

# Do Natural Gas Wells, Pipelines and Compressor Stations Leak, Potentially Endangering Our Water, Land, And Lives?

## YOU BETCHA!

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There has been much discussion and debate about the benefits of moving from coal to natural gas – “a cleaner energy source”. With the surge in shale gas discovery and development, natural gas, which is approximately 90% methane, is a growing part of our nation’s energy mix. There are now more than 40,000 shale gas wells in operation in the U.S. today – three times as many as in 2005.<sup>1</sup>

Natural gas as a means to produce electricity has been hailed by the Intergovernmental Panel on Climate Change<sup>2</sup> as the fuel that can act as a “bridge” between carbon-heavy coal and zero-carbon renewables, helping to reduce humans’ impact on the climate.<sup>3</sup> “One reason natural gas is called “clean” is because it emits 50 percent less carbon dioxide than coal when you burn it. Thus it’s seen by some as a ‘bridge’ fuel until zero-carbon-producing renewables can take over. But natural gas isn’t clean in the way that solar is clean. It’s clean-er than coal. It’s better than the worst; that’s all.”<sup>4</sup>

In fact, methane is a potent greenhouse gas that traps 86 times more heat as CO<sub>2</sub> does over a 20-year period. Scientists have warned that methane emissions from the natural gas industry are a significant contributor to climate change, and in 2013, President Obama’s Climate Action Plan stated that “curbing emissions of methane is critical to our overall effort to address global climate change.”<sup>5</sup>

Most studies have shown that about 50% of the methane leakage from natural gas comes from drilling sites and gas processing plants with the remainder (about 50%) coming from pipelines, compressors, and storage systems.

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<sup>1</sup> Tracking down fugitive methane leaks, Picarro Surveyor’s highly-sensitive, mobile technology helps detect gas leaks along the natural gas supply chain, Environmental Defense Fund, accessed 9 November 2014, <http://www.edf.org/energy/innovation/gas-leak-detection-innovation>

<sup>2</sup> IPCC, Intergovernmental Panel on Climate Change, Working Group III, - Mitigation of Climate Change, Chapter 7, Energy Systems, 2014, accessed 9 November 2014, [http://report.mitigation2014.org/drafts/final-draft-postplenary/ipcc\\_wg3\\_ar5\\_final-draft\\_postplenary\\_chapter7.pdf](http://report.mitigation2014.org/drafts/final-draft-postplenary/ipcc_wg3_ar5_final-draft_postplenary_chapter7.pdf)

<sup>3</sup> Huge Methane Leaks Add Doubt on Gas as ‘Bridge’ Fuel, by Bobby Magil, Climate Central, Published: April 15th, 2014, accessed 9 November 2014, <http://www.climatecentral.org/news/huge-methane-leaks-add-doubt-on-natural-gas-as-a-bridge-fuel-17309>

<sup>4</sup> Is Natural Gas “Clean”? By Mark Bittman, September 30, 2013, NY Times, accessed 9 November 2014, [http://opinionator.blogs.nytimes.com/2013/09/30/is-natural-gas-clean/?\\_r=0](http://opinionator.blogs.nytimes.com/2013/09/30/is-natural-gas-clean/?_r=0)

<sup>5</sup> EPA Is Failing To Stop Methane Leaks From Pipelines, Inspector General Says, BY KATIE VALENTINE POSTED ON JULY 26, 2014 AT 12:01 PM, accessed 9 November 2014, <http://thinkprogress.org/climate/2014/07/26/3464570/epa-inspector-general-methane-report/>

## NATURAL GAS HAS HIDDEN CLIMATE RISKS

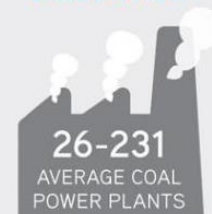
**METHANE** – A PRIMARY COMPONENT OF NATURAL GAS – LEAKS FROM DRILLING SITES AND PIPELINES. IT IS **25 TIMES MORE POTENT** THAN CARBON DIOXIDE AT TRAPPING HEAT.

1-9% of all natural gas produced **ESCAPES** into the atmosphere



U.S. 'FUGITIVE' METHANE EMISSIONS (2012)  
Equivalent CO<sub>2</sub> Emissions in Million Metric Tons (MMT)

THAT'S EQUIVALENT  
TO THE HEAT-TRAPPING  
EMISSIONS FROM:



©2014 Union of Concerned Scientists; [www.ucsusa.org/fugitiveemissions](http://www.ucsusa.org/fugitiveemissions)

If that were not bad enough, studies show that methane emissions are higher for hydraulic fracturing of shale gas than conventional natural gas production.<sup>6</sup> The natural gas produced in the Marcellus shale region is generally referred to as “wet” gas and has many contaminants.

According to Sara Delgado, “Natural gas from the wellhead can have a number of contaminants including carbon dioxide, water, sulfur compounds and solids. These contaminants are removed during the treating and processing of natural gas (before the gas goes into the interstate pipeline), leaving mostly methane which must meet pipeline specifications in order to be transported. Natural gas is often classified as dry or wet. Dry gas needs very little treating and processing before it goes into the pipeline. Wet gas consists primarily of methane but also contains varying amounts of natural gas liquids such as ethane (C<sub>2</sub>); propane (C<sub>3</sub>); normal butane (NC<sub>4</sub>); isobutane (IC<sub>4</sub>); pentanes plus (C<sub>5</sub>+ ) which are all hydrocarbons. Wet gas does

<sup>6</sup> Infographic: The Climate Risks of Natural Gas — Fugitive Methane Emissions: Fugitive methane emissions are 25 times more potent than carbon dioxide at trapping heat, Union of Concerned Scientist, accessed 9 November 2014, [http://www.ucsusa.org/clean\\_energy/our-energy-choices/coal-and-other-fossil-fuels/infographic-natural-gas-fugitive-methane-emissions.html#.VF9xo\\_nF9v0](http://www.ucsusa.org/clean_energy/our-energy-choices/coal-and-other-fossil-fuels/infographic-natural-gas-fugitive-methane-emissions.html#.VF9xo_nF9v0) AND [http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean\\_energy/Climate-Risks-of-Natural-Gas-Infographic-Fugitive-Methane-Emissions.pdf](http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_energy/Climate-Risks-of-Natural-Gas-Infographic-Fugitive-Methane-Emissions.pdf)

need to be treated and processed to remove these natural gas liquids or NGLs".<sup>7</sup> EQT/NextEra may in fact remove all the contaminants before it enters the interstate transmission line, but there are reports that compressor stations are used along routes to continue to clean the fracked gas before it reaches its final destination – in the case of the MVP that final destination will be the Transco station 165 in Pittsylvania County. The U.S. Department of Energy has announced a series of initiatives aimed at curbing methane emissions from the nation's natural gas infrastructure.<sup>8</sup>

An analysis published in *Science* concluded that more methane is leaking from natural gas wells and pipelines than the federal government has estimated, eroding some of the climate benefits of the cleaner-burning fuel<sup>9</sup>. The report cites the results made by sixteen researchers from Stanford, the National Renewable Energy Laboratory, University of Michigan, MIT and elsewhere. They reviewed more than 200 studies estimating how much methane, a potent greenhouse gas, escapes into the atmosphere.<sup>10</sup>

The panel concluded that actual methane emissions are 25 to 75 percent higher than the estimates published by the Environmental Protection Agency's national Inventory of Greenhouse Gas Emissions and Sinks.<sup>11</sup>

Another recent study adds to the growing evidence those escaping gases, called "fugitive" emissions, are numerous, especially methane emissions while a well is being drilled, a phase of well development previously thought to emit little if any methane. The study, conducted by researchers at Purdue and Cornell universities<sup>12</sup> and other institutions, is one of numerous studies conducted over the past several years that have discovered methane leaking from oil and natural gas wells, pipelines and hydraulic fracturing operations.<sup>13</sup>

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<sup>7</sup> Sara Delgado, Sr. Communication Specialist, Communications & Strategic Outreach, Williams Partners. In response to an email inquiry. Response received on November 26, 2014.

<sup>8</sup> U.S. Department of Energy seeks to curb methane emissions from gas infrastructure, JULY 29, 2014 | 5:15 PM By Marie Cusick, accessed on 8 November 2014, <http://stateimpact.npr.org/pennsylvania/2014/07/29/u-s-department-of-energy-seeks-to-curb-methane-emissions-from-gas-infrastructure/>

<sup>9</sup> Methane Leaks from North American Natural Gas Systems, Energy and Environment Policy Forum, *Science* 14 February 2014, Vol. 343 no 6172 pp. 733-735, by A. R. Brandt, G. A. Heath, E. A. Kort, F. O'Sullivan, G. Pétron, S. M. Jordaan, P. Tans, J. Wilcox, A. M. Gopstein, D. Arent, S. Wofsy, N. J. Brown, R. Bradley, G. D. Stucky, D. Eardley, R. Harriss, accessed on 9 November 2014. <https://www.sciencemag.org/content/343/6172/733.summary>

<sup>10</sup> New Study Shows Total North American Methane Leaks Far Worse than EPA Estimates, by Sharon Kelly, posted Fri, 2014-02-14 12:40, accessed on 9 November 2014. <http://www.desmogblog.com/2014/02/14/new-study-shows-total-north-american-methane-leaks-far-worse-epa-estimates>

<sup>11</sup> Do Methane Leaks Negate Climate Benefits of Natural Gas? Four Takeaways From a New Science Study, Posted February 14, 2014 by Jesse Jenkins, *The Energy Collective*, accessed 9 November 2014, <http://theenergycollective.com/jessejenkins/341086/do-methane-leaks-negate-climate-benefits-natural-gas-four-takeaways-new-science->

<sup>12</sup> Huge Methane Leaks Add Doubt on Gas as 'Bridge' Fuel, by Bobby Magil, April 15, 2014, Climate Central, accessed on 9 November 2014. <http://www.climatecentral.org/news/huge-methane-leaks-add-doubt-on-natural-gas-as-a-bridge-fuel-17309>

<sup>13</sup> A Close Look at Fugitive Methane Emissions from Natural Gas, by James Bradbury James Bradbury and Michael Obeiter - April 02, 2013, World Resources Institute, accessed on 9 November 2014. <http://www.wri.org/blog/2013/04/close-look-fugitive-methane-emissions-natural-gas>

“Over a 100-year timeframe, methane is about 35 times as potent a climate change-driving greenhouse gas than carbon dioxide, and over 20 years, it's 84 times more potent. Natural gas drilling could emit up to 1,000 times the methane previously thought, possibly significantly increasing the greenhouse gas footprint of the production of natural gas, the study shows.”<sup>14</sup>

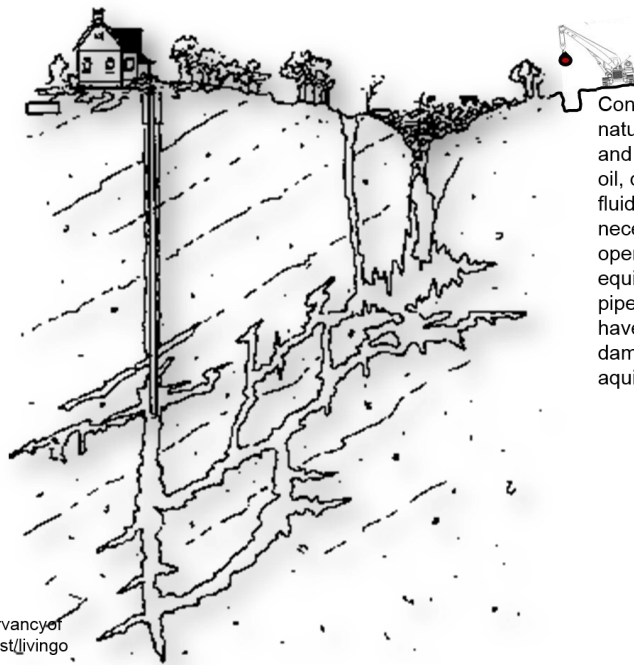
Despite its great promise though, current production practices impose unacceptable impacts on air, water and landscapes. Methane leakage is a key area of concern, as leaks during the production, distribution and use of natural gas have the potential to undermine and possibly even reverse the greenhouse gas advantage that natural gas has over coal or oil.<sup>15</sup>

### Construction of the Pipeline can be damaging to Aquifers

The proposed pipelines will be 42” in diameter, among the largest ever. Each will push 2 billion cubic feet of methane at 1,400 psi per day – that is more than 23,000 cu. ft. passing by any point along the route per second. The proposed pipelines will go over karst topography and will need to be buried in trenches that will be a minimum of 5’ wide and upwards of 8’ – 11’ deep requiring digging and blasting in karst topography. None of the companies proposing pipelines through Virginia have ever constructed pipelines of this size going over mountainous and karst topography – so we will serve as a guinea pig and will provide them with on-the-job OR on-the-karst training.<sup>16</sup>

#### Problems of Natural Gas Pipelines Over Karst Topography

Homeowner whose water source is a well.



Construction of a natural Gas Pipelines and the likely leaks of oil, diesel fuel, hydraulic fluids, gasoline, etc. all necessary for the operation of heavy equipment used in pipeline construction have the potential to be damaging to a karst aquifer.

<http://www.caveconservancyofvirginia.org/livingonkarst/livingonkarst.htm>

There is a growing body of empirical research which provides evidence of the dangers to underground air and water due to construction of natural gas pipelines over or near sinkholes.

<sup>14</sup> New Methane Leak Data Adds Doubt About Future Of Natural Gas As 'Bridge' Fuel, Climate Central | By Bobby Magill, Posted: 04/16/2014 2:47 pm EDT Updated: 04/16/2014 2:59 pm EDT, accessed 9 November 2014, [http://www.huffingtonpost.com/2014/04/16/methane-leak-natural\\_n\\_5161247.html](http://www.huffingtonpost.com/2014/04/16/methane-leak-natural_n_5161247.html)

<sup>15</sup> Tracking down fugitive methane leaks, Picarro Surveyor's highly-sensitive, mobile technology helps detect gas leaks along the natural gas supply chain, Environmental Defense Fund, accessed 9 November 2014, <http://www.edf.org/energy/innovation/gas-leak-detection-innovation>

<sup>16</sup> <http://www.caveconservancyofvirginia.org/livingonkarst/livingonkarst.htm>

Obviously, many/most of the sinkholes lead to, or are part of, a cave system, so the impact on sinkholes naturally results in a detrimental impact to caves. Also, many caves in Virginia have archeological significance as well as being the home for many different types of animals including eight different species of bats with three species - Indiana bat, Gray bat, and Virginia Big-eared bat - being listed on the Federal Endangered Species List. So the construction of the pipelines and the subsequent natural gas going through them will have potentially devastating results on the karst topography, underground aquifers, and endangered species.

A number of organizations have contributed to understanding karst typography<sup>17</sup> including the American Cave Conservation Association, Cave Conservancy of the Virginias,<sup>18</sup> Commonwealth of Pennsylvania Department of Environmental Protection,<sup>19</sup> Illinois Basin Consortium, National Park Service, U.S. Bureau of Land Management, USDA Forest Service, U.S. Department of the Interior,<sup>20</sup> U.S. Fish and Wildlife Service, the U.S. Geological Survey,<sup>21</sup> The Virginia Department of Mines Minerals and Energy<sup>22 & 23 & 24</sup> .

Even as landowners, County and Commonwealth officials battle the merits of the EQT/NextEra proposed Mountain Valley Pipeline, sinkhole and cavern-riddled geology poses major construction and operational challenges to the developers.

Steel transmission pipelines as proposed by EQT/NextEra going through mountain areas will face significant risks during their construction and operating life. One of the biggest challenges is to protect the pipe and its external coatings against mechanical damage from impact and penetration.

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<sup>17</sup> Living with Karst: A Fragile Foundation. AGI Environmental Awareness Series. 2001, accessed on 9 November 2014. <http://www.americangeosciences.org/sites/default/files/karst.pdf>

<sup>18</sup> Living on Karst: A Reference Guide for Landowners in Limestone Regions, Produced by the Cave Conservancy of the Virginias, June 1997, Carol Zokaities, editor, accessed on 9 November 2014. [http://www.caveconservancyofvirginia.org/livingonkarst/living\\_on\\_karst\\_ccv\\_1997\\_booklet.pdf](http://www.caveconservancyofvirginia.org/livingonkarst/living_on_karst_ccv_1997_booklet.pdf)

<sup>19</sup> Sinkholes, Fact Sheet, Commonwealth of Pennsylvania Department of Environmental Protection, accessed on 9 November 2014. [https://www.dep.state.pa.us/dep/deputate/minres/bmr/factsheets/eLibrary\\_temp/Sinkholes/5300-FS-DEP4045.pdf](https://www.dep.state.pa.us/dep/deputate/minres/bmr/factsheets/eLibrary_temp/Sinkholes/5300-FS-DEP4045.pdf)

<sup>20</sup> Mapping Sinkholes and Areas of Surface Mapping Sinkholes and Areas of Surface Water Water--Groundwater Interaction in Relation Groundwater Interaction in Relation to Geologic Structure to Geologic Structure, by Daniel H. Doctor, Eastern Earth Surface Processes Team, Reston, VA with acknowledgments: Katarina Doctor (George Mason University), David Nelms, George Harlow, Kurt McCoy, Mark Kozar (USGS-WRD), David Weary and Randall Orndorff (USGS-GD) USGS Science for a changing world, U.S. Department of the Interior [http://va.water.usgs.gov/GreatValley/ForumOctober2009/DOCTOR\\_Sinkholes\\_GreatValleyForum\\_2009a.pdf](http://va.water.usgs.gov/GreatValley/ForumOctober2009/DOCTOR_Sinkholes_GreatValleyForum_2009a.pdf)

<sup>21</sup> The Science of Sinkholes, Categories: Featured, Natural Hazards, Posted On March 11, 2013 At 5:48 Am, Last Update 11:16 AM By: Jessica Robertson (Jrobertson@USGS.GOV) AND RANDALL ORNDORFF ([RORNDORFF@USGS.GOV](mailto:RORNDORFF@USGS.GOV)), accessed on 9 November 2014. [http://www.usgs.gov/blogs/features/usgs\\_top\\_story/the-science-of-sinkholes/](http://www.usgs.gov/blogs/features/usgs_top_story/the-science-of-sinkholes/)

<sup>22</sup> Sinkholes and Karst Terrain, Virginia Department of Mines Minerals and energy, accessed 9 November 2014. <http://www.dmme.virginia.gov/dgmr/sinkholes.shtml>

<sup>23</sup> Sinkholes, Virginia Department of Mines Minerals and energy, accessed 9 November 2014. <http://www.dmme.virginia.gov/dgmr/pdf/sinkholes.pdf>

<sup>24</sup> Karst Assessment Standard Practice [http://www.dcr.virginia.gov/natural\\_heritage/documents/karst\\_assessment\\_guidelines.pdf](http://www.dcr.virginia.gov/natural_heritage/documents/karst_assessment_guidelines.pdf)

According to Vlad Propovci and Bredero Shaw, geography will be a significant risk factor with two sub-categories: "topography and geology. Mountain areas can have a challenging topography such as steep slopes, river and lake crossings. Geology can also raise issues during both construction and operation, with companies faced with hard rock, wet or frozen ground conditions, earthquake and fault zones, erosion and landslides, karst and sinkholes.<sup>25</sup>

According to Dr. Ralph Ewers, a Karst Hydrogeologist, states, "The natural conduits in karst terrain provide routes through which both liquids and gasses can move freely. The speed of water movements in these features revealed by tracer testing has shown conclusively that velocities equal to ordinary walking and jogging speeds are not uncommon for waters coursing through them. Thus, locations a mile or more from a leak site could be affected before a leak site is identified."<sup>26</sup> Leaks of oil, diesel fuel, hydraulic fluids, gasoline from the heavy equipment necessary to construct an interstate natural gas pipeline can introduce significant contaminants to underground karst acquirers and thus to the drinking water from wells which many of us in Southwest Virginia rely on.

The route of the proposed Mountain Valley Pipeline will intersect several Significant Cave Conservation Sites<sup>27</sup> and there are several other sites just north and south of the proposed route and within the MVP study area. In addition to the Significant Cave Conservation Sites, there are more than 200 additional caves within the MVP study area.

### **Compressor Stations**

And then there are the dangers posed by compressor stations. Along the route of the proposed Mountain Valley Pipeline will be compressor stations. Each compressor station will have between 2 and 15 compressors depending on the final volume of gas to be distributed by EQT/NextEra. Not only will the compressor run on natural gas as stated by EQT/NextEra at a recent meeting with the Montgomery County Board of Supervisors at a working meeting held at the Blacksburg High school on 5 November with more than 1,000 concerned citizens in attendance,<sup>28</sup> the compressor stations will emit huge amounts of methane gas into the atmosphere. The Department of Energy is taking first steps to look into mandatory energy efficiency standards for natural gas compressors, which are devices that compress gas and push it down pipelines. The devices are estimated to use up 7 percent of the gas consumed in the United States.<sup>29</sup> & <sup>30</sup>

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<sup>25</sup> Protecting pipelines in mountain areas by Vlad Popovici, Bredero Shaw, Toronto, Canada, Pipelines International, December 2009, accessed on 9 November 2014.

[http://pipelinesinternational.com/news/protecting\\_pipelines\\_in\\_mountain\\_areas/009326/](http://pipelinesinternational.com/news/protecting_pipelines_in_mountain_areas/009326/)

<sup>26</sup> The Proposed Bluegrass Pipeline: A Bad Deal For America, Kentucky, And Those Who Inherit Our Land, 2013, accessed on 9 November 2014, <http://www.nobluegrasspipeline.com/ky-terrain.html>

<sup>27</sup> A *Significant Cave* is one which meets three of nine significant criteria, such as it contains a rare and endangered species.

<sup>28</sup> Montgomery County Board of Supervisors Meeting with EQT/NextEra, November 6, 2014.

[https://www.youtube.com/watch?feature=player\\_embedded&v=0K8vp0RM7qU](https://www.youtube.com/watch?feature=player_embedded&v=0K8vp0RM7qU)

<sup>29</sup> METHANE: DOE discloses first steps to curb leaks in natural gas systems, Gayathri Vaidyanathan, E&E reporter, ClimateWire: Wednesday, July 30, 2014, accessed 8 November 2014,

<http://www.eenews.net/stories/1060003765>

<sup>30</sup> Energy Efficiency Criteria Coming for Compressors: U.S. Energy Department program directed at pipeline leaks, *Published: 07/30/2014 08:54 AM*, accessed 8 November 2014,

<http://www.compressortech2.com/July-2014/Energy-Efficiency-Criteria-Coming-for-Compressors/#.VF66tvnF9v0>

## **Summary**

Drilling sites, pipelines and compressor stations leak dangerous methane gas and possibly other contaminants into the atmosphere posing a health risk to all of us living along the pipeline. Construction of an interstate pipeline poses other risks to karst aquifers.

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