelly, D. (2012, March 19). Study shows air emissions near fracking sites may pose health risk. University of Colorado Denver. Retrieved June 10, 2014, from <http://www.ucdenver.edu/about/newsroom/newsreleases/Pages/health-impacts-of-fracking-emissions.asp>

<sup>50</sup> McKenzie, L. M., Witter, R. Z., Newman, L. S., & Adgate, J. L. (2012). Human health risk assessment of air emissions from development of unconventional natural gas resources. *Science of the Total Environment*, 424, 79-87. doi: 10.1016/j.scitotenv.2012.02.018

<sup>51</sup> Banerjee, N. (2012, March 20). Study: 'Fracking' may increase air pollution health risks. *Los Angeles Times*. Retrieved June 11, 2014, from <http://articles.latimes.com/2012/mar/20/local/la-me-gs-fracking-increases-air-pollution-health-risks-to-residents-20120320>

<sup>52</sup> Physicians, Scientists & Engineers for Healthy Energy. (2011, December 12). Appeal to Gov. Cuomo to consider cancer risks re: High volume hydraulic fracturing for natural gas [Letter to A. Cuomo].

<sup>53</sup> Physicians, Scientists & Engineers for Healthy Energy. (2011, October 5). Letter to Governor Cuomo [Letter to A. Cuomo].



April 21, 2011 ó Environment & Energy (E&E) reported that ozone levels exceeding federal health standards in Utah's Uintah Basin, as well as wintertime ozone problems in other parts of the Intermountain West, stem from oil and gas extraction. Levels reached nearly twice the federal standard, potentially dangerous even for healthy adults to breathe. Keith Guille, spokesman for the Wyoming Department of Environmental Quality, said, "We recognize that definitely the main contributor to the emissions that are out there is the oil and gas industry." <sup>54</sup>

March 8, 2011 ó The Associated Press reported that gas drilling in some remote areas of Wyoming caused a decline of air quality from pristine mountain air to levels of smog and pollution worse than Los Angeles on its worst days, resulting in residents complaining of watery eyes, shortness of breath and bloody noses. <sup>55</sup>

November 18, 2010 ó A study of air quality in the Haynesville Shale region of east Texas, northern Louisiana, and southwestern Arkansas found that shale oil and gas extraction activities contributed significantly to ground-level ozone (smog) via high emissions of ozone precursors, including volatile organic compounds and nitrogen. <sup>56 57 58 59</sup>

September, 2010 ó A health assessment by the Colorado School of Public Health for gas development in Garfield County, Colorado determined that air pollution will likely "be high enough to cause short-term and long-term disease, especially for residents living near gas wells. Health effects may include respiratory disease, neurological problems, birth defects and cancer." <sup>60,61</sup>

January 27, 2010 ó Of 94 drilling sites tested for benzene in air over the Barnett Shale, the Texas Commission on Environmental Quality (TECQ) discovered two well sites emitting what they determined to be "extremely high levels" and another 19 emitting elevated levels. <sup>62</sup>

*SOURCE:* <http://concernedhealthny.org/wp-content/uploads/2014/07/CHPNY-Fracking-Compendium.pdf>

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<sup>54</sup> Streater, S. (2011, April 21). Air pollution: Winter ozone problem continues to mystify regulators, industry. E&E Publishing, LLC. Retrieved June 11, 2014, from <http://www.eenews.net/stories/1059948108>

<sup>55</sup> Gruver, M. (2011, March 8). Wyoming is beset by a big-city problem: Smog. USA Today. Retrieved June 11, 2014, from [http://usatoday30.usatoday.com/money/industries/energy/2011-03-08-natural-gas-ozone-wyoming\\_N.htm](http://usatoday30.usatoday.com/money/industries/energy/2011-03-08-natural-gas-ozone-wyoming_N.htm)

<sup>56</sup> U.S. Environmental Protection Agency. (2013). Integrated Science Assessment for Ozone and Related Photochemical Oxidants. Retrieved June 11, 2014, from <http://www.epa.gov/ncea/isa/ozone.htm>

<sup>57</sup> Kemball-Cook, S., Bar-Ilan, A., Grant, J., Parker, L., Jung, J., Santamaria, W., ... Yarwood, G. (2010). Ozone Impacts of Natural Gas Development in the Haynesville Shale. *Environmental Science & Technology*, 44(24), 9357-9363. doi: 10.1021/es1021137

<sup>58</sup> McKenzie, L. M., Witter, R. Z., Newman, L. S., & Adgate, J. L. (2012). Human health risk assessment of air emissions from development of unconventional natural gas resources. *Science of the Total Environment*, 424, 79-87. doi: 10.1016/j.scitotenv.2012.02.018

<sup>59</sup> Myers, O., Flowers, H., Kang, H., Bedrick, E., Whorton, B., Cui, X., & Stidley, C. A. (2007). The association between ambient air quality ozone levels and medical visits for asthma in San Juan County (U.S.A., New Mexico Department of Health, Environmental Health Epidemiology Bureau Epidemiology and Response Division).

<sup>60</sup> Witter, R., McKenzie, L., Towle, M., Stinson, K., Scott, K., Newman, L., & Adgate, J. (2010). Health impact assessment for Battlement Mesa, Garfield County Colorado. Colorado School of Public Health. Retrieved June 10, 2014, from <http://www.garfield-county.com/public-health/documents/1%20%20Complete%20HIA%20without%20Appendix%20D.pdf>

<sup>61</sup> Battlement Mesa HIA/EHMS. (2013, November 30). Retrieved June 10, 2014, from <http://www.garfield-county.com/environmental-health/battlement-mesa-health-impact-assessment-draft2.aspx>

<sup>62</sup> The Associated Press. (2010, January 27). Texas agency finds high benzene levels on Barnett Shale. Retrieved June 10, 2014, from [http://www.nola.com/business/index.ssf/2010/01/texas\\_agency\\_finds\\_high\\_benzen.html](http://www.nola.com/business/index.ssf/2010/01/texas_agency_finds_high_benzen.html)

**EXHIBIT 4:**

**MINUTES OF SELECT MEC MEETINGS**

**MEETING MINUTES OF THE**

**NORTH CAROLINA MINING AND ENERGY COMMISSION**

**May 15-16, 2014**

William G. Ross Jr. Conference Room, Nature Research Center, RALEIGH, NC

Ms. Therese Vick (Blue Ridge Environmental Defense League) expressed her concern about the MEC not properly addressing rules to protect air quality. She stated that her organization had asked the Environmental Management Commission (EMC) to address air quality matters, but that the EMC had not responded. Ms. Vick talked about oil and gas industry activities degrading air quality and asked that the MEC study air quality matters and develop rules for air quality. She also stated concern about draft legislative language within Senate Bill 786 which would make the accidental disclosure of trade secret information a felony.

**MEETING MINUTES OF THE**

**NORTH CAROLINA MINING AND ENERGY COMMISSION**

**April 16, 2014**

GROUND FLOOR HEARING ROOM, ARCHDALE BUILDING, RALEIGH, NC

Therese Vick (Blue Ridge Environmental Defense League) mentioned concerns about adverse impacts to air quality resulting from oil and gas operations. She described multiple instances of air pollution that had occurred over the past year at various locations in the US. She stated that the US EPA was too slow in its development of new air quality regulations and expressed her disappointment with the MEC not requiring air emission monitoring at oil and gas sites. Ms. Vick recommended that the MEC draft respective rules for the Environmental Management Commission to consider.

*SOURCE:* [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=a4ea6648-fcdd-436b-8788-115d12fa4929&groupId=8198095](http://portal.ncdenr.org/c/document_library/get_file?uuid=a4ea6648-fcdd-436b-8788-115d12fa4929&groupId=8198095)

*SOURCE:* [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=9773d2fe-3aa4-4a10-8927-0b944175bb90&groupId=8198095](http://portal.ncdenr.org/c/document_library/get_file?uuid=9773d2fe-3aa4-4a10-8927-0b944175bb90&groupId=8198095)

**MEETING MINUTES OF THE**

**NORTH CAROLINA MINING AND ENERGY COMMISSION**

**January 31, 2014**

MEC Meeting Ms. Therese Vick (BREDL) referenced a study from the University of Colorado's School of Public Health. She stated that the study had been peer reviewed and provided copies of an article referencing the study. Ms. Vick stated that BREDL never supported a 500 foot setback and also explained that empirical data regarding setback distances existed. She cited an example of a recommendation from an article stating that hospitals or schools should not be located within 1000 feet of areas with high volume truck traffic. Ms. Vick stated that groups of idling trucks could increase cancer risks to the population. She also talked about references to "Big Foot" and displayed her "Big Foot" t-shirt to the MEC. Ms. Vick referenced a report from the League of Women Voters regarding the impacts to public health resulting from industrial shale gas activities. She also explained that the oil and gas industry had "the back door" and had resources that others did not have.

*SOURCE:* <http://portal.ncdenr.org/web/mining-and-energy-commission/mec-01-31-2014>

**MEETING MINUTES OF THE**

**NORTH CAROLINA MINING AND ENERGY COMMISSION**

**ENVIRONMENTAL STANDARDS COMMITTEE**

**September 5, 2013**

Therese Vick (Blue Ridge Environmental Defense League) ó Ms. Vick expressed her belief that the setback numbers provided in the draft rules were too low. Ms. Vick asked about variances and whether a home purchaser or the home mortgage company was considered the property owner. She stated that no health risk assessment study had been completed and requested that all comments regarding the rule set development show all track changes for the setback rules and be placed on line. She mentioned a study from West Virginia showing that setbacks of 625 ft were not far enough.

Martha Girolami (Chatham County resident) ó Ms. Girolami talked about health studies related to air quality and also explained that various chemicals become airborne from oil and gas wells, as well as from holding ponds. Children, pregnant women, and elderly people will have to vacate their homes due to oil and gas operations.

*SOURCE:* <http://portal.ncdenr.org/web/mining-and-energy-commission/esc-09-5-2013>

**MEETING MINUTES OF THE  
NORTH CAROLINA MINING AND ENERGY COMMISSION  
ENVIRONMENTAL STANDARDS COMMITTEE  
July 25, 2013**

Therese Vick (Blue Ridge Environmental Defense League) talked about noise impacts on hearing and how prolonged exposure can induce hypertension, sleep deprivation, and mood disruptions. Ms. Vick also mentioned that a West Virginia University study indicated that greater setback distances were needed from oil and gas operations due to the presence of benzene; she stated that she will forward the study to the Committee.

*SOURCE:* <http://portal.ncdenr.org/web/mining-and-energy-commission/esc-07-25-2013>

**MEETING MINUTES OF THE  
NORTH CAROLINA MINING AND ENERGY COMMISSION  
ENVIRONMENTAL STANDARDS COMMITTEE  
May 2, 2013**

Therese Vick, Blue Ridge Environmental Defense League and a Chatham County resident, also echoed concerns over the lack of required air quality testing that is in the current draft rules; provided an EPA report óEPA Needs to Improve Air Emissions Data for the Oil and Natural Gas Production Sectorö (see attached report).

*SOURCE:* <http://portal.ncdenr.org/web/mining-and-energy-commission/esc-05-02-2013>