COMMONWEALTH OF VIRGINIA
BEFORE THE VIRGINIA STATE CORPORATION COMMISSION

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IN RE:	)	
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PATH ALLEGHENY VIRGINIA	)	**DOCKET NO. PUE-2009-**
TRANSMISSION CORPORATION:	)	**00043**
APPLICATION FOR APPROVAL OF	)	
ELECTRIC FACILITIES UNDER THE	)	
UTILITY FACILITIES ACT	)	

DIRECT TESTIMONY OF CHRISTOPHER A. JAMES ON BEHALF OF THE SIERRA CLUB

October 14, 2009

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I. INTRODUCTION

Q. What is your name, position and business address?

A. My name is Christopher A. James. I am a Senior Associate at Synapse Energy Economics, Inc., 22 Pearl Street, Cambridge, MA 02139.

Q. Please describe Synapse Energy Economics.

A. Synapse Energy Economics ("Synapse") is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, market power, electricity market prices, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Synapse's clients include state consumer advocates, public utilities commission staff, attorneys general, environmental organizations, federal government and utilities. A complete description of Synapse is available at our website, www.synapse-energy.com.

Q. Please summarize your educational background and recent work experience.

A. I graduated from the Worcester Polytechnic Institute in 1978 with a Bachelor of Science Degree in Mechanical Engineering.[1] My undergraduate thesis focused on design and construction of a low-cost hyperbolic solar collector. In 1988, I received a Master of Arts Degree in Environmental Studies from Brown University. My graduate thesis focused on criteria and toxic emissions from medical waste incineration. In addition, I have taken numerous EPA courses in air pollution science, combustion, continuous emissions monitors and boiler operation. I have taken an environmental law course at the University of Hartford.

From 1984 to 2007, I worked for, in chronological order, the Rhode Island Department of Environmental Management; the US Environmental Protection Agency ("EPA"), Seattle, Washington; and the Connecticut Department of Environmental Protection ("DEP"). I was Manager of Climate Change and

[1] Exhibit CAJ-1: Resume of Mr. James

Energy Program for the Connecticut DEP, and also served as Director of Air Planning. From 1999 to 2007, I served as the DEP representative to the Connecticut Energy Conservation Management Board, a statutorily created body responsible for the oversight, planning and administration of the state's energy efficiency, conservation and load management programs, currently funded at approximately $87 million annually.

As Director of Air Planning for the Connecticut DEP, I was responsible for developing and implementing the state's air quality plans, referred to as state implementation plans or SIPs. Under my direction, air quality plans, policies and regulations were developed and implemented to ensure that Connecticut made progress to meet and attain National Ambient Air Quality Standards. The entire state of Connecticut is designated non-attainment for ozone and the southern part of the state is designated non-attainment for fine particulate matter ("$PM_{2.5}$"). Since Connecticut's non-attainment is partially caused by emissions from upwind sources, particularly electric generating plants, I worked frequently with regional planning organizations, such as the NESCAUM (Northeast States for Coordinated Air Use Management) and the Ozone Transport Commission, to agree upon and develop emissions control strategies that could be applied consistently across the states to ensure that emissions reductions were equitable, and to minimize the potential for one area to benefit economically from less stringent requirements.

I also served as co-chair of the National Association of Clean Air Agencies' global warming committee, co-chair of the New England Governors/ Eastern Canadian Premiers' global warming committee, co-chair of the Regulatory Assistance Project's distributed resources collaborative, and I co-chaired the NESCAUM collaborative to develop a model rule for environmental performance standards. I was the Connecticut staff lead for development of the Regional Greenhouse Gas Initiative; DEP staff lead on the Governor's Climate Change Coordinating Committee and the Connecticut DEP representative to the New England Demand Response Initiative. I was also one of only two air regulators on the EPA/DOE Leadership Group to develop and implement the National Action Plan for Energy Efficiency.

I joined Synapse in August 2007. My recent clients have included the Sierra Club, California Energy Commission, Maine Public Utilities Commission, the New Jersey Ratepayer Advocate, AARP, the National Association of Clean Air Agencies, Environmental Defense, EPA and the Regulatory Assistance Project (in which I am working with Chinese air quality officials to reduce the environmental impacts from coal-fired power plants).

I have testified before state regulatory commissions in Connecticut in proceedings related to the siting of new power plants and emissions standards for new distributed resources. I have testified before the Iowa Utilities Board in a proceeding related to approval of an energy efficiency program. I have submitted testimony to the Wisconsin Public Service Commission in a 2009 proceeding related to approval of cost-recovery for emissions control equipment. I have also participated in and presented testimony before state and Federal courts in cases involving violations of the Clean Air Act. These include asphalt plants, wood products facilities, aerospace production facilities and power plants. I was the EPA Region 10 technical lead for the first nationally coordinated enforcement actions of the Clean Air Act in 1991-92 against Louisiana-Pacific; in multimedia enforcement actions against two pulp mills in Alaska; and in several actions against power plants. Each of the power plant cases were settled prior to the remedy phase of the respective trials.

A copy of my current resume is attached as Exhibit CAJ-1.

Q. On whose behalf are you testifying in this case?

A. I am testifying on behalf of the Sierra Club.

Q. Have you testified previously before this Commission?

A. No.

Q. What is the purpose of your testimony?

A. Synapse was retained by the Sierra Club to assist in its evaluation of the Application of PATH Allegheny Virginia Transmission Corporation, Case No. PUE-2009-00043, that was filed with the Virginia State Corporation Commission on May 19, 2009.

This testimony presents the results of my analysis.

Q. Please summarize your conclusions.

A. My conclusions are as follows:

1. The PATH transmission line will increase generation by dirtier coal-fired power plants in western PJM.

2. Increased generation in western PJM due to the PATH transmission line will impact Virginia and other eastern states due to transported air pollution.

3. The additional air pollution will affect Virginia's existing and future expected ozone and fine particulate non-attainment areas, making it more difficult for the State to meet public health standards.

Q. Please explain how you conducted your investigations in this proceeding.

A. I have reviewed the application, testimony and exhibits filed by the PATH Allegheny Virginia Transmission Corporation in this proceeding. I have reviewed the information and documents, including confidential documents, provided by the Applicants in response to data requests submitted by the Sierra Club and the staff of the Virginia State Corporation Commission. I also have reviewed public information related to the issues addressed in the Applicants application, testimony and exhibits and in our testimony and exhibits.

II. THE PATH TRANSMISSION LINE WILL INCREASE GENERATION BY DIRTIER COAL-FIRED POWER PLANTS IN WESTERN PJM.

Q. Have you conducted an analysis of the impact of the PATH transmission line on generation in PJM?

A. Yes.

Q. Please explain your findings.

A. Construction and completion of the PATH transmission line will increase emissions of sulfur oxides (SO_2), oxides of nitrogen (NO_x), fine particulate ($PM_{2.5}$), mercury and carbon dioxide (CO_2). My analysis is conservative, and I believe that my analysis has understated the quantity of air pollution increase that would occur as a result of completion of the PATH transmission line.

Oxides of nitrogen are pre-cursors to the formation of ozone and fine particulate. Both oxides of nitrogen and sulfur oxides are responsible for acid deposition, which has affected the region's forests and Chesapeake Bay. The fine particulate forms of oxides of nitrogen and sulfur oxides (nitrates and sulfates, respectively) also are responsible for regional haze and impairment of visibility. Shenandoah National Park is particularly affected by regional haze and has many periods of impaired visibility. Mercury emissions from power plants have led many states to impose advisories to limit the consumption of fish caught on their rivers, lakes and other bodies of water. In Virginia, there are existing fish advisories that warn against consumption of fish in eight river basins.[2]

Q. How was your analysis conducted?

A. I conducted a conservative high-level analysis of the likely emissions impact of the PATH line. I based this assumption on responses to discovery requests and testimony by the Applicants. I assumed that because the PJM region to the west of the PATH terminus has a lower locational marginal price than the PJM region at the eastern PATH terminus that, should PATH be built, the least expensive plants to the west of the PATH terminus would increase output, while the most expensive plants in the east would decrease output.[3] The resulting increase in emissions in the west, minus the resulting decrease in

[2] http://www.vdh.state.va.us/epidemiology/DEE/publichealthtoxicology/advisories/index.htm

[3] Exhibit CAJ-2 provides a graph of these differential prices in electricity between eastern and western PJM

emissions in the east is what I am considering the emissions impact of the PATH line. This scenario assumes no increased demand within PJM. However, if demand does increase, I would expect that emissions would increase in western PJM and that overall emissions would be greater than what I have provided here.

In total, I found that, if the line carries 2000 MW per hour on every hour from west to east, [4] CO_2 emissions will increase (net) by 3.75 to 7.79 million tons per year, SO_2 emissions will increase by 67,000 to 88,000 short tons per year, and NO_X emissions will rise by 12,000 to 20,000 short tons per year. These increased emissions result from simply moving generation from the east to the west, with no net gain in power output.

The analysis draws on 2008 data from the EPA Clean Air Markets Division Continuous Emissions Monitoring database. The Clean Air Markets database tracks hourly gross generation, emissions of CO_2, NO_X, and SO_2, and heat input from combustion-fired generators across the nation larger than 40 MW. Plants in PJM were identified using 2007 eGRID. The 1072 electric generating units within PJM are all tracked in the Clean Air Markets database. In 2008, these PJM units produced 480 trillion watt hours ("TWh") of gross generation.

Units most likely to be influenced by PATH were identified by a simple selection criteria. Units in New Jersey, Delaware, and the District of Columbia were identified as Eastern PJM units, while units in Ohio and West Virginia were assumed to be in Western PJM. Units in Pennsylvania, Maryland, and Virginia were classified as Western and Eastern units depending on their location either west or east of 77.5 degrees west longitude, corresponding approximately with the PJM Western Interface. This split at 77.5 degrees west roughly corresponds with the footprint that was part of the "classic PJM" versus the newer western PJM footprint. Power plants in Illinois, Indiana,

[4] Based on information provided in the Applicant's testimony and interrogatory responses, I am assuming conservatively that the PATH line's transfer capacity on average will be 2000 MW.

Kentucky, North Carolina, and Tennessee were excluded from this analysis in order to be as conservative as possible. In this characterization, there are 613 units in the west, and 249 in the east. Approximately half the generation in the east is gas-based, and over 90% of the generation in the west is coal-based.

I estimated marginal units according to a methodology developed by Synapse Energy Economics for the US EPA,[5] in which units which have historically responded to changes in load are more likely to respond to future changes in demand, either increases or decreases. In this method, a "flexibility index" is developed for each unit, describing the fraction of operating hours in which the unit ramps up by at least 2.5% of its maximum capacity. Units with high indices are considered to be peakers, while those with low indices are considered baseload units. This method of analysis is more conservative than reliance on capacity factors alone.

Q. Please describe capacity factors, the flexibility index that you used, and the relationship between the two terms.

A. As typically used, the term capacity factor refers to a power plant's generating output compared to its rated capability over the 8,760 possible hours that it could operate during a year. A power plant with a rated capacity of 500 MW that generates 500 MW each hour for 4,380 hours in a year would have a capacity factor of 50% or 0.50. If the same plant generated 500 MW each hour for 7000 hours in a year, its capacity factor would be 79.91% or 0.7991. Baseloaded power plants typically have capacity factors that range up to 85-87.5%; load following power plants typically have capacity factors in the 30-50% range, and peaking power plants typically have capacity factors in a 5-20% range. Individual power plants will operate differently, and may in fact vary their operation over the course of a year, depending upon the load demanded. Also, a plant may operate at 100% capacity factor for a few hours

[5] Hausman, ED. J Fisher, and B Biewald. July 2008. *Analysis of Indirect Emissions Benefits of Wind, Landfill Gas, and Municipal Solid Waste Generation.* Synapse Energy Economics for US EPA. Available online at: http://www.epa.gov/nrmrl/pubs/600r08087/600r08087.pdf

in a day, then ramp down to idle at low load conditions for many hours, depending upon the load demanded.

The flexibility index refers to the capability of a power plant to vary its generating output. My analysis does not opine about why a plant may vary its output. The flexibility index is based upon observation and analysis of actual operating data. Taking the same example above, assume we have a power plant with an observed capacity factor of 65%. That value is in the lower end of the range that is typical of a baseload plant. If I conducted an analysis based on available headroom, i.e. the difference in the power plant's maximum generating output compared to its observed operation, I would evaluate the generating output possible at an 87.5% capacity factor and compare that to the plant's observed output. This difference would be the quantity of MWh that the plant could generate if it operated at its maximum capacity for the entire year. The 87.5% value is a typical maximum annual capacity factor for a coal-fired power plant, taking into account periods of time when a power plant is not operating due to scheduled maintenance periods. In this example, an analysis based on power plant capacity factors would assume that the plant could increase its generating output to operate at an 87.5% capacity factor if conditions that kept it from increasing its operation were relieved.

However, a particular power plant may not be able to vary its generating output. The flexibility index accounts for the ability of power plant to vary output. Power plants that are observed to vary their operations more over the course of a year have a higher flexibility index than those which do not vary their operation. Again, using the same 500 MW power plant example, if the plant has a capacity factor of 65%, I could assume that it was capable of increasing its capacity factor to 87.5% and calculate the additional number of MWh and pollution that would be emitted by this plant accordingly. However, for purposes of this analysis, I would assume conservatively that if the plant has a low flexibility index, it is not likely to increase its generating output at all, regardless of whether transmission, load or other conditions changed. On this basis, all power plants with low flexibility indices are excluded from my analysis of the potential quantity of increased air pollution that would occur from completion of the PATH transmission line. (This exclusion is

conservative, since it is possible in reality that such plants could increase their generating output.)

Conversely, if the same 500 MW power plant has a high flexibility index, that would indicate that the power plant varies its operation frequently. If conditions changed due to increased demand, changes in transmission, etc., this plant would be likely to increase its generating output to reach a capacity factor of 87.5%. Plants with high flexibility indices are included in my evaluation of the potential quantity of increased air pollution that would occur from completion of the PATH transmission line.

In sum, the flexibility index analysis is more conservative than an analysis that evaluates differences in capacity factors. My analysis assumes that power plants with low flexibility indices will not change their generating output and that those will high flexibility indices will change their generating output.

Q. How did you determine the quantity of MWh and air pollution that could result from the construction of the PATH transmission line?

A. In this high-level analysis, I assumed that the transmission line would carry, on average, 2000 MW per hour, every hour, or 17.5 TWh per year. I divided this line demand pro-rata into all the units in the east and the west, weighted by the flexibility index and output, to determine which units increase or decrease generation. I then accounted for the change in CO_2, SO_2, and NO_X emissions from these plants. In this "core" case, net GHG and criteria emissions all rise significantly. My conservative estimate, assuming the line will carry 2000 MW per hour every hour, is that CO_2 emissions would rise by 3.75 to 7.79 million tons per year, SO_2 emissions would rise by 67,000 to 88,000 tons per year, and NO_X emissions would rise by 12,000 to 20,000 tons (see Table 1).

I would also expect fine particulate ($PM_{2.5}$) emissions to increase by similar percentages to those expected for the above pollutants. I cannot determine the precise amount by which fine particulate emissions would increase. For over 15 years, the Clean Air Act has required power plants to install, maintain and operate continuous emissions monitors that accurately record the quantity of NO_x, SO_2 and CO_2 emissions. EPA has a complete and public data base where

information on quantities of these pollutants emitted by power plants is stored and maintained. However, EPA has yet to promulgate the same type of regulations or methods for fine particulate emissions. As a result, power plants can use several techniques to determine the quantity of fine particulate emissions. These techniques are not directly comparable. For example, one suggested method is to assume equivalence between $PM_{2.5}$ emissions and coarser fine particulate (PM_{10}) emissions for which EPA has published measurement techniques. Another suggested technique is to assume that all condensable pollutants collected during the course of directly sampling emissions from a power plant stack be defined as $PM_{2.5}$. The results of these two different techniques are not directly comparable. Using the condensable method may include quantities of gases, such as volatile organic compounds, which are not considered fine particulates. Using the PM_{10} surrogate technique does not accurately quantify $PM_{2.5}$ emissions. Therefore, while I can conclude that emissions of fine particulate will increase as a result of the construction of the PATH transmission line, due to the variations in how such emissions are determined, I cannot calculate the exact quantity by which fine particulate emissions would increase. Nevertheless, fine particulates are one of the main pollutants emitted by coal-fired power plants, and it is safe to assume that these emissions will increase as a result of increased generation at coal-fired power plants following construction of the PATH transmission line.

I also explored what would occur if only gas plants in the east and only coal plants in the west were affected by the PATH line, representing a likely economic endpoint. The results from the core case discussed above and this second economic case are shown in Table 1, below. I believe the results associated with the economic case (East Gas Reduced) are the more likely ones to occur.

Table 1: Change in Emissions due to PATH, Core and Economic Cases

Western PJM			
	Δ CO2 (tons)	Δ SO2 (tons)	Δ NOX (tons)
Flexibility Index, 2000 MW (Core Case)	14,934,636	89,974	21,963

East Gas Reduced, 2000 MW (Economic Case)	15,597,804	88,463	23,712
Eastern PJM			
	Δ CO2 (tons)	Δ SO2 (tons)	Δ NOX (tons)
Flexibility Index, 2000 MW (Core Case)	-11,184,641	-22,957	-9,847
East Gas Reduced, 2000 MW (Economic Case)	-7,805,205	-69	-3,287
Net Impact			
	Δ CO2 (tons)	Δ SO2 (tons)	Δ NOX (tons)
Flexibility Index, 2000 MW (Core Case)	3,749,995	67,017	12,116
East Gas Reduced, 2000 MW (Economic Case)	7,792,599	88,393	20,425

The table suggests that for the core case and the economic case, the net emissions impacts will be significant. The core case represents an increase in net emissions among the selected set of electric generating units of 4% SO_2 and 3% NO_X. For the economic case, where only gas is impacted in the east and coal in the west, this analysis suggests that CO_2 emissions will rise by over 2.5%, SO_2 by nearly 5.5%, and NO_X by over 4.5%.

Q. Table 1 includes a row that is entitled "east gas reduced, 2000 MW", what does this mean?

A. In eastern PJM, many natural gas-fired power plants have been constructed in recent years. While these power plants emit less air pollution and greenhouse gases, these plants at times have higher operating costs. This means that at times, these natural gas-fired power plants are the marginal unit, or last unit, that are dispatched to operate for any given hour. The electricity price differentials between eastern and western PJM mean that, if the ability to transfer more MW from western PJM to eastern PJM occurs, such as through the construction of the PATH transmission line, the natural gas-fired power plants in eastern PJM will be among the first power plants to be displaced, *i.e.*

to have their generating output curtailed and reduced. The economic case in table 1 entitled “east gas reduced, 2000 MW” therefore reflects an environmental outcome that would likely occur if 2000 MW transferred by the PATH transmission line displace the operation of 2000 MW of natural gas-fired power plants in eastern PJM. The difference in air pollution shown in Table 1 for the “east gas reduced, 2000 MW” economic case represents the difference in emissions between 2000 MW of generating output from natural gas-fired power plants in eastern PJM and 2000 MW of generating output from the average across all fossil-fueled power plants in western PJM, over the course of a year.

Q. Is it possible for generators in eastern PJM to increase their output and transmit this output to western PJM?

A. Yes. The PATH Applicants have indicated that it is possible for electricity to be transmitted from east to west as it is from west to east.

Q. Why wouldn’t generators in eastern PJM increase their output to take advantage of the opportunity to transmit this output to western PJM?

A. While it is physically possible for generators in eastern PJM to transmit their output to western PJM, such an outcome is highly unlikely.

Q. Please explain.

A. If PJM operated under *environmental* dispatch rules, such rules would favor the cleaner generating units in eastern PJM, and these units would increase their output, and transmit power to western PJM. However, regional transmission organizations such as PJM operate on a principle of *economic* dispatch. The external environmental and public health impacts associated with power plant emissions have not been included in the operating costs of these units. As a result, the higher emitting coal boilers in western PJM have lower operating costs than the cleaner gas units in eastern PJM. Under economic dispatch rules, generators with the lowest operating costs are dispatched first, and as demand increases, higher cost generators are eventually dispatched. Exhibit CAJ-2 provides the average monthly price differentials for peak and off-peak periods between eastern and western PJM

during 2008, the latest full year for which data are available.[6] For peak periods, electricity prices in eastern PJM are higher than those in western PJM by about $3 per MWh in March to almost $25 per MWh in July. During off-peak periods, electricity prices in eastern PJM are higher than those in western PJM by about $4 per MWh in November and December to about $15 per MWh in July.

This difference in electricity prices between eastern and western PJM means that if the PATH transmission line is completed, the lower cost coal generators in western PJM will increase their output to provide energy into eastern PJM to take advantage of the higher prices in eastern PJM. As I explained above, many generators in western PJM have room to increase their generating output. The PATH transmission line provides these generators in western PJM with the opportunity to do so. Another factor that will exacerbate the air pollution effects caused by the PATH transmission line is that the differential in electricity prices during peak periods is highest during the summer months, a period also coincident with higher ozone concentrations. Increased generation in western PJM will produce additional air pollution during the same periods when atmospheric conditions are favorable to the transport of this pollution to the east, increasing the concentrations of ozone and fine particulate pollution in Virginia and neighboring states.

Q. You discussed earlier that the potential increase in air pollution from the construction of the PATH transmission line were likely to be greater than what your analysis has reflected. Why do you think this is so?

A. The Applicants for the PATH transmission line have argued that the transmission line is needed to improve reliability of service due to load growth in eastern PJM. My analysis shown in table 1 has assumed that electricity

[6] Exhibit CAJ-2 depicts data that is obtained monthly from PJM by Synapse. http://www.pjm.com/markets-and-operations/energy/real-time/monthlylmp.aspx

demand will not increase in either eastern or western PJM. If demand increases in eastern PJM, the impact of the PATH transmission line will be that generation increases in both eastern and western PJM together. The environmental outcome of this demand increase will likely be by the quantity of air emissions shown in Table 1 for "western PJM" under the results for "core case." This row shows that CO_2 emissions would increase by nearly 15 million tons per year; that SO_2 emissions would increase by nearly 90 thousand tons per year; and that NO_x emissions would increase by nearly 22 thousand tons per year.

III. INCREASED GENERATION IN WESTERN PJM DUE TO THE PATH TRANSMISSION LINE WILL NEGATIVELY IMPACT VIRGINIA AND OTHER EASTERN STATES DUE TO TRANSPORTED AIR POLLUTION

Q. What is your understanding of the impact of the PATH transmission line on air quality in Virginia?

A. Construction and operation of the PATH transmission line will cause or contribute to increases in criteria and greenhouse gas pollutants. These pollutants will be transported to the Washington, DC, and Baltimore metropolitan areas. Both metropolitan areas, which include counties in Virginia, Maryland and West Virginia, are designated non-attainment for ozone.[7] Also, several counties in Virginia, Maryland and West Virginia are designated non-attainment for fine particulates ($PM_{2.5}$).[8] Increased emissions from PATH would exacerbate affects upon public health and the environment, and impede the ability of the Commonwealth to attain national ambient air quality standards.

Q. Why are fine particulate and ozone emissions a concern?

[7] Exhibit CAJ-3 provides a map of the counties in Virginia designated as non-attainment for the 0.08 parts per million ozone standard. Designations for the new 0.075 parts per million ozone standard have not yet been finalized by EPA.

[8] Exhibit CAJ-4 provides a map of the counties in Virginia designated as non-attainment for the fine particulate standard.

A. There are serious public health concerns associated with both pollutants. The health effects from these pollutants are well established, as reported in recent EPA decisions to make the national ambient air quality standards for both ozone and $PM_{2.5}$ more stringent. Adverse health effects from fine particles include decreased lung function, aggravated asthma, heart attacks, and even premature death. Exposure to ground-level ozone can causes similar health effects.[9]

Q. What are the states' obligations to control air pollutants?

There are two important principles associated with the Clean Air Act's requirements for states to develop plans to achieve the public health-based air quality standards. First, states are responsible for reducing air pollution based upon the air quality that is monitored within their borders. Second, states are required to reduce air pollution within their state if the pollution in their state affects another state. The first principle means that states have to make every effort possible to reduce pollution in their state even if they are documenting that pollution from another state is what is causing violations of air quality standards. And only if they have satisfied this obligation are they able to compel other states to stop exporting pollution. This principle is sometimes referred to as a "clean hands principle." The second principle is that states are required to reduce pollution in their own state if the pollution from that state causes or contributes to air quality violations in another state, even if air quality monitors in the state do not measure violations of public-health standards.

The Clean Air Act also provides a remedy for a state that has documented that the air pollution that causes that state to violate air quality standards comes from another state. A state that is affected by the air pollution from another state can petition EPA to require the polluting state to reduce the effects of its pollution on a state whose air quality is impaired by the transported pollution.

[9] http://www.epa.gov/oar/particlepollution/health.html (fine particles) and http://www.epa.gov/air/ozonepollution/health.html (ozone)

My rationale for mentioning these provisions of the Clean Air Act is that construction of the PATH transmission line will increase emissions in states that are part of western PJM and these increased emissions will impair the ability of states in eastern PJM to comply with EPA's public health-based air quality standards for ozone and fine particulate.

Q. How did you reach this conclusion?

A. The science of air pollution transport from fossil fuel fired generation in the Ohio Valley to the states downwind along the Eastern Seaboard is well established. EPA has studied air pollution transport for decades. EPA has worked with states to assess the causes, contributors and effects of transported air pollution. The data compiled by EPA in the context of these efforts has repeatedly demonstrated that power plants are significant contributors to air pollution problems in the Eastern Seaboard.

During 1995 and 1996, EPA convened a working group involving the 37 easternmost states in a comprehensive modeling effort to assess causes and contributors to high concentrations of the ozone standard along the Eastern Seaboard. That effort, known as the Ozone Transport Assessment Group (OTAG), focused on modeling the interstate and interregional transport of air pollution. Inputs to the model included point source emissions and air quality. In June 1997, OTAG concluded that oxides of nitrogen (NO_x) emissions from utilities and other major sources should be reduced by up to 85% from their 1990 emissions levels in order to resolve on-going ozone non-attainment problems in eastern states.

In August 1997, eight New England and the Middle Atlantic states petitioned the US EPA under section 126 of the Clean Air Act. Each petition:

- Based its findings on the recently completed OTAG effort,
- Emphasized that transported air pollution from states to their west caused and contributed to exceedances of the health-based National Ambient Air Quality Standard (NAAQS) for ozone, and
- Requested that EPA act to reduce emissions from fossil fuel fired generation.

The state petitions included evidence that air masses entering their state had concentrations of ozone that were at or above the NAAQS for ozone. This

transported air pollution exacerbated the state's ability to comply with the ozone NAAQS. Also, locally required pollutant reductions, part of these states' implementation plans, were rendered ineffective by the transported pollution. Finally, the affected states had imposed more stringent environmental regulations than the upwind states. These differential requirements hindered economic competitiveness. Generating facilities in downwind states along the Eastern Seaboard have differentially higher operating costs, as part of their environmental and public health impacts have been internalized through compliance with more stringent regulations.

EPA issued findings on September 24, 1998, that agreed with the states' section 126 petitions and the OTAG recommendations that power plant emissions in the Ohio Valley are major contributors to on-going violations of the ozone standard in eastern states.

Maryland has continued to document the transport of air pollution from the Ohio River Valley.[10] The Maryland Department of the Environment (MDE) and the University of Maryland have collaborated on a long-term project that involves real-time sampling of the air mass using aircraft. This effort has lead MDE to conclude that long-range transport is responsible for 40-80% of the air pollution that is measured in the Washington, DC and Baltimore metropolitan areas. This is especially evident during periods of high ozone levels during the summer months, when the air mass that enters Maryland continues to exhibit pollutants that are at or above the levels of the eight-hour ozone NAAQS.

Q. What is the relevance of work completed by the MDE and University of Maryland to air quality in Virginia?

A. Simply stated, air pollution does not recognize political or geographic boundaries. The air masses sampled by University of Maryland aircraft also travel across Virginia. Counties in northern Virginia are part of the greater

[10] Visualization of Ozone Pollution Transport from Ohio River Valley into Maryland; David Krask, MDE, et al; National Air Quality Conference, Portland, OR; April 7, 2008

Washington, DC metropolitan area, along with counties in Maryland and the District of Columbia. The MDE works with Virginia and the District of Columbia to develop comprehensive strategies to reduce pollution consistently across all three jurisdictions.

IV. THE ADDITIONAL AIR POLLUTION WILL AFFECT VIRGINIA'S EXISTING AND FUTURE OZONE AND FINE PARTICULATE NON-ATTAINMENT AREAS, MAKING IT MORE DIFFICULT FOR THE COMMONWEALTH TO MEET PUBLIC HEALTH STANDARDS

Q. You have stated that the construction of the PATH transmission line will increase air pollution emitted by electric generating units located west of the PATH terminus. Describe the result of this increased air pollution on Virginia's ability to comply with public health standards for ozone and fine particulate.

A. Today, several counties in Maryland, Virginia and West Virginia have been designated non-attainment for ozone, fine particulate or both pollutants.[11] Many of these counties are located in or adjacent to the Baltimore and Washington, DC metropolitan areas. However, monitors that are located away from these metropolitan areas in both Virginia and West Virginia also measure air quality that exceeds the National Ambient Air Quality Standard for ozone and fine particulates. The maps shown as Exhibits CAJ-3 and CAJ-4 show that counties in western and southeastern Virginia are also designated non-attainment for ozone and/or fine particulate.

As required by the Clean Air Act, EPA recently reviewed public health effects and science to determine that the 0.08 parts per million, eight-hour standard for ground-level ozone was inadequate to protect public health. As a result, EPA promulgated a new eight-hour ozone standard of 0.075 parts per million. States and EPA are currently in the process of evaluating air quality monitoring data and, based upon these data, EPA will designate areas as attainment, non-attainment or unclassifiable.[12] My review of 2008 air quality

[11] Exhibits CAJ-3 and CAJ-4, *Ibid.*

[12] http://iaspub.epa.gov/airsdata/ADAQS.monvals?geotype=st&geocode=DC+DE+MD+PA+VA+WV&geoinfo=st%7EDC+DE+MD+PA+VA+WV%7EDistrict+of+Columbia%2C+Delaware%2C+Maryland%2C+Pennsylvania%2C+Virginia

data reflects that several areas in Virginia, Maryland and West Virginia that are currently designated as non-attainment under the existing ozone standard will continue to exceed the new ozone standard, and these states will be required to submit plans to EPA to demonstrate how emissions that cause or contribute to these exceedances will be reduced. Following this process, states including Virginia will be required to develop new regulations or revise existing regulations and reduce emissions that cause or contribute to an exceedance of the ozone standard. One of the chief contributors to ozone formation is NO_x emissions from the electric generating sector. States are required to develop plans that demonstrate that emissions will be reduced over time to attain the ozone standard, and also to ensure that emissions from their state do not impact another state's ability to attain an air quality standard.

Virginia, Maryland and West Virginia will be required to develop plans that demonstrate how each state will reduce emissions locally to comply with the new ozone standard. The same states may also choose to petition EPA to require additional reductions from upwind states that affect that state's ability to comply with the NAAQS. However, a state affected by air pollution transport must be able to also show EPA that it has taken all required steps to reduce pollution within its borders ("clean hands principle") in order to demonstrate that its ability to meet the NAAQS is affected by transported pollution.

Q. Based upon your analysis, what do you conclude regarding the air quality and greenhouse gas emissions impacts that will occur from the construction of the PATH transmission line?

A. The construction of the PATH transmission line will enable generators located in western PJM to access electricity markets in eastern PJM. Differentially higher prices in eastern PJM create economic incentives for generators in western PJM to participate in eastern PJM markets. Generators that have the capacity and flexibility to increase their electricity output will do so. There are

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many such units in western PJM. These western PJM generators emit more air pollution and greenhouse gases per MWh output than units in eastern PJM. As a result, NO_x and SO_2 emissions will increase by tens of thousands of tons each year, and CO_2 emissions will increase by several million tons each year.

The air quality modeling work completed by OTAG ten years ago, and continuing research by states such as Maryland today, documented that air pollution is transported from the Ohio River Valley to states to the east, and that such effects were and continue to be significant. Corollary effects have also been well demonstrated, *i.e.* the forced shutdown of many electric generating units due to the 2003 blackout resulted in significant air quality and visibility improvement. Any increase in air pollution transported into Virginia and neighboring states will negatively impact those states ability to attain and maintain compliance with national ambient air quality standards for ozone and fine particulates.

Q. Does this complete your testimony?

A. Yes, it does.