Buckingham County Compressor Station

Atlantic Coast Pipeline

POLLUTION REPORT: Unfair, Illegal and Unjust

Technical Report No. 16-342

December 2016

Blue Ridge Environmental Defense League

Blue Ridge Environmental Defense League

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One person speaking alone may not be heard,
but many people speaking with one voice cannot be ignored.

Janet Marsh, Founder

Table of Contents

Executive Summary

Noise and air pollution from natural gas compressor station, as revealed in this report, would place a disproportionate impact on minority communities in Buckingham County.

Locating a compressor station in a rural district would violate the county zoning ordinance. The list of permitted uses in the A-1 District does not include compressor stations nor does it include energy facilities. A compressor station is not a ñpublic utility generating plant,ò a ñpublic utility booster stationò nor any other category of permissible special use.

Unwanted, unpleasant noise is a growing public health problem. Industrial sources of noise commonly disrupt communities. Disturbing levels of sound become a medical issue when the noise interferes with normal activities and the quality of life. Being unable to sleep or to have a normal conversation for extended periods or at recurring intervals creates stress. These conditions lead to acute, chronic and long-term problems. The economic considerations of industrial special interest groups cannot be allowed to take precedence over the right to be secure in oneôs home.

Compressors operate 24 hours a day, 365 days a year. During the winter, natural gas powered turbines can emit many times more pollution. On average, at low temperatures the combustion turbines at the Buckingham Compressor Station would emit 13 times as much nitrogen oxides, 6 times as much carbon monoxide, and 2 times as much volatile organic compounds. Pollution controls are unreliable. Lean-burn engine technology proposed for the Buckingham compressor would have wide variations in nitrogen oxide and carbon monoxide emissions depending on the load placed on the turbines. The state air permit would allow dangerous levels of hazardous air pollutants formaldehyde and hexane. Over two and a half tons of formaldehyde and a half-ton of hexane would be emitted from the compressor station every year.

The Buckingham County Planning Commission convened a public hearing at which many people spoke and multiple issues were raised, including toxic air pollution, objectionable noise, environmental justice and others. People from Union Hill, Union Grove and many other communities spoke at public hearings and public comment sessions, providing the county with a detailed justification for rejecting the application by Atlantic Coast Pipeline, LLC for a Special Use Permit

Virginia statutes governing energy development clearly support environmental justice. The policy of the Commonwealth is to ñensure that development of new, or expansion of existing, energy resources or facilities does not have a disproportionate adverse impact on economically disadvantaged or minority communities.ò The Virginia General Assembly enacted this law to protect family life and public health in residential areas. Buckingham County must go back and implement the law which protects its residents from obnoxious noise and toxic air pollution.

Overview of Combustion Turbine Compressor

Combustion Turbines

A natural gas turbine is an internal combustion engine. The turbines burn natural gas fuel at high temperature and the turbine blades convert the heat energy into mechanical power. The turbines turn a shaft which is attached to mechanical compressor units, increasing natural gas pressure to move it through the pipeline. The components of a natural gas turbine include a compressor, a combustor, a turbine, an output shaft, and exhaust. The turbine manufacturing company for the proposed Buckingham facility describes their operation:

> The compressor takes in outside air and then compacts and pressurizes the air molecules through a series of rotating and stationary compressor blades. In the combustor, fuel is added to the pressurized air molecules and ignited. The heated molecules expand and move at high velocity into the turbine section. The turbine converts the energy from the high velocity gas into useful rotational power though expansion of the heated compressed gas over a series of turbine rotor blades. Rotational power from the turbine section is delivered to driven equipment through the output shaft via a speed reduction gearbox. The engineôs exhaust section directs the spent gas out of the turbine section and into the atmosphere.[1]

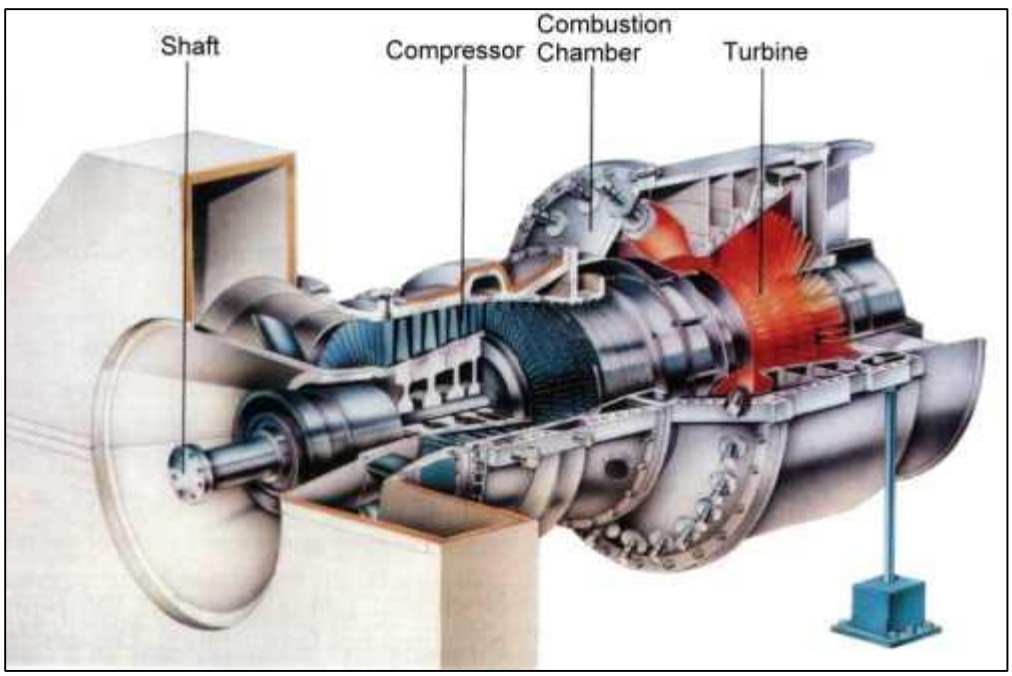

Figure A. Single Shaft Gas Turbine

Combustion turbines are remarkable for their lack of efficiency in converting chemical energy to mechanical energy. Regardless of its end use, a combustion turbine must have an input compressor to raise the pressure of the air-fuel mixture. Energy output is reduced because intake

[1] *Solar Turbines* website at https://mysolar.cat.com/en_US/products/gas-turbine-overview.html

air is compressed up to 30 atmospheres of pressure. Accordingly, according to the US Environmental Protection Agency, ñMore than 50 percent of the shaft horsepower is needed to drive the internal compressor and the balance of recovered shaft horsepower is available to drive an external load.ò[2]

Under normal conditions, a simple cycle unitôs thermal efficiency ranges from 15 to 42 percent. As a result, from 58 to 85 percent of the fuel burned produces no power. But air pollution and global warming gases are created by combustion whether power is produced or not.

The Proposed Buckingham Compressor Station

Information in the original application submitted by Atlantic Coast Pipeline listed the central power plant equipment manufactured by Solar Turbines, Inc. as follows:

(CT-01) Mars 100 Combustion Turbine
(CT-02) Taurus 70 Combustion Turbine
(CT-03) Taurus 60 Combustion Turbine *changed to a Titan 130*
(CT-04) Centaur 50L Combustion Turbine

On June 17, 2016, Atlantic Coast Pipeline, LLC and Dominion Transmission, Inc. submitted a supplemental filing to Virginia DEQ indicating a change in Combustion Turbine Unit 3 (CT-03), substituting a Titan 130 for the Taurus 60. No other changes were submitted. The new unit was much larger than the first, raising overall power of the compressor station by 30%.

Table 1. Buckingham C2 Station Turbine Power Ratings

Turbine Type Manufacturer: Solar	Emission Unit	Rated Horsepower[3]	Nominal Output Horsepower[4]	Nominal Output Kilowatts[4]
Mars 100	CT 01	17,574	15,900	11,860
Taurus 70	CT 02	11,882	10,915	8,140
Titan 130	CT 03	21,765	20,500	15,290
Centaur 50L	CT 04	6,642	6,130	4,570
Capstone C200 (10 units)	MT-01ï MT-10	2,680	n/a	2,000
	Totals =	60,543	53,445	41,860

See Appendix A for detailed list

The power rate of the original applicationôs four-unit compressor station was listed by the company at 44,512 horsepower. With the substituted turbine Unit 3, the four-unit Buckingham Compressor Station increased to a total of 57,863 horsepower. Also, the permit application lists ten additional turbines which would burn natural gas to generate on-site electrical power. Each of these units is rated at 200 kilowatts (268 hp), for a total power of 2,000 kW (2,680 hp).

[2] US EPA Air Pollution Emission Factors, AP-42, Stationary Gas Turbines, Section 3.1.2 Process Description
[3] Table C-1 Permit to Construct Application Project Equipment List, ACP Buckingham Compressor Station, Updated Air Permit Application, June 17, 2016, submitted to Virginia Dept. of Environmental Quality
[4] Solar Turbines, Inc. corporate brochure, ñCompressor Set/Mechanical Drive Specificationsò

Air Pollution

Atlantic Coast Pipeline, LLC and Dominion Transmission, Inc. want to build a series of compressor stations to move gas through the Atlantic Coast Pipeline. Atlantic Coast Pipeline, LLC submitted an air permit application for the facility in Buckingham County which was received by the Virginia Department of Environmental Quality Blue Ridge Regional Office on September 17, 2015. ACPôs application to DEQ indicates the plant would emit huge levels of air pollution:

Table 2. Estimated Annual Emissions[5]

Pollutant	Annual Emissions (pounds/year)
Nitrogen oxides (NOx)	100,400
Carbon monoxide (CO)	190,400
Sulfur dioxide (SO2)	14,600
Volatile organic compounds (VOC)	65,400
Particulate matter (PM)	87,800
Hazardous air pollutants (HAP)	9,940
TOTAL	**468,540**
Greenhouse gas (CO2e)	647 million

These air pollution levels are estimates. The actual emissions can be affected by many things, including weather conditions, operator ability, control devices, regulations and load factors.

> At very low load and cold temperature extremes, the turbine system must be controlled differently in order to assure stable operation. The required adjustments to the turbine controls at these conditions cause emissions of NOx, CO and VOC to increase (emission rates of other pollutants are unchanged).[6]

Compressors operate 24 hours a day, 365 days a year. During the winter, natural gas powered turbines can emit many times more pollution. Temperature condition considered extreme according to ACP are between -20 degrees F. and 0 degrees F., occurring no more than 50 hours/year. The air permit application shows a very large multiplication of emissions during sub-zero temperatures, for the four units averaging 13.45 times higher levels of NOx, 5.85 times higher levels of carbon monoxide (CO) and 1.95 times higher levels of volatile organic compounds. Occurring for 50 hours per year, as estimated by the company, would be 5.7% of the operating time operating at excessive levels of air pollution emissions.[7]

In the permit application, ACP claims that the Buckingham Compressor Station will not be subject to federal Clean Air Act acid rain regulations because it will not sell electricity and therefore ñis a non-utility facility.ò[8]

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[5] Table C-9 Project Potential Emissions, ACP Buckingham Compressor Station, updated permit application submitted to Virginia DEQ on June 17, 2016 by Dominion Transmission, Inc.
[6] Buckingham Compressor station air permit application 9/17/15, page 6-7
[7] Buckingham Compressor station air permit application 9/17/15, Table 3.2, page 7
[8] Buckingham Compressor station air permit application 9/17/15, Section 4.7, page 19

The Buckingham Compressor Station would emit 647 million pounds of carbon dioxide and other global warming pollutants every year of operation.

Many types of pollution-causing equipment are exempt from state regulations. According to the air permit application for the proposed Buckingham plant, exempt equipment would include:

WH-01	One 9.5 MMBtu/hour (million British Thermal Unit per hour) boiler
LH-01ï 04	Four line heaters each rated at 17 MMBtu/hour
MT-01ï 10	Ten Capstone C200 Microturbines each rated at 200 kilowatts

The air permit application proposes to use a lean combustion control technologyð called SoLoNOxð on the four main compression turbines, Units CT-01, CT-02, CT-03 and CT-04. Also, ACP proposes to use selective catalytic reduction (SCR) technology to help control nitrogen oxide emissions (NO_x). To control carbon monoxide emissions (CO), the company proposes to use operator-managed ñgood combustion practicesò and oxidation catalyst technology.

Air pollution emissions can vary, sometimes greatly, depending on the operating work load placed on the turbines. The US Environmental Protection Agency compiles pollution data for almost all fuel burning engines in its AP-42 database. The information published there states:

> Available emissions data indicate that the turbineôs operating load has a considerable effect on the resulting emission levels. Gas turbines are typically operated at high loads (greater than or equal to 80 percent of rated capacity) to achieve maximum thermal efficiency and peak combustor zone flame temperatures. With reduced loads (lower than 80 percent), or during periods of frequent load changes, the combustor zone flame temperatures are expected to be lower than the high load temperatures, yielding lower thermal efficiencies and more incomplete combustion.[9]

For example, lean-burn pollution control technology selected by ACP for Buckingham would allow wide variations in nitrogen oxide (NO_x) and carbon monoxide (CO) emissions depending on the load placed on the turbines by the compressor. US EPA emission factors for this type of engine (presented in pounds/million BTU heat input) indicate the following:

Pollutant	Higher Loads	Lower Loads	Increase
NO_x	0.0991	0.111	12%
CO	0.0151	1.27	2,490%

The comparison of emissions at high and low operating loads indicates more pollution when the plant capacity drops below 80%. For carbon monoxide, the increase is very large. This shows that the plant runs dirtier for some compounds at low operating loads. On the other hand, certain emissions increase at higher operating loads. The comparison on the following page indicates significantly more xylene and toluene pollution when the turbines run above 80% capacity (again presented in pounds/million BTU heat input):

[9] US EPA AP-42, Section 3.1, Stationary Gas Turbines, Subsection 3.1.3 Emissions

Pollutant	Lower Loads	Higher Loads	Increase
Xylene	0.0000548	0.0000638	+16%
Toluene	0.0000937	0.000134	+43%

Still other factors may cause wide variations in pollution; for nitrogen oxides, emission variations of 30% or more are caused by changes in humidity and temperature.[10]

Hazardous Air Pollutant Emissions: Formaldehyde and Hexane

The permit application provides estimates of hazardous air pollutants: formaldehyde and hexane. Over two and a half tons of formaldehyde would be emitted from the four turbines, boiler and heaters every year.

Table 3. Hazardous Air Pollutant Emissions[11]

Emission Point ID	Source	Formaldehyde emissions pounds/year	Hexane emissions pounds/year
CT-01	Compressor Turbine (100)	1,635	
CT-02	Compressor Turbine (70)	1,101	
CT-03	Compressor Turbine (130)	1,984	
CT-04	Compressor Turbine (50L)	688	
WH-01	Boiler	6	146
LH-01ð 04	Line Heaters	11	1,048
TOTAL		**5,425**	**1,194**

Formaldehyde vapors are highly irritating to the eye and respiratory tract. Formaldehyde causes nausea, headaches, and difficult breathing. Formaldehyde can also cause or aggravate asthma. The US EPA has classified formaldehyde as a ñprobable human carcinogenò (Group B1). The compressor would have many emission points releasing formaldehyde.

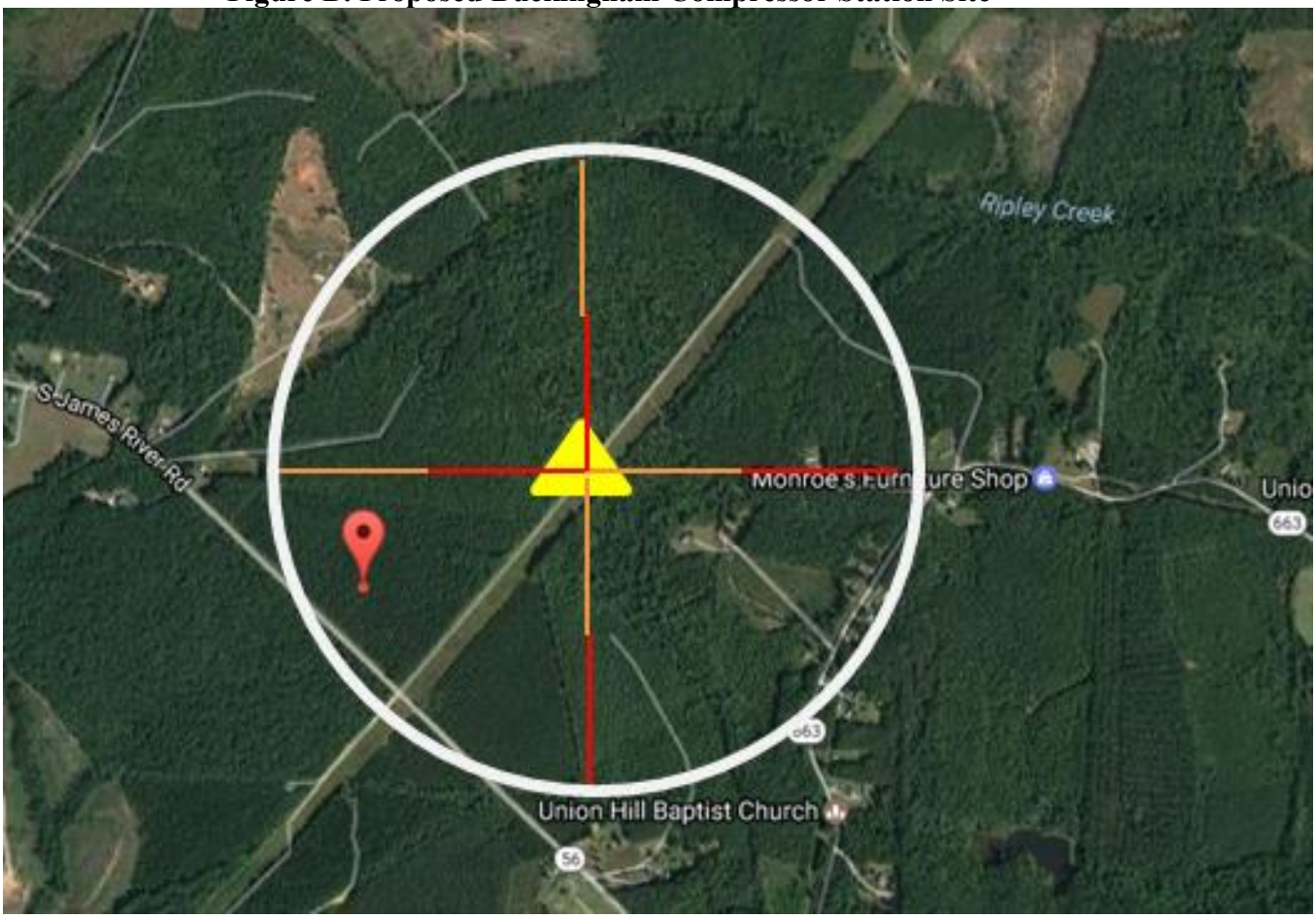
For decades *n*-Hexane, an isomer of hexane, has been identified as a peripheral neurotoxin, poisonous or destructive of nerve tissue.[12] Isomers of hexane are classified as chronic toxicants and irritants. Toxic hexane exposure symptoms include numbness and paresthesia, ñpins-and-needles,ò of the hands and feet. Chronic hexane exposure produces a gradual loss of motor function.

For this report, Blue Ridge Environmental Defense League ran a US Environmental Protection Agency computer model to determine the actual levels of formaldehyde and hexane which would be in the air around the proposed Buckingham compressor station. The map below marks the proposed compressor station site with a yellow tringle. The circle is superimposed on the map at a distance of 2,000 feet from the site. According to the permit application, the Buckingham

[10] US EPA AP-42, Section 3.1, Stationary Gas Turbines, Subsection 3.1.3.1 Nitrogen oxides
[11] Proposed Permit Limits for Toxic Pollutants/HAPS, ACP Buckingham Compressor Station, updated permit application, Appendix B page 23, submitted to Virginia DEQ June 17, 2016 by Dominion Transmission, Inc.
[12] Yamada S. ñAn occurrence of polyneuritis by n-hexane in the polyethylene laminating plantsò Jpn J Ind Health 1964;6:192

County ACP-2 Compressor Station would be located at coordinates 37°35'23.29"N 78°39'31.48"W (37.589803, -78.658744)

Figure B. Proposed Buckingham Compressor Station Site



See surrounding area map attached as Appendix B

The results of our modeling exercise reveal high levels of formaldehyde out to a distance of 1,640 feet (500 meters) from the plant site, and high levels of hexane 246 feet (75 meters) from the site. The impacts on residents within this distance would be at special health risk from chronic exposure to toxic air pollution. The detailed modeling results are attached to this report as Appendix C.

Noise Pollution

The high pressure operation of compressors makes them painfully noisy up close:

> The basic noise sources are caused by trapping a definite volume of fluid and carrying it around the case to the outlet with higher pressure. The pressure pulses from compressors are quite severe, and equivalent sound pressure levels can exceed 105dB.[13]

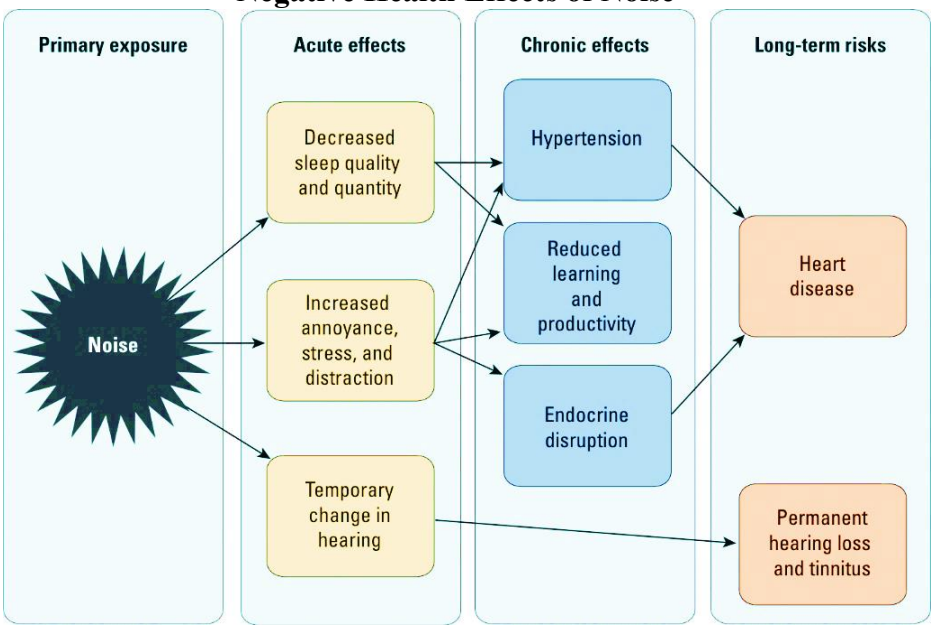
[13] *Occupational exposure to noise: evaluation, prevention and control,* Edited by Berenice Goeltzer, Colin H.

How distance affects the impact of a source of noise varies. Sound can travel longer or shorter distances depending on the medium through which it moves. For example, sound travels at 768 miles per hour in dry air and at 3,300 mph in water. Experts have determined that disruptive sound levels can travel far from the source and over natural and artificial barriers such as trees and walls.

> The atmospheric effects become most important at distances beyond about 1000 feet from the source....The normally humid environment in the southeastern US allows sound to travel further with less reduction in level. Downwind and under many night-time conditions (cooler air near the surface), sound waves that start upward will bend downward. Thus, the noise reduction benefits of barriers can be negated by these atmospheric effects.[14]

Thus, although sound generally decreases with distance, under some circumstances noise pollution can have higher impacts at greater distances.

Negative Health Effects of Noise[15]



Public Health Danger

Disturbing levels of sound become a medical issue when the noise interferes with normal activities and the quality of life. Being unable to sleep or to have a normal conversation for extended periods or at recurring intervals creates stress. These conditions lead to acute, chronic

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Hansen and Gustav A. Sehrndt, Published on behalf of the World Health Organization by the Federal Institute for Occupational Safety and Health, Dortmund, Germany, © WHO, 2001, ISBN 3-89701-721-0, page 110

[14] *Evaluation of Environmental Sound in the Community*, Stewart ND, Ph.D. FASA FASTM (July 23, 2011), page 3, downloaded 1/16/15 from http://www.sacnc.com

[15] ñEnvironmental Noise Pollution in the United States: Developing an Effective Public Health Response,ò Monica S. Hammer, Tracy K. Swinburn, and Richard L. Neitzel, *Environmental Health Perspectives*,ò Vol. 122, No. 2, February 2014, pp. 115-119

and long-term problems. And the negative impacts of noise pollution on human health can be serious.

> Chronic environmental noise causes a wide variety of adverse health effects, including sleep disturbance, annoyance, noise-induced hearing loss, cardiovascular disease, endocrine effects, and increased incidence of diabetes.[16]

Natural gas compressor stations operate 24 hours a day, 365 days a year. Chronic noise pollution can cause ill health effects, including high blood pressure, ulcers, colitis and asthma. Federal laws and regulations attempt to reduce this risk to public health, but state and local governments also have a responsibility to curb noise pollution. Too often, noise pollution from industrial sources is not controlled. For, example, in a Pennsylvania community the owner of a home with a compressor station 3,000 feet away reported, ñYou lay in bed, you can hear this thing running. It sounds like a truck in the driveway, 30 feet away.ò In another community, where a natural gas compressor station had just been brought on-line, the plant neighbors started complaining about the noise. Ambient noise levels in this rural area were measured between 43 and 46 decibels (dBA) at night.

Buckingham County Special Use Permit

The Buckingham County Planning Commission has approved a special use permit for the ACP-2 Compressor Station. If approved by the Board of Supervisors, the compressor would be allowed to generate 55 decibels at the property line or any adjacent building (Special Use Permit Item #6). This level of noise pollution would be twice as high as the typical sound level in a rural area; i.e., 45 decibels. The proposal also states that ñsilencers shall be used during blowdowns,ò but fails to state a noise limit (SUP Item #18). As written, the Special Use Permit approved by the Buckingham County Planning Commission would be unenforceable.

> Condition 6. Noise attenuation measures will be implemented making <u>all reasonable efforts</u> such that noise levels attributable to normal plant operations will be kept to an L90 reading of 55 dBA (decibels) or less at the property lines with the exception that the front property line (along Route 56, S. James River Hwy) may have a dBA of 60. If testing by a qualified noise consultant shows an exceedance of these levels Dominion will consult with Buckingham County regarding the reasons for the exceedances and <u>reasonably available noise mitigation measures</u>. Also, noise levels attributable to normal plant operations <u>will be</u> less than 55 dBA at any adjacent existing building that is not on the subject property. [17]

What this condition says is that noise levels caused by the compressor station would be at or below 55 decibels 90% of the time. That is what ñL90 at 55 dBAò means. Therefore, since natural gas pipeline compressors operate 24/7, the compressor could exceed the standard ten percent of the time; that is, the standard could be exceeded for 876 hours per year, which is 36.5 daysð more than five weeks per yearð for 24 hours per day. And the exceedances during these

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[16] *Id.*
[17] Buckingham County Planning Commission Case 16-SUP236, 11/21/16

five weeks would be subject to NO noise limit whatsoever. Moreover, the condition states that ñall reasonable effortsò would be made to limit noise but does not require it.

Measured sound levels in the rural Union Hill area average 44.2 dBA during the day and 31.6 dBA during the night. The 55 decibel benchmark exceeds background noise levels by 10.8 dB during the day and 23.4 dB at night.[18] These are huge differences.

Zoning Errors

Case No. 16–SUP236, Atlantic Coast Pipeline, Special Use Permit Application

An air permit for the compressor station from the Virginia DEQ cannot proceed without Buckingham Countyôs approval. Pursuant to Virginia lawð Chapter 22 (§§15.1-2200 et seq.) of Title 15.2ð a Local Governing Body Certification Form must be signed by a local official certifying that the proposed industrial facility conforms to all local ordinances. The declaration of legislative intent associated with this law states:

> This chapter is intended to encourage localities to improve the public health, safety, convenience, and welfare of their citizens and to plan for the future development of communities to the end that transportation systems be carefully planned; that new community centers be developed with adequate highway, utility, health, educational, and recreational facilities; that the need for mineral resources and the needs of agriculture, industry, and business be recognized in future growth; that the concerns of military installations be recognized and taken into account in consideration of future development of areas immediately surrounding installations and that where practical, installation commanders shall be consulted on such matters by local officials; <u>that residential areas be provided with healthy surroundings for family life;</u> that agricultural and forestal land be preserved; and that the growth of the community be consonant with the efficient and economical use of public funds.[19]

(Emphasis added.) The Buckingham County Planning Commission convened a public hearing on September 26 at which many people spoke and multiple issues were raised, including toxic air pollution, objectionable noise, environmental justice and others. The Virginia General Assemblyôs intent in passing the underlying statute clearly states its purpose as, *inter alia*, protecting family life and public health in residential areas. People from Union Hill, Union Grove and many other communities spoke at these hearings and public comment sessions, providing the Commission with a detailed justification for rejecting the application by Atlantic Coast Pipeline, LLC for a Special Use Permit.[20]

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[18] Source data: Table 92.4-17 Fact Sheet: ñAtlantic Coast Pipeline: Proposed Compressor Station #2, Buckingham County,ò October/November 2015, page 3. This ACP fact sheet is intended as a summary of information pertaining to CS2. Additional details are available in the Atlantic Coast Pipeline Environmental Resource Report 9: Air and Noise Quality (RR9). RR9 was submitted to the Federal Energy Regulatory Commission as part of the projectôs Application for a Certificate of Public Convenience and Necessity

[19] Code of Virginia, Title 15.2 §2200, Counties, Cities and Towns, Planning, Subdivision of Land and Zoning, accessed 12/2/16 at http://law.lis.virginia.gov/vacode/15.2-2200/

[20] For example, detailed comments from Sharon Ponton during the public hearing stated, ñThe Planning Commission must deny the Special Use Permit application for the compressor station because the Atlantic Coast

On September 8, 2015, the Buckingham County Administrator, Rebecca Carter, prematurely signed and submitted the Local Governing Body Certification Form to Virginia DEQ. After checking the box on the form which states ñThe proposed facility is fully consistent with all applicable local ordinances,ò Ms. Carter added in longhand the proviso ñ*upon obtaining a special use permit from the County of Buckingham, Va.*ò The submission of the form appears to have been prompted by an Atlantic Coast Pipeline representative. This certification was delivered one year before the Planning Commission held a public hearing on the matter. The Local Governing Body Certification Form offers only two choices: the proposed facility is (a) *fully* consistent with or (b) inconsistent with local ordinances. Regardless of this certification form, the compressor station is not fully consistent with local ordinances.

The Atlantic Coast Pipeline LLC requested a Special Use Permit under the Public Utility Exception in the A-1 Zone ordinance. To qualify for this exception, a facility must be a public utility. However, the compressor station proposed by Atlantic Coast Pipeline, LLC is not a public utility. The companyôs air permit application states that the Buckingham Compressor Station will not be subject to federal Clean Air Act acid rain regulations because it will not sell electricity and therefore ñis a non-utility facility.ò[21]

Further, the Atlantic Coast Pipeline, LLC is not listed on the Virginia State Corporation Commissionôs website as a regulated gas utility. The Atlantic Coast Pipeline, LLC is a Delaware limited liability corporation formed August 27, 2014 as a natural gas transmission company, not a utility. ACPôs sole business purpose is the development of facilities for the transmission of natural gas.

It is the intent of the county zoning plan to discourage the random scattering of residential, commercial or industrial uses in A-1 districts, which are established for agricultural uses. Buckingham Countyô Comprehensive Plan Map of Growth Areas, the planned industrial zones are nowhere near the proposed site of the compressor station.

The signing of the Local Governing Body Certification Form was not only premature, it is factually incorrect.

Environmental Justice

Many studies have shown that hazardous and solid waste facilities, industrial plants, and power stations of many types have traditionally been sited disproportionately in communities of color and low-income neighborhoods. In addition to being aesthetically unappealing, power plants emit toxic air pollution which has a negative effect on the health and well-being of plant neighbors. Low-income communities often lack the economic or political clout to fight these facilities. A review of environmental justice and equity law by the American Bar Association and the Hastings College of Law revealed the following:

Pipeline, LLC is not a utility. Therefore, it does not qualify for the public utility exception in the Countyôs A-1 Zone.ò

[21] Buckingham Compressor application 9/17/15, Section 4.7, page 19

> Poor communities of color breathe some of the least healthy air in the nation. For example, the nationôs worst air quality is in the South Coast Air Basin in Southern California, where studies have shown that Latinos are twice as likely as Whites to live within one mile of an EPA Toxic Release Inventory listed facility, and Latinos, African Americans, and Asian populations in the region face 50% higher cancer risks than Anglo-Americans in the region.8 Advocates nationwide argue that because poor people of color bear a disproportionate burden of air pollution, their communities should receive a disproportionate share of money and technology to reduce toxic emissions, and that laws like the Clean Air Act should close loopholes that allow older, polluting facilities to escape pollution control upgrades.[22]

Walter Fauntroy, District of Columbia Congressional Delegate to Congress, prompted the General Accounting Office to investigate environmental justice issues. The GAO released its findings that three-quarters of the hazardous waste landfill sites in eight southeastern states were located in primarily poor, African-American and Latino communities. United Church of Christ's Commission for Racial Justice published *Toxic Wastes and Race in the United States*, which revealed that race was the single most important factor in determining where toxic facilities were located, and that it was the intentional result of local, state and federal land-use policies. Dr. Robert Bullard published *Dumping in Dixie: Race, Class, and Environmental Quality*, in which he showed the importance of race as a factor in the siting of polluting industrial facilities.[23]

Virginia Law Requires Equitable Development

The Hastings study also focused on individual state law and found that Virginia statutes governing energy development articulate support for environmental justice. One of the stated objectives is ñdeveloping energy resources and facilities in a manner that does not impose a disproportionate adverse impact on economically disadvantaged or minority communities.ò[24]

The Virginia statutes direct various state agencies to work together to create a comprehensive 10-year energy plan that reinforces the EJ and other objectives.[25] The stateôs 10-Year Plan, among other things, must include the following information: an analysis of siting of energy facilities to identify any disproportionate adverse impact of such activities on economically disadvantaged or minority communities. In considering which parcels of land are suitable for energy facility development, the agencies must consider, in addition to technical matters, ñpotential impacts to natural and historic resources and to economically disadvantaged or minority communities and compatibility with the local land use plan.ò[26]

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[22] Environmental Justice for All: A Fifty State Survey of Legislation, Policies and Cases (fourth ed.), Steven Bonorris, Editor , Copyright © 2010 American Bar Association and Hastings College of the Law. With citation, any portion of this document may be copied and distributed for non-commercial purposes without prior permission. All other rights are reserved. http://www.abanet.org/environ/resources.html or www.uchastings.edu/cslgl

[23] Natural Resources Defense Council, https://www.nrdc.org/stories/environmental-justice-movement

[24] VA. CODE ANN. § 67-101 (2009); *see also Id*. at § 67-102, stating that to achieve the objectives of § 67-101, it shall be the policy of the Commonwealth to ñensure that development of new, or expansion of existing, energy resources or facilities does not have a disproportionate adverse impact on economically disadvantaged or minority communities.ò

[25] *Id*. at § 67-201

[26] *Id*. at § 67-201(d)

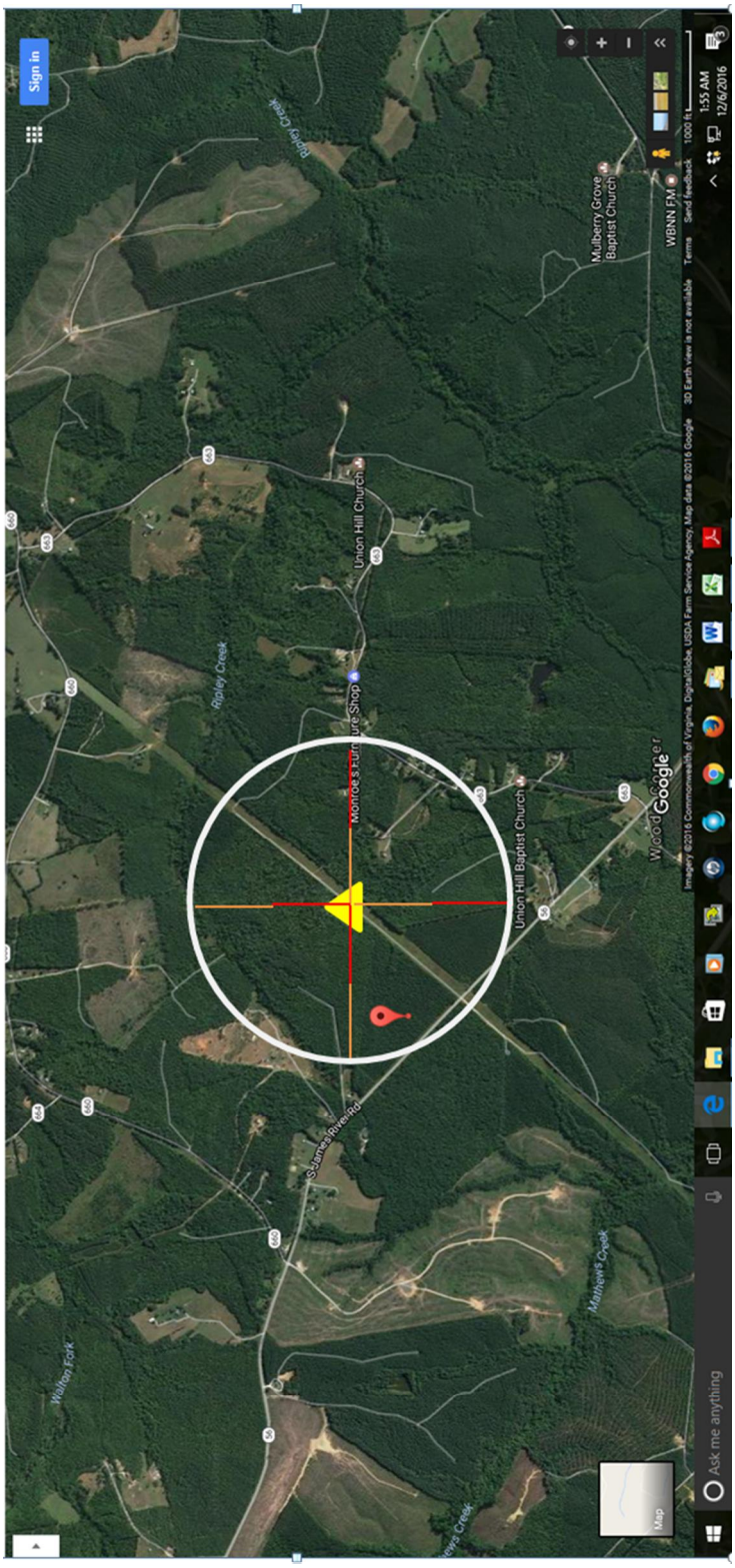
The Buckingham County Planning Commission heard evidence of environmental injustice from local residents and regional organizations during the public hearings on special use permit for the ACP-2 Compressor Station. State law is clear in this matter. However, the Planning Commission failed with respect to its statutory obligation to ensure that the ACP energy facility does not have a disproportionate impact on Buckinghamôs African American community.

Appendix A

Table C-1 Permit to Construct Application Project Equipment List
ACP Buckingham Compressor Station - Buckingham County, Virginia

Emission Point ID	Source	Manufacturer	Model/Type	Rated Capacity
CT-01	Compressor Turbine	Solar Turbines	Mars 100-16000S	17,574 hp
CT-02	Compressor Turbine	Solar Turbines	Taurus 70-10802S	11,882 hp
CT-03	Compressor Turbine	Solar Turbines	Titan 130-20502S	21,765 hp
CT-04	Compressor Turbine	Solar Turbines	Centaur 50-6200LS	6,642 hp
WH-01	Boiler	TBD	TBD	9.5 MMBtu/hr
LH-01	Line Heater	ETI	WB HTR	17 MMBtu/hr
LH-02	Line Heater	ETI	WB HTR	17 MMBtu/hr
LH-03	Line Heater	ETI	WB HTR	17 MMBtu/hr
LH-04	Line Heater	ETI	WB HTR	17 MMBtu/hr
MT-01	Microturbine	Capstone	C200	200 kW
MT-02	Microturbine	Capstone	C200	200 kW
MT-03	Microturbine	Capstone	C200	200 kW
MT-04	Microturbine	Capstone	C200	200 kW
MT-05	Microturbine	Capstone	C200	200 kW
MT-06	Microturbine	Capstone	C200	200 kW
MT-07	Microturbine	Capstone	C200	200 kW
MT-08	Microturbine	Capstone	C200	200 kW
MT-09	Microturbine	Capstone	C200	200 kW
MT-10	Microturbine	Capstone	C200	200 kW
FUG-01	Fugitive Leaks - Blowdowns	-	-	-
FUG-02	Fugitive Leaks - Piping	-	-	-
TK-1	Accumulator Tank	-	-	2,500 gal
TK-2	Hydrocarbon (Waste Oil) Tank	--	--	2,000 gal
TK-3	Ammonia Tank	--	--	8,000 gal

Appendix B: Surrounding Area of Proposed Compressor Site



Appendix C: Screening Model Data Readouts for Formaldehyde and Hexane

Formaldehyde

Enter the peak emission rate of the contaminant of concern

Peak (30 min) Emission Rate =	**0.078**	**g/s**	**2.709**	**tons/yr**
MW=	**30.03**			
Concern level	**0.122**	**ppm**	**149.8**	**ug/m3**

Distance (M)	**Point**	**Area**	**Volume**	**Worst**	**Recommendation**
10	1.00E+03	1.34E+04	1.33E+03	**1.34E+04**	reduce emissions
100	5.75E+01	1.84E+03	6.00E+02	**1.84E+03**	reduce emissions
200	3.14E+01	7.29E+02	3.33E+02	**7.29E+02**	reduce emissions
300	2.16E+01	3.96E+02	2.15E+02	**3.96E+02**	reduce emissions
400	1.66E+01	2.51E+02	1.51E+02	**2.51E+02**	reduce emissions
500	1.35E+01	1.75E+02	1.13E+02	**1.75E+02**	reduce emissions
600	1.14E+01	1.29E+02	9.06E+01	**1.29E+02**	its OK
700	9.65E+00	1.00E+02	7.35E+01	**1.00E+02**	its OK
800	8.41E+00	8.14E+01	6.11E+01	**8.14E+01**	its OK
900	8.44E+00	6.76E+01	5.24E+01	**6.76E+01**	its OK
1000	8.46E+00	5.73E+01	4.52E+01	**5.73E+01**	its OK

n-Hexane

Enter the peak emission rate of the contaminant of concern (1194 lb/y ÷ 8760 h/y = 0.136 lb/h = 0.017 g/s)

Peak (30 min) Emission Rate =	**0.017**	**g/s**	**0.59**	**tons/yr**
MW=	**86.18**			
Concern level	**0.31**	**ppm**	**1093**	**ug/m3**

Distance (M)	**Point**	**Area**	**Volume**	**Worst**	**Recommendation**
10	2.18E+02	2.92E+03	2.91E+02	**2.92E+03**	reduce emissions
75	*9.00E+01*	*1.10E+03*	*1.85E+02*	***1.10E+03***	reduce emissions
100	1.25E+01	4.01E+02	1.31E+02	**4.01E+02**	its OK
200	6.84E+00	1.59E+02	7.26E+01	**1.59E+02**	its OK
300	4.71E+00	8.62E+01	4.68E+01	**8.62E+01**	its OK

Interpolation of this model for the region between 10 and 100 meters indicates that the area source emissions exceed the safe level out to 75 meters from the combustion turbine facility. See worksheet at Appendix D, page 19.

Appendix D: Interpolation of Hexane Modeling Data