STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-2, SUB 1095
DOCKET NO. E-7, SUB 1100
DOCKET NO. G-9, SUB 682

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of Application of Duke Energy Corporation and Piedmont Natural Gas Company Inc., to Engage in Business Combination Transaction and Address Regulatory Conditions and Codes of Conduct	) DIRECT TESTIMONY) OF TOUCHÉ HOWARD) FOR NC WARN,) THE CLIMATE TIMES) AND NC HOUSING) COALITION

Q. PLEASE STATE YOUR NAME, OCCUPATION, BUSINESS ADDRESS AND EDUCATION

A. My name is Touché Howard, and I am currently a firefighter with the City of Durham, North Carolina, where I have worked since 2003. My work address is 4900 Highway 55, Suite 160-314, Durham, NC. I worked as a consulting environmental engineer in several areas including the oil and gas industry for over 25 years. This experience includes air emissions measurements at hundreds of oil and gas facilities around the world. I hold a B.S. in Chemical Engineering, and an M.S. in Environmental Engineering, specializing in air emissions and transport.

Q. IN WHAT CAPACITY ARE YOU APPEARING BEFORE THIS COMMISSION?

A. I am appearing as a witness on behalf of NC WARN, The Climate Times ("TCT") and the NC Housing Coalition. NC WARN and The NC Housing Coalition

are interested in this proceeding because many of its members are customers of Duke Energy Carolinas, LLC ("DEC"), Duke Energy Progress ("DEP"), and/or Piedmont Natural Gas ("PNG") who are concerned about the rising risks of generating electricity from natural gas. NC WARN and its members and TCT are also concerned about climate change and pollution caused by the life-cycle emissions of natural gas power plants, including emissions from natural gas production and transportation.

Q. PLEASE EXPLAIN THE PURPOSE OF YOUR TESTIMONY

A. The purpose of my testimony is:

1) To show that methane emissions from natural gas production is far worse than the EPA or the oil and gas industry acknowledge; and
2) The likelihood of new regulations to reduce methane emissions from natural gas production means that the cost of gas could increase.

If this merger is approved, the combined companies' increased use and investment in natural gas transmission and distribution pipelines, compressor stations, and other equipment and facilities for natural gas may also increase the economic, environmental, health and safety risks for Duke Energy ratepayers. Far safer alternatives exist, such as solar, wind and energy efficiency.

1) METHANE EMISSIONS FROM NATURAL GAS PRODUCTION ARE FAR WORSE THAN THE EPA OR THE OIL AND GAS INDUSTRY ACKNOWLEDGE

Q. PLEASE EXPLAIN YOUR EXPERIENCE IN METHANE EMISSIONS FROM NATURAL GAS SYSTEMS

A. I have experience measuring methane emissions from the wellhead to the local distribution system that pipes natural gas to homes, businesses and power plants. I have served as project manager and trainer for fugitive emission measurement and management programs since 1989 at over 500 natural gas facilities. I recently provided instrumentation, training, field measurements, and analysis for a nationwide methane emissions measurement program focused on above- and below-ground emissions from natural gas distribution systems. I have published over 20 papers on topics including methane and other emissions from natural gas and oil production facilities, including a 2015 study by Brian K. Lamb and others, used by the EPA in its April 2016 *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014*. I have also worked for consulting firms that do contract work for various oil and gas companies, and participated in academic research. (See vita, ATTACHMENT A).

In the early 1990s, I invented a device that measures natural gas emissions, called the Hi-Flow Sampler (US Patent RE37,403). In 2003, I assigned the patent to the Gas Research Institute. The commercial version of the device is the Bacharach Hi-Flow Sampler or BHFS, which is approved by the EPA, and is used worldwide to measure methane emissions in the production, storage and delivery of natural gas. (I do not own any rights to the BHFS, nor have I ever financially benefitted from sales of the BHFS, which cost approximately $20,000 each, with about 500 in use.)

Thus, I have direct experience in methane emissions from natural gas production, in the field and as a researcher working with others on data analysis. In 2015, I published two papers in scientific journals, both concerning methane emissions in natural gas production: one addressed why the BHFS was underreporting methane emissions at natural gas production sites,[1] and a second paper that reviewed the findings of a 2013 paper on the direct measurement of methane emissions from natural gas production sites that used the BHFS.[2] From this research, and reading the research of others, I have concluded that methane emissions from natural gas are far worse than either the EPA or others acknowledge.

Q. PLEASE EXPLAIN THE EXTENT OF METHANE EMISSIONS FROM THE PRODUCTION OF NATURAL GAS

A. Methane emissions occur in the routine production of natural gas, from both planned venting (continuous and intermittent) and unintentional leakage (referred to collectively in this testimony as "emissions") throughout the production, storage and delivery of natural gas. Methane emissions from oil and gas production have recently been identified as the largest source of greenhouse gas pollution in the U.S.[3]

---

[1] *Sensor transition failure in the high flow sampler: Implications for methane emission inventories of natural gas infrastructure*, by Touché Howard, Tom Ferrara and Amy Townsend-Small, 3/24/15: http://www.tandfonline.com/doi/abs/10.1080/10962247.2015.1025925

[2] *University of Texas study underestimates national methane emissions at natural gas production sites due to instrument sensor failure*, by Touché Howard, Energy Science & Engineering Volume 3, Issue 5, pages 443–455, September 2015: http://onlinelibrary.wiley.com/doi/10.1002/ese3.81/abstract

[3] *Methane Leaks Erase Climate Benefits of Fracked Gas, Countless Studies Find*, by Joe Romm, Climate Progress, 2/17/16: http://thinkprogress.org/climate/2016/02/17/3750240/methane-leaks-erase-climate-fracked-gas/

Q. DO YOU THINK CURRENT METHANE EMISSION RATE ESTIMATES FROM NATURAL GAS PRODUCTION ARE ACCURATE?

A. No. After decades of experience working at natural gas production sites alongside both academic and industry researchers, and as the inventor of the technology used to measure methane emissions, I believe that current emission rate estimates are far too low.

Q. ARE THERE OTHER STUDIES THAT AGREE WITH YOUR CONCLUSION THAT METHANE EMISSIONS FROM NATURAL GAS PRODUCTION ARE FAR HIGHER THAN CURRENT ESTIMATES?

A. Yes, there many studies that agree with me, including a March 2016 Harvard study that found far higher levels of methane than EPA estimates, a Stanford study that analyzed 200 earlier studies, and many others. The Stanford study stated that "America's natural gas system is leaky," which I agree with wholeheartedly.[4] Much of the EPA emission rates are based on industry-provided estimates, not actual measurements.

2) THE LIKELIHOOD OF NEW REGULATIONS TO REDUCE METHANE EMISSIONS FROM NATURAL GAS PRODUCTION MEANS THAT THE COST OF GAS COULD INCREASE

[4] *By The Time Natural Gas Has a Net Climate Benefit You'll Likely be Dead and the Climate Ruined*, by Joe Romm, ClimateProgress, 2/19/14: http://thinkprogress.org/climate/2014/02/19/3296831/natural-gas-climate-benefit/

Q. ARE THERE CURRENTLY EPA OR STATE REGULATIONS FOR EMISSIONS FROM NATURAL GAS PRODUCTION?

A. Right now, there are no federal regulations for existing natural gas infrastructure. Although a few states such as Colorado have started to address methane emissions from natural gas, efforts to regulate natural gas emissions at the state level have been opposed by industry. The Energy Policy Act of 2005 exempted hydraulic fracturing ("fracking") from federal clean air and clean water rules,[5] an exemption known as the "Halliburton loophole." Because methane emission rates for natural gas production were developed in the early 1990s, they do not reflect the current increase in hydraulically fractured wells, now at 67% of total U.S. gas production.[6]

Q. DID THE EPA RECENTLY RELEASE RULES FOR METHANE EMISSIONS FROM ANY FUTURE NATURAL GAS PRODUCTION SITES?

A. Yes, on May 12, 2016, the EPA released its final rule on emission standards for *new* – but not *existing* – oil and gas wells and well-site equipment. The EPA has yet to release rules for *existing* infrastructure.[7] EPA does not expect to publish rules for existing infrastructure until 2017.

---

[5] *Is the IOGCC, Created by Congress in 1935, Now a Secret Oil and Gas Lobby?,* by Lisa Song, Inside Climate, 4/11/16: http://insideclimatenews.org/news/07042016/iogcc-secret-oil-gas-lobby-interstate-compact-congress-fracking-halliburton-loophole

[6] *Hydraulically fractured wells provide two-thirds of U.S. natural gas production,* EIA, 5/5/16: http://www.eia.gov/todayinenergy/detail.cfm?id=26112

[7] *Oil and Natural Gas Air Pollution Standards,* EPA, https://www3.epa.gov/airquality/oilandgas/actions.html (accessed 6/6/16)

Q. DO YOU BELIEVE FUTURE RULES TO REGULATE METHANE EMISSIONS FROM EXISTING NATURAL GAS WELLS WILL INCREASE THE COST OF NATURAL GAS?

A. Yes, I believe that although we clearly need rules to regulate methane emissions from existing oil and gas production, these rules will likely lead to increased costs for natural gas. In other words, the price that utilities pay for gas could increase due to the additional costs to reduce methane emissions. In this merger, and if the Atlantic Coast Pipeline (ACP) is approved and built, Duke Energy will be responsible for natural gas pipelines and compressor stations, which can be large sources of gas leaks and thus have special safety concerns. Although industry might recoup the money spent to reduce methane emissions by selling the recovered gas, reducing methane loss would require substantial investment.

Q. DOES INDUSTRY SUPPORT THE REGULATION OF METHANE EMISSIONS FROM NATURAL GAS PRODUCTION?

A. I do not believe so. The oil and gas industry was able to evade regulation in the Energy Policy Act of 2005, and has consistently downplayed emissions and lobbied to prevent regulation. In my professional opinion, the oil and gas industry erroneously claims that current emissions are low, and so no regulation is needed.

Q. CAN YOU PLEASE ADDRESS METHANE EMISSIONS AND HOW THEY AFFECT PUBLIC HEALTH AND SAFETY?

A. I believe policy makers underestimate the impact of natural gas use on the climate and on public health – from both methane and other toxic air emissions – and thus fail to take action to guard against these problems. In some cases, such as Denton, TX,[8] or Longmont, Colorado,[9] state legislatures have overridden local legislation enacted to address the concerns of citizens based on a misguided understanding of methane impacts. There are also huge emissions from compressor stations, and a cautionary tale from Minisink, New York, home to a large compressor station.

In the Minisink case, 200 homes were within one mile of the compressor station, and a few within 600 feet. After the compressor station was built and operating, research was done on the health effects from the compressor's emissions. Though average emissions were within EPA guidelines, many people living a mile or less from the compressor station reported disturbing symptoms such as nosebleeds, headaches, rashes and nausea. The research results showed that compressor station emissions spiked many times above EPA limits as often as twice a week, and stayed within guidelines only because emissions were averaged as the EPA required. Air samples showed continuous low levels of toxics gases such as benzene, methane and toluene. These same health problems also showed up among people living near fracking operations in southwestern Pennsylvania. One family

[8] *After Fracking Ban, Denton Residents Ponder Next Steps,* by Jim Malewitz, 6/3/15: https://www.texastribune.org/2015/06/03/more-questions-answers-denton-ponders-next-steps/
[9] *Colorado Supreme Court strikes down Longmont's voter-approved fracking ban,* by Karen Antonacci, Longmont Times-Call, 5/2/16: http://www.timescall.com/longmont-local-news/ci_29839751/colo-supreme-court-strikes-down-longmont-fracking-ban

living less than a mile from the compressor gave up trying to sell their home and lost it to foreclosure.[10]

Methane and toxic air emissions pose an unresolved hazard to gas industry workers as well. There are many examples of pipeline explosions in residential neighborhoods, as well as explosions at natural gas facilities. One well known instance is the explosion in 2010 in San Bruno, California, which killed eight people and destroyed 38 homes. The problem was failing welds, and when the utility increased gas pressure, the welds gave out and the pipeline ruptured and exploded. The utility responsible for the pipeline was fined $1.6 billion, more than its yearly profit.[11]

Q. DO YOU BELIEVE THAT NATURAL GAS EMISSIONS POSE A PROBLEM FOR THE CLIMATE?

A. The Intergovernmental Panel on Climate Change (IPCC) has determined that methane is 100 times more potent than carbon dioxide over a ten-year period in terms of climate impacts. Methane is the dominant component of natural gas, which can also include heavier hydrocarbons such as ethane, propane, and butane. There are growing concerns that the heat-trapping characteristics of methane emissions from the natural gas system might substantially exceed any climate benefits that

[10] *The Monster of Minisink: a Cautionary Tale*, by Elaine Ulman, The Recorder, 4/6/16: http://www.recorder.com/Opinion/Columns/-The-Monster-of-Minisink---a-cautionary-tale-1369712

[11] *PG&E slapped with $1.6 billion fine for brutal San Bruno explosion,* by George Avalos, San Jose Mercury News, 4/10/15: http://www.mercurynews.com/portlet/article/html/fragments/print_article.jsp?articleId=27880159&siteId=568

might be gained as the electric power industry and others replace coal and oil with natural gas, including fracking or shale gas.

As a firefighter, I recognize the danger to the climate in the increased intensity and duration of wildfires. I also recognize the danger to our communities and oil and gas workers of toxic emissions and explosions. I know that there are safer, cheaper alternatives to natural gas, and I believe that these cleaner energy sources serve our communities better than expanding the use of natural gas. I am not "against" natural gas, but I believe it should be used as sparingly as possible. The truth is that we simply do not understand the level of emissions across this industry. It is almost certainly higher than studies have shown, and we can take steps now to greatly reduce our dependence on natural gas.

Q. BASED ON YOUR ANSWERS TO THE PREVIOUS QUESTIONS, DO YOU BELIEVE THAT THE PROPOSED MERGER HAS UNDERLYING RISKS TO RATEPAYERS?

A. Yes. The combined companies' increased use and investment in natural gas and associated infrastructure could make the company and its ratepayers more vulnerable to increases in natural gas costs that result from more stringent methane emissions regulations. Furthermore, increased reliance on natural gas holds serious environmental, health and safety risks that will adversely impact both the companies' ratepayers and other vulnerable communities and workers.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

ATTACHMENT A

Touché Howard

Education

B.S. Chemical Engineering, University of Idaho, 1984.

M.S. Environmental Engineering, Washington State University, 1991. Specialization in air pollution emissions and transport.

Experience

Special Projects Manager, Indaco, Inc.
Pullman, WA/ Fayetteville, NC/Durham, NC (1988 – present)

Mr. Howard is the inventor of the Hi-Flow Sampler (US Patent RE37,403) and the developer of the Vent-Bag™, both of which are used to measure natural gas leak rates and are measurement methods approved under the EPA Mandatory Reporting Rule (MRR) for Greenhouse Gases for natural gas compressor stations and tanks. Mr. Howard has also served as a project manager and trainer for fugitive emission measurement and management programs since 1989. In this capacity, he has conducted measurement and training programs at over five hundred natural gas facilities throughout North America, Europe, and the Former Soviet Union. He has also assisted clients in submitting comments to the EPA during rulemaking periods. Mr. Howard recently provided instrumentation, training, field measurements, and analysis for a nationwide methane emissions measurement program focused on above and below ground leakage from natural gas distribution systems. Representative projects include:

- Nationwide leak measurements at natural gas distribution systems conducted in cooperation with 15 natural gas distribution companies (Sponsor: Environmental Defense Fund/Private Clients).
- Leak measurements from abandoned oil and gas wells (Sponsor: Environmental Defense Fund)
- Leak measurements at over 200 natural gas compressor stations in the United States (Sponsors: US EPA/GRI/Private Clients).
- Measurement of trends in leak rates at natural gas compressor stations and metering and regulating stations (Sponsors: PRCI/GRI/US EPA).
- Leak measurements and training using the Hi-Flow sampler at natural gas compressor stations and metering and regulating stations in Russia (Sponsor: US EPA and private clients).
- Leak measurements and training using the Hi-Flow sampler at natural gas compressor stations and metering and regulating stations in Ukraine (Sponsors: US DOE, US AID, and private clients).
- Leak measurements and training using the Hi-Flow sampler at metering and regulating stations in Ukraine (Sponsors: Private Clients).

- Leak measurements and training at natural gas compressor stations and from underground pipelines in Kyrgyzstan, Kazakhstan, and Uzbekistan (Sponsor: European Commission).
- Development of a unified leak measurement data base integrating data from six different companies with over 7000 measurements from approximately 100 sites (Sponsor: Private clients).
- Fugitive air emissions measurements from over fifty Arctic oil production facilities (Sponsors: BP/ARCO).
- Risk evaluation of sour gas well head accidents using field tracer techniques (Sponsor: Energy Resources Conservation Board, Alberta, Canada)
- Evaluation of chemical emission models for area sources using field tracer techniques (Sponsor: American Petroleum Institute).
- Preparation of monitoring plans for EPA GHG MRR programs.
- Quality assurance reviews of EPA MRR leak measurement data.

Research Assistant
Lab for Atmospheric Research, Washington State University – Pullman, WA (1984 – 1987)

- Operation of WSU Clean Air Facility at Palmer Station, Antarctica for a one year period monitoring remote greenhouse gases and ozone depleting chemicals.
- Development of SF6 measurement instrumentation
- Assisted in building ventilation studies, wind tunnel simulations, and dispersion measurements at Arctic oil facilities.
- Measurement of emissions from refinery wastewater facilities.

Patents, Licenses, and Certifications

- US Patent RE37,403 – "A High Flow Sampler for Leak Measurements at Process Components"
- Registered professional engineer (1993-2012)
- Firefighter I and II (State of North Carolina, NFPA 1001 1997)
- Rescue Technician – NFPA 1006
- Emergency Medical Technician – Intermediate (State of North Carolina)
- Hazardous Material Technician Level II (NFPA 472 1997)
- Swift Water Rescue Technician -- Advanced (NFPA 1670)
- Urban Search and Rescue -- Structural Collapse Rescue Technician

Publications and Presentations

Davies, M.J.E., M.P. Brennand, L.D. Holizki, and T. Howard, 1991. Minimum dilution in the atmosphere and the application to uncontrolled gas releases. Presented at the 84th Annual Meeting of the Air and Waste Management Association, Paper No. 91-84.5.

Holizki, L. D., M.J.E. Davies, and T. Howard, 1991. Modeling and field measurement of atmospheric dispersion for a well blowout or pipeline rupture. Presented at the 84th Annual Meeting of the Air and Waste Management Association, Paper No. 91-86.3.

Hosick, T., T. Howard, and B. Lott, 1993. Fundamental uncertainties in estimating fugitive emissions using screening concentrations at process components. Presented at the 1993 American Institute of Chemical Engineers Summer National Meeting, Seattle, WA.

Howard, T., R. Siverson, A. Wenzlick, and B. Lott, 1994. A high flow rate sampling system for measuring emissions from leaking process components. Presented at the 1994 International Workshop on Environmental and Economic Impact of Natural Gas Losses, Prague, Czech Republic.

Howard, T., and B. Lamb, 1992. Measured and modeled values of mass transfer coefficients for volatile organic compounds in refinery wastewater impoundments. Presented at the 85th Annual Meeting of the Air and Waste Management Association, Paper No. 92-103.06.

Howard, T., and B. Lamb, 1996. Real time atmospheric measurements of fume hood exhaust recirculation and impact on clean air intakes at a laboratory research center. Ninth Conference on the Applications of Air Pollution Meteorology, 76th Annual Meeting of the American Meteorological Society, Atlanta, GA, 1996.

Howard, T., B. Lamb, W.L. Bamesberger, and P. Zimmerman, 1992. Measurement of hydrocarbon emission fluxes from refinery wastewater impoundments using atmospheric tracer techniques. J. Air Waste Manage. Assoc. 42, 1337.

Howard, T., H. Westberg, R. Martin, J. Rydock, J. Greenberg, D. Fashimpaur, and K. Jelinek, 1993. Measurement of fugitive hydrocarbon emissions from oil production facilities using indoor tracer techniques. Presented at the 1993 American Institute of Chemical Engineers Summer National Meeting, Seattle, WA.

Howard, T., 1993. Uncertainties in modeling air emissions from refinery wastewater impoundments. Presented at the American Petroleum Institute Air Toxics and Total VOC Emissions Estimating Workshop, San Diego, CA, 1993.

Howard, T. 2015. University of Texas study underestimates national methane emissions at natural gas production sites due to instrument sensor failure. Energy Sci. Engineer. doi:10.1002/ese3.81.

Howard, T., Ferrara, T.W., Townsend-Small, A. 2015. Sensor transition failure in the high volume sampler: Implications for methane emissions estimates from natural gas infrastructure, *Journal of the Air and Waste Management Association* **2015**, 65:7, 856-862, doi:10.1080/10962247.2015.1025925.

Howard, T. 2015. Comment on "Methane emissions from process equipment at natural gas production sites in the United States: Pneumatic controllers", *Environmental Science & Technology* **2015**, *49*, 3981-3982, doi:10.1021/acs.est.5b00507.

Indaco, 1990. Measurement of hydrocarbon emission fluxes from refinery wastewater impoundments using atmospheric tracer techniques. API Publication 4518. American Petroleum Institute, Washington, DC.

Indaco, 1993. A fundamental evaluation of the Chemdat7 air emissions model. API Publication 4571. American Petroleum Institute, Washington, DC.

Indaco, 1995. A high flow rate sampling system for measuring leak rates at natural gas facilities. GRI-94/0257.38. Gas Research *Institute*, Chicago, IL.

Indaco, 1995. Leak rate measurements at U.S. natural gas transmission compressor stations. GRI-94/0257.37. Gas Research Institute, Chicago, IL.

Lamb, B., G. Allwine, W.L. Bamesberger, H. Westberg, B. McManus, J. Shorter, C. Kolb, B. Mosher, R. Harris, and T. Howard, 1992. Measuremen.t of methane emissions rates from natural gas systems using a tracer flux approach. Presented at the 85th Annual Meeting of the Air and Waste Management Association, Paper No. 92-142.04.

Lamb, B., B. McManus, J. Shorter, C. Kolb, B. Mosher, R. Harris, E. Allwine, D. Blaha, T. Howard, A. Guenther, R. Lott, R. Siverson, H. Westberg, and P. Zimmerman, 1995. Development of atmospheric tracer methods to measure methane emissions from natural gas facilities and urban areas. Environmental Science and Technology, Vol 29, No. 6.

Lamb, Brian K., Steven L. Edburg, Thomas W. Ferrara, Touché Howard, Matthew R. Harrison, Charles E. Kolb, Amy Townsend-Small, Wesley Dyck, Antonio Possolo, and James R. Whetstone, 2014. Direct measurements show decreasing methane emissions from natural gas local distribution systems in the United States, *Env. Sci. & Tech*,doi:10.1021/es505116p.

Shorter, J., B. McManus, C. Kolb, E. Allwine, R. Siverson, B. Lamb, B. Mosher, R. Harris, T. Howard, and R. Lott, 1997. Collection of leakage statistics in the natural gas system by tracer methods. Envrion. Sci. Technology, 1997, 31, 2012-2019.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of the foregoing DIRECT TESTIMONY OF TOUCHE HOWARD upon each of the parties of record in this proceeding or their attorneys of record by deposit in the U.S. Mail, postage prepaid, or by email transmission.

This is the 10th day of June 2016.

/s/ *John D. Runkle*

_____