BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

IN RE: APPLICATION OF TRANS-ALLEGHENY INTERSTATE LINE COMPANY FOR (I) A CERTIFICATE OF PUBLIC CONVENIENCE TO OFFER, RENDER, FURNISH AND/OR SUPPLY TRANSMISSION SERVICE IN THE COMMONWEALTH OF PENNSYLVANIA; (II) AUTHORIZATION AND CERTIFICATION TO LOCATE, CONSTRUCT, OPERATE AND MAINTAIN CERTAIN HIGH VOLTAGE ELECTRIC TRANSMISSION LINES AND RELATED ELECTRIC SUBSTATION FACILITIES; (III) AUTHORITY TO EXERCISE THE POWER OF EMINENT DOMAIN FOR THE CONSTRUCTION AND INSTALLATION OF AERIAL ELECTRIC TRANSMISSION FACILITIES ALONG THE PROPOSED TRANSMISSION LINE ROUTES IN PENNSYLVANIA; (IV) APPROVAL OF AN EXEMPTION FROM MUNICIPAL ZONING REGULATION WITH RESPECT TO THE CONSTRUCTION OF BUILDINGS; AND (V) APPROVAL OF CERTAIN RELATED AFFILIATED INTEREST ARRANGEMENTS	))))))))))))))))	Docket Nos. A-110172 A-110172F0002 A-110172F0003 A-110172F0004 G-00071229

DIRECT TESTIMONY

AND EXHIBITS OF

PETER J. LANZALOTTA

October 31, 2007

DIRECT TESTIMONY OF
PETER J. LANZALOTTA

Q. PLEASE STATE YOUR NAME, AFFILIATION AND BUSINESS ADDRESS.

A. Peter J. Lanzalotta, Lanzalotta & Associates LLC, 67 Royal Pointe Drive, Hilton Head Island, SC 29926.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND.

A. I am a graduate of Rensselaer Polytechnic Institute, where I received a Bachelor of Science degree in Electric Power Engineering. In addition, I hold a Masters degree in Business Administration with a concentration in Finance from Loyola College in Baltimore.

Q. PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE.

A. I am a Principal of Lanzalotta & Associates LLC, which was formed in January 2001. Prior to that, I was a partner of Whitfield Russell Associates, with which I had been associated since March 1982. My areas of expertise include electric utility system planning and operation, electric service reliability, cost of service, and utility rate design. I am a registered professional engineer in the states of Maryland and Connecticut. My prior professional experience is described in Exhibit PJL-1, which is attached hereto.

I have been involved with the planning operation, and analysis of electric utility systems and with utility regulatory matters, including reliability-related matters, certification of new facilities, cost of service, cost allocation, and rate design, as an employee of and as a

consultant to a number of privately- and publicly-owned electric utilities, regulatory agencies, developers, and electricity users over a period exceeding thirty years.

I have been involved in a number of projects focused on electric utility transmission and distribution system reliability. I have worked for many years on behalf of the City of Chicago on electric reliability-related matters, and have been engaged by various government offices and agencies in the states of Delaware, Maryland, New Jersey, and Pennsylvania to help address electric service reliability concerns.

Q. HAVE YOU GIVEN EXPERT TESTIMONY IN ANY JUDICIAL OR QUASI-JUDICIAL PROCEEDINGS?

A. Yes, I have presented expert testimony before the Federal Energy Regulatory Commission and before regulatory commissions and other judicial and legislative bodies in 21 states, the District of Columbia, and the Provinces of Alberta and Ontario. My clients have included utilities, regulatory agencies, ratepayer advocates, independent producers, industrial consumers, the federal government, and various city and state government agencies. In Pennsylvania, I have most recently submitted testimony in an investigation of the electric service reliability of the First Energy electric utilities, and in investigations dealing with Pike County Light and Power Company's electric service reliability and its interconnectability with the PJM transmission system. The proceedings in which I have testified are listed in Exhibit PJL-2.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. My testimony, on behalf of the Office of Consumer Advocate ("OCA") addresses the following issues:

(1) Is there is a need for the Prexy facilities proposed by the Company?

(2) Are there reasonable and preferable alternatives to the Prexy facilities?

(3) Is there is a need for the 502 Junction facilities proposed by the Company?

(4) Is the Company's proposed use of aerial spraying of herbicides to maintain transmission rights-of-way reasonable?

(5) Has the Company addressed magnetic field concerns and the use of prudent techniques to minimize field exposures?

Q. ON WHAT INFORMATION IS YOUR TESTIMONY BASED?

A. In preparing my testimony I have reviewed the Company's Application, the testimony of Company expert witnesses, the Company responses to interrogatories, PJM documents and information, and FERC documents. I have participated in one of the guided site visits. I have attended some of the public input hearings in this proceeding. In addition, I have performed studies based on the information provided to evaluate the need for system reinforcement and alternatives for providing that reinforcement.

Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS.

A. Based on my review, I find the following:

(1) There is no need to build a new 500 kV line from 502 Junction to Prexy, or to build the new Prexy substation, in order to reinforce the 138 kV transmission system in Pennsylvania and address the problems described in TrAILCo Exhibit LAH-3. My initial studies indicate that the addition of four new 138 kV lines along the routes of existing 138 kV transmission lines, and the addition of capacitors at two existing substations, would eliminate all the problems described by the Company.

(2) The specific reliability problems identified for resolution by this line in Virginia and West Virginia should be further studied by TrAILCo, Allegheny and the state commissions, including Pennsylvania, to determine whether there are acceptable less costly alternatives with fewer adverse impacts. The planning criteria used to predict these reliability concerns may be overly conservative for this purpose. To the extent the 502 segment of the TrAILCo proposal is intended to deliver lower production cost generation to the east, the analysis discussed in OCA witness Fagan's testimony must be conducted in order to determine whether economic benefit would result in light of the likelihood of increased costs related to carbon dioxide emissions.

(3) My primary recommendation is that alternatives to the 502 Junction to Prexy 500 kV transmission line, the Prexy 500-to-138 kV substation, and the Prexy 138 kV circuits be pursued to reinforce the 138 kV system in Pennsylvania. If, however, the Commission were to approve any part of the Company's proposed facilities, more protective conditions should be imposed. I propose that that the Company's policy limitations on the use of aerial spraying of herbicides be considered

absolutely mandatory for use along transmission rights-of-way in Pennsylvania that are part of this proceeding. I further propose that no aerial spraying of herbicides be permitted along these transmission rights-of-way unless ground access to an area is limited by terrain contours or other features, or unless such access reflects unacceptable safety concerns. Finally, I propose that the Company's point assessment system for buffer violations be changed such that there is reduced tolerance for failure to leave the proscribed buffer.

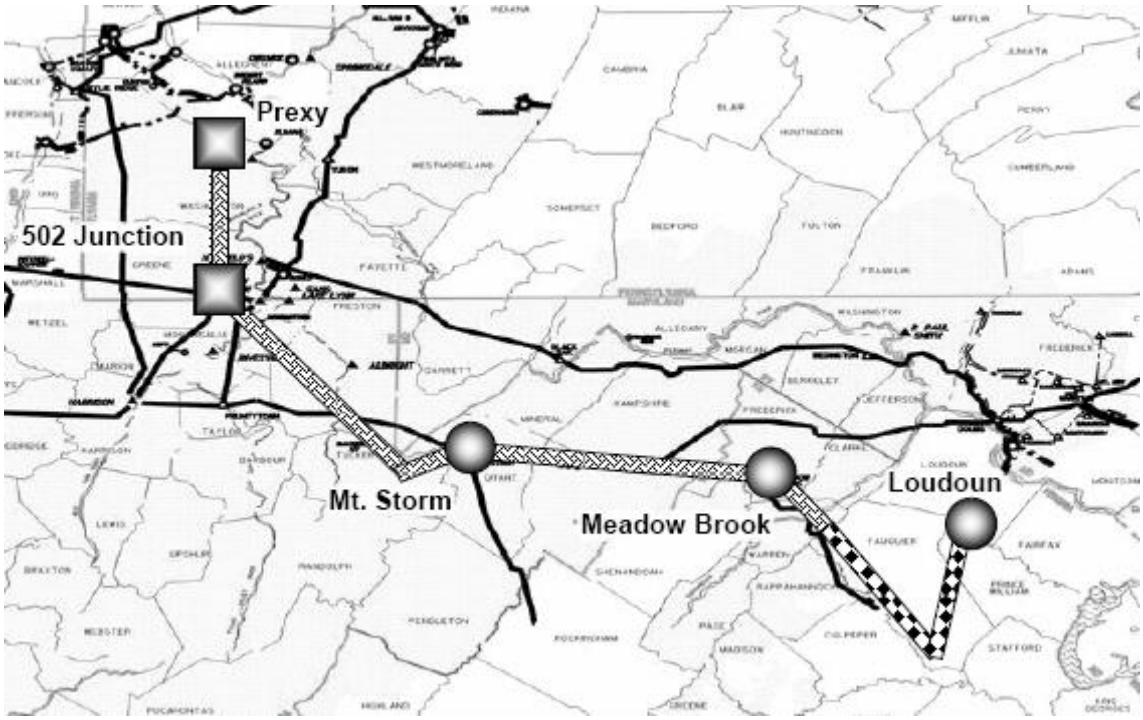
(4) Where new 138 kV lines are to be constructed, and where such construction will permit the use of reverse phasing without significantly increasing material costs, then reverse phasing should be used in these situations to reduce the EMF emitted from the lines.

The Proposed Facilities

Q. PLEASE DESCRIBE THE TRANSMISSION SYSTEM ADDITIONS AND REINFORCEMENTS THAT ARE PROPOSED FOR APPROVAL IN THIS PROCEEDING.

A. TrAILCo has proposed what is, in essence, two distinct 500 kV transmission lines, along with two new 500 kV substations, and new 500 kV equipment in existing substations. Looking at Figure 1 below, which is an excerpt from TrAILCo Exhibit LAH-1, we see the two new 500 kV substations proposed for Pennsylvania, i.e., Prexy and 502 Junction.

Figure 1



The first new 500 kV transmission line, referred to in the Company's filing as the Prexy Segment, is proposed to run north from the 502 Junction 500 kV substation to the proposed Prexy 500-to-138 kV substation, a distance of about 36 miles. The second new

500 kV transmission line, referred to in the Company's filing as the 502 Junction Segment, runs southeast from 502 Junction to the West Virginia state line, about 1.2 miles away through Pennsylvania, and continues on through West Virginia and Virginia to the existing Mt. Storm, Meadowbrook, and Loudoun substations, about another 240 miles.

Figure 2

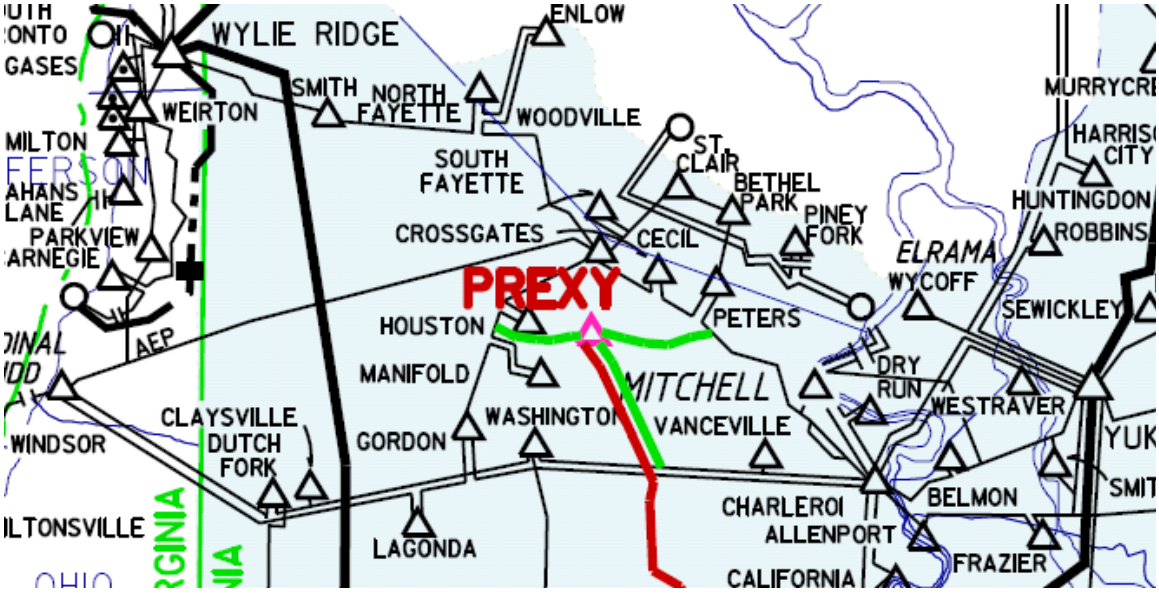
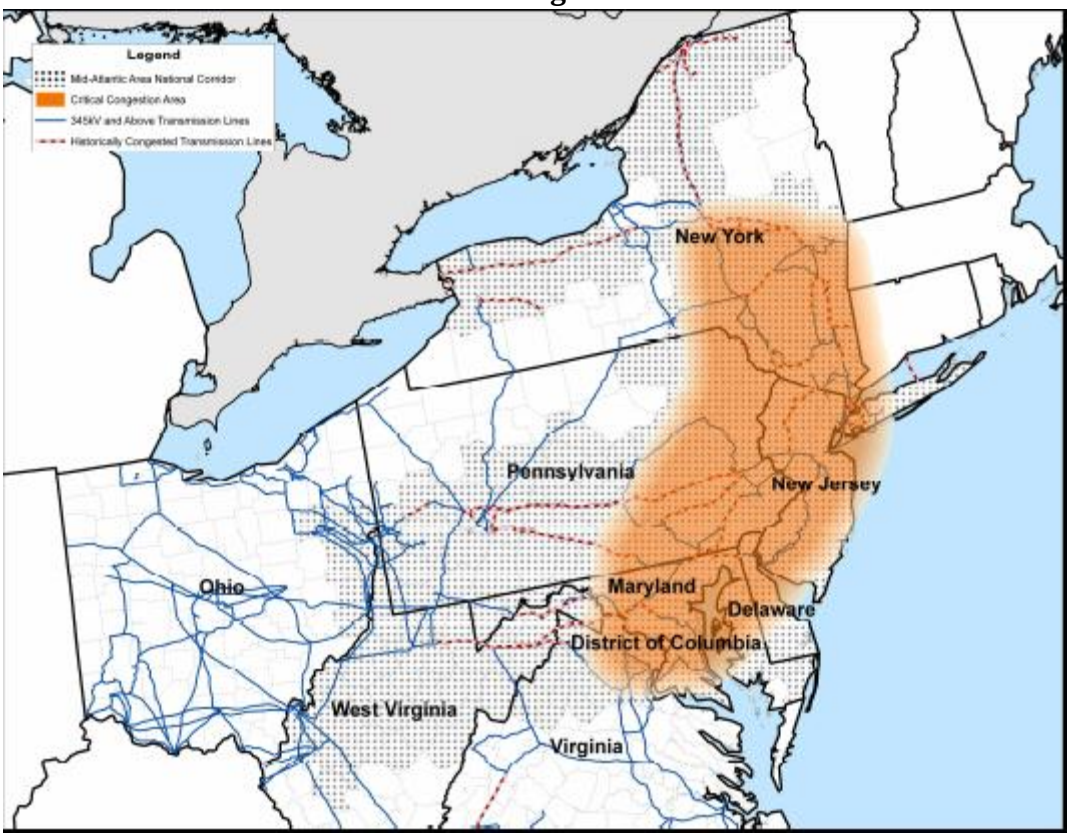


Figure 2 above, taken from TrAILCo Exhibit LAH-5, shows more detail of the proposed Prexy 500-to-138 kV substation and the three 138 kV transmission lines that have been proposed to interconnect the Prexy substation into the 138 kV system in Washington County, PA. Two of the three 138 kV lines will, in fact, be double circuits. The third, which runs south back along the 500 kV line to Prexy, would be constructed as a double circuit, but would be operated as a single 138 kV circuit for now.

Q. HOW DOES THE LOCATION OF THESE PROPOSED FACILITIES COMPARE WITH THE MID-ATLANTIC NATIONAL INTEREST TRANSMISSION CORRIDOR RECENTLY FINALIZED BY THE U. S. DOE?

A. Figure 3 below, depicts the Mid-Atlantic National Interest Transmission Corridor, as well as the area of most critical transmission system congestion.

Figure 3



It should be noted that the area where the 500 kV transmission line from 502 Junction to Prexy substation is proposed is entirely within Pennsylvania and is not located in the area of critical congestion, although it is located in the designated corridor.

The Existing Prexy Area Facilities

Q. PLEASE DESCRIBE THE EXISTING TRANSMISSION FACILITIES IN THE VICINITY OF THE PREXY SUBSTATION PROPOSED BY THE COMPANY.

A. As shown in Figure 2, the proposed Prexy substation would be located in the middle of an existing 138 kV network (the thin black lines) located in Washington County, PA, and fed out of the Wylie Ridge substation to the northwest, the Windsor substation to the southwest, and the Charleroi substation to the southeast. The existing 138 kV network includes:

(i) a 138 kV line from Wylie Ridge substation that runs through the Smith substation, the North Fayette substation, the Enlow substation and, finally, the Cecil substation,

(ii) a pair of 138 kV circuits that run from Charleroi west to Windsor, with connections with the Vanceville, Washington, Gordon, Lagonda, Claysville, and Dutch Fork substations (among others),

(iii) a 138 kV line from Charleroi substation to Cecil substation, that connects to or runs through the Peters and Crossgates substations, with a 138 kV side loop from Peters substation, through Bethel Park and St. Clair substations, to Cecil substation,

(iv) a 138 kV line from Cecil substation to Gordon substation that runs through the Houston and Manifold substations, and,

(v) a 138 kV line from Windsor substation, past Buffalo Junction, to Cecil substation.

Need for the Proposed Prexy Facilities

Q. WHY HAS THE COMPANY PROPOSED THE PREXY 500 KV SEGMENT, THE PREXY SUBSTATION, AND THE PREXY 138 KV TRANSMISSION LINES?

A. TrAILCo Witness Lawrence Hozempa, on page 5 of TrAILCo Statement No. 2, testifies that there are four reliability problems that will occur in 2009 if the Prexy Facilities are not constructed. These four reliability problems are listed in TrAILCo Exhibit LAH-3 and in Figure 4 in my testimony. They include four different double contingencies of the 138 kV network in Washington County, PA.

Q. WHAT DO YOU MEAN BY CONTINGENCIES?

A. "Contingencies" refer to electric system occurrences when one or more individual elements of the system, such as individual transmission lines, substation transformers, or generating units, are assumed, for planning purposes, to suffer forced outages. Typically, when elements of the transmission system are forced out of service, the rest of the system becomes more heavily loaded. In order to provide reliable electric service, transmission system planners have to plan, at a minimum, for a system that will deliver reliable service even if any individual component of that system suffers an unplanned outage. This is commonly referred to as a "first contingency" or a "single contingency" planning standard. All of the electrical reliability problems supporting the need for the Prexy

Facilities in TrAILCo Exhibit LAH-3 are "double contingencies", each with a separate forced outage occurring in two separate locations on the 138 kV network.

Q. WHAT ARE THE SYSTEM IMPACTS IN 2009 OF THE DOUBLE CONTINGENCIES THAT THE COMPANY USES TO JUSTIFY THE NEED FOR REINFORCEMENT OF ITS TRANSMISSION SYSTEM IN WASHINGTON COUNTY, PA?

A. Figure 4, below, which is excerpted from TrAILCo Exhibit LAH-3, lists the four pairs of double contingencies, along with the problems that occur as a result. The first double contingency is an outage of the Buffalo Junction 138 kV transmission interconnection and an outage of the Wylie Ridge to Smith 138 kV line. This results in an overload on the Union Junction 138 kV transmission interconnection.

Figure 4

	Electrical Occurrence	Electrical Result
1	Outage of Buffalo Junction and Wylie Ridge-Smith 138 kV lines.	The Union Junction 138 kV line exceeds its emergency rating and overloads.
2	Outage of Buffalo Junction and Union Junction 138 kV lines.	The Wylie Ridge-Smith 138 kV line exceeds its emergency rating and overloads. Also, the 138 kV voltage at 11 substations drops below acceptable limits and could lead to a voltage collapse in the area.
3	Outage of Union Junction and Wylie Ridge-Smith 138 kV lines.	The Gordon-Manifold 138 kV line exceeds its emergency rating and overloads. Also, the 138 kV voltage at 15 substations drops below acceptable limits and could lead to a voltage collapse in the area.
4	Outage of Union Junction and Gordon-Manifold 138 kV lines.	The 138 kV voltage at 10 substations drops below acceptable limits and could lead to a voltage collapse in the area.

The second set of contingencies, the simultaneous outage of both the Buffalo Junction and the Union Junction 138 kV lines, results in an overload of the Wylie Ridge to Smith 138 kV line and in low voltage at a large number of local 138 kV substations. In similar fashion, the third and fourth sets of contingencies, both are combinations of an outage of Union Junction and an outage of another 138 kV transmission line, also result in widespread low voltage and in limited 138 kV line overloads. I note that none of these four cases mentions any 138 kV transformer overloads as a result of any of these four contingency situations. This is significant, since the Company's proposal to address these problems includes adding new 500-to-138 kV transformer capacity.

The two "junctions," Buffalo Junction and Union Junction are obviously critical points on the transmission system, as they are part of every one of the four sets of contingencies in TrAILCo Exhibit LAH-3. These junctions are points on the transmission system where one transmission line hooks into another transmission line with a "T" type of connection, with no breakers or other protective devices between the two lines. When one of the lines has a fault, both are forced out of service because of the lack of protective devices between the two lines. Looking at Figure 2, the Buffalo Junction is located along the 138 kV line from Windsor, in the lower left, to Cecil in the center. The "T" tap that is Buffalo Junction is located close to Windsor, near the letters "AEP." The Union Junction is along the 138 kV line from Charleroi, in the lower right, to Peters, near Mitchell.

Q. DOES THE COMPANY'S PROPOSED 500 KV TRANSMISSION LINE, ITS 500-TO-138 KV PREXY SUBSTATION, AND ITS 138 KV TRANSMISSION LINES SUCCESSFULLY DEAL WITH THE PROBLEMS THAT RESULT FROM THE FOUR DOUBLE CONTINGENCIES FROM TRAILCO EXHIBIT LAH-3?

A. Yes. However, as I explain in my testimony, there are less expensive, and less intrusive, ways to address the problems in TrAILCo Exhibit LAH-3 than what has been proposed by the Company.

Q. WHAT ALTERNATIVES TO THE PROPOSED PREXY FACILITIES DID THE COMPANY SAY WERE CONSIDERED?

A. The Company was asked about alternatives to the Prexy facilities that were considered in OCA-I-17a. In response, the Company answered that the only alternative to its proposed plan that it considered was a 500-to-138 kV substation in western Washington County along the Wylie Ridge-to-Harrison 500 kV line.

Q. WHY WAS THE ALTERNATIVE OF A 500-TO-138 KV SUBSTATION IN WESTERN WASHINGTON COUNTY REJECTED?

A. In response to OCA-VII-4(b), the Company stated that the first alternative, the new 500-to-138 kV substation along the Wylie Ridge-to-Harrison 500 kV line, did not raise voltages in northern Washington County to an acceptable level.

Q. DO YOU HAVE ANY CONCERNS WITH THE ASSESSMENT CONDUCTED BY THE COMPANY?

A. Yes. I have performed analyses of the load flow data associated with the system conditions expected in 2009. These analyses of the 2009 base case system load flow studies indicate that all of the voltage problems associated with the 2009 contingencies in the Company's testimony can be addressed without the construction of a new 500 kV substation, regardless of its location.

It is curious to me that all of the Company's alternatives include the addition of new 500-to-138 kV substation with new 500-to-138 kV substation transformer capacity. As I mentioned above, not one of the double contingencies presented in support of the need for the Prexy facilities, in TrAILCo Exhibit LAH-3, (Figure 4 above), results in any

reported overloads of the existing transformers feeding the Company's 138 kV system. In other words, there is no apparent need to add new 500-to-138 kV substation transformers to the system. My analyses indicate that the voltage problems that are reflected in TrAILCo Exhibit LAH-3 can be corrected without the need for a new 500-to-138 kV substation or a new 500 kV transmission line.

Q. WHAT ALTERNATIVES EXIST THAT WERE APPARENTLY NOT CONSIDERED?

A. My analyses indicate that it is possible to eliminate all of the problems listed in TrAILCo Exhibit LAH-3 by adding four 138 kV transmission lines on existing rights-of-way to the 138 kV network in Washington County, and by adding two 138 kV substation capacitors to the existing system in Washington County. These alternatives are described in greater detail later in my testimony. I haven't seen any indication that this approach was modeled or considered by the Company.

In addition, it is possible to reduce the current impact of a fault affecting the 138 kV transmission lines that make up Buffalo Junction or Union Junction by reconfiguring the system to eliminate these "T" connections so that one fault will no longer take out two transmission lines. This could be as simple as placing a small substation at the junction connection point with circuit breakers for one or more of the transmission lines. Or it could be something more substantial, such as a new circuit out of an existing substation to connect to one of the transmission lines at the junction point, thus eliminating the "T" connection. I haven't seen any indication that this approach was considered by the Company, either.

Q. PLEASE DISCUSS THE ANALYSES YOU PERFORMED ON THESE ALTERNATIVES?

A. In addition to reviewing the loading of electric system facilities in the area and the capabilities of electric system facilities in the area, I reviewed and worked with load flow study materials used in the analysis of the four double contingencies in TrAILCo Exhibit LAH-3. Load flow studies are performed by computer model to examine the performance of the transmission system with regard to loading of facilities and the voltage level of facilities, under various configurations of facilities, at various load levels, and under various types of contingencies.

Load flow studies are performed on what is a commercially available computer model. Data files that describe the configuration of the electric system, its loads and its resources are loaded in and the model attempts to find a convergent solution, which can then be saved, as a "saved" case. These saved cases include both the system description, and also the solution set of loads, flows and settings that produced the convergent solution. These saved cases can be reviewed directly, without the need to produce a successful convergence of the system data with a run of the model. Modifications can be made to the saved case to reflect various system reinforcements and then it is solved to convergence again to produce a new saved case.

I ran contingency load flow studies against the unreinforced 2009 system to study the problems listed in TrAILCo Exhibit LAH-3. Then, I added reinforcements to the 138

kV system and ran the same contingencies against my reinforced system to determine whether the problems had been eliminated. Consistent with the Company's study assumptions, I assumed that no customer loads would be dropped due to these contingencies[1].

Q. WHAT 138 KV TRANSMISSION LINES, OR OTHER REINFORCEMENTS, DID YOU MODEL IN AN EFFORT TO ADDRESS THE PROBLEMS PRESENTED IN TRAILCO EXHIBIT LAH-3?

A. I modeled the addition of the following new 138 kV transmission lines:

Wylie Ridge to Cecil

Charleroi to Peters

Peters to Cecil

Cecil to Gordon

These lines all follow the paths of existing 138 kV transmission lines. In some places, there may be existing transmission poles with space available for a new 138 kV circuit, especially near existing substations. Otherwise, a new set of poles would be needed. The addition of these lines eliminate most of the problems presented by the Company in TrAILCo Exhibit LAH-3, however, some borderline voltage concerns still remain.

1 Under the minimum NERC standards for multiple contingencies, the controlled interruption of customer demand (dropping of customer loads), the planned removal of generators, and the curtailment of firm power transfers are accepted methods to implement to keep the system stable. See TrAILCo Exhibit LAH-4, pg. 1, Part B Requirements, Section R-1, Category C of Table 1. PJM and TrAILCo are using a more conservative reliability standard in this instance that calls for bringing the system to a stable state without dropping customer load. I have utilized this more conservative requirement in my analyses as well.

Q. WHAT BORDERLINE VOLTAGE CONCERNS REMAINED?

A. Under contingency conditions, the Company permits 138 kV substation voltages to drop as low as 10% below 138 kV, i.e., nominal votage. With the addition of the 138 kV lines described above, the voltage at some area substations drop to 6% to 7% below nominal voltage under contingency conditions. My preference was for a more conservative solution that reduced these voltage drops to less than 5%.

Q. WHAT SOLUTION DID YOU CONSIDER FOR THESE VOLTAGE CONCERNS?

A. The addition of 44 MVAR[2] of capacitors at the Smith substation and at the Bethel Park substation, in conjunction with the addition of the lines described above, achieved my goal of reducing the voltage drops to less than 5%.

Q. WILL THIS APPROACH REQUIRE ADDITIONAL FACILITIES AT EXISTING 138 KV SUBSTATIONS?

A. Yes, it will. However, the Company has indicated, in its response to OCA-V-1(f) that, other than the Mitchell substation, none of the other area substations would require the purchase of additional property in order to add additional equipment. In addition, it is possible to adjust the terminal points of the new 138 kV lines listed above to some extent and still achieve system reinforcement. I note that the Company's preferred alternative also requires the construction of new 138 kV transmission lines, many of them along new rights-of-way, which would be eliminated under my alternative.

2 Mega-Volt-Ampres Reactive

Q. COULD YOU FURTHER EXPLAIN YOUR UNDERLYING APPROACH?

A. The theory behind my selection for new lines was to by-pass Union Junction and to provide extra redundancy on critical 138 kV transmission segments. It demonstrates that there are system reinforcement alternatives that deal with the contingencies the Company is concerned about that do not require either a new 500 kV line or a new 500 kV substation at Prexy.

The facilities additions that I have studied by no means represent an optimized solution, but rather a first attempt at dealing with a set of listed problems as is presented in TrAILCo Exhibit LAH-3. As I mentioned earlier, another potentially fruitful approach to reinforcement would be to eliminate the "T" taps on the 138 kV transmission lines at Buffalo Junction and Union Junction. I chose system reinforcements that would be relatively easy to represent in the load flow model. Reconfiguring these "T" taps would be a more complicated modeling exercise, but also has the potential to greatly reduce the system impacts of the contingencies listed in TrAILCo Exhibit LAH-3.

Q. WHAT DO YOU CONCLUDE REGARDING THE NEED FOR THE PROPOSED 500 KV LINE FROM 502 JUNCTION TO PREXY AND FOR THE PROPOSED 500-TO-138 KV SUBSTATION AT PREXY?

A. There is no need to build a new 500 kV line from 502 Junction to Prexy, or the new Prexy substation, in order to reinforce the 138 kV transmission system in Pennsylvania and address the problems described in TrAILCo Exhibit LAH-3. My initial studies indicate that the addition of four new 138 kV lines along the routes of existing 138 kV

transmission lines, and the addition of capacitors at two existing substations, would eliminate all the problems described in TrAILCo Exhibit LAH-3.

Q. HOW WOULD THE COST OF YOUR FOUR NEW 138 KV LINES AND TWO CAPACITOR BANKS COMPARE TO THE COSTS OF THE PROPOSED PREXY FACILITIES?

A. The cost of the Prexy facilities, as provided by the Company in response to OCA-I-17(b), is $213.52 million. Of this amount, about $144 million is for 500 kV facilities that are completely avoided by my alternative proposal. The cost of the Prexy facilities also includes almost $36 million for 138 kV substation facilities, including a new substation capacitor bank, and more than $33 million for new 138 kV transmission lines. I have estimated that the cost of the new 138 kV lines and related substation facilities under my alternative could cost about $55 million, comprised of $41 million for new 138 kV lines, $4 million for circuit breakers and related substation facilities, $824 K for capacitors, and some $9 million in contingencies. This is less than the $69 million estimated for 138 kV substation facilities and new 138 kV lines under the Company's proposal, to say nothing of the $144 million we save by avoiding the need to build the 500 kV transmission line and 500 kV substation facilities included among the Prexy facilities.

Q. YOU EARLIER ASSERTED THAT ADDING 138 KV LINES ALONG EXISTING LINE ROUTES TO EXISTING SUBSTATIONS WAS LESS INTRUSIVE THAT THE 500 KV FACILITIES PROPOSED BY THE COMPANY. PLEASE COMMENT.

A. The 500 kV line to Prexy would be about 160 feet high and would traverse more than 30 miles of virgin right-of-way. 138 kV lines on the Company's system are typically less than 60 feet tall.

The lines proposed in my testimony are conceptually designed to follow rights-of-way that currently have an existing 138 kV line and, so, are already impacted to some degree. The 138 kV lines to the east and west of Prexy substation as proposed by the Company are along rights-of-way that currently do not have a transmission line and, therefore, will cause greater impacts along those routes.

The Company's proposal requires the construction of a new 500 kV-to-138 kV substation along with transformers, breakers, busswork, fences, and the like. Conversely, my proposal would add 138 kV lines to existing substations. This proposal would add one or more breakers and could add bus-work to existing substations, but this would not require addition of a transformer and might not even require expansion of the fenced-in areas of the substation. My approach is less intrusive to those living near the substation sites.

Need for the Proposed 502 Junction Facilities

Q. COULD YOU NOW TURN TO THE TRANSMISSION FACILITIES RELATED TO WHAT HAS BEEN CALLED THE 502 JUNCTION TO LOUDOUN TRANSMISSION LINE?

A. Yes. The 502 Junction substation and the 500 kV transmission line to West Virginia and Virginia is part of a larger project proposed by TrAILCo. This project is approximately 241 miles in length, with 1.2 miles crossing Pennsylvania from the 502 Junction substation to the West Virginia line.

Q. WHAT INFORMATION DOES TRAILCO OFFER TO SUPPORT A NEED FOR THE 502 JUNCTION SUBSTATION AND THE 500 KV TRANSMISSION LINE TO WEST VIRGINIA AND VIRGINIA?

A. TrAILCo Witness Scott Gass testifies, starting on page 8 of TrAILCo Statement No. 4, that there are 11 electric reliability problems that are likely to occur beginning in 2011 and one electric reliability problem that is likely to occur beginning in 2014 if these facilities are not constructed. These problems, which are all in West Virginia and Virginia, are identified on Chart A of TrAILCo Exhibit SWG-1, which is reproduced below as Figure 5.

Figure 5

	Electrical Occurrence	Electrical Result
1	Outage of Mount Storm – Greenland Gap Line #572A.	Mount Storm – Doubs 500 kV Line #512 exceeds its emergency rating and overloads.
2	Outage of Meadowbrook – Greenland Gap Line #572B.	
3	Outage of Hatfield – Black Oak 500 kV Line # 542.	
4	Outage of Bedington – Black Oak 500 kV Line # 544.	
5	Outage of Mount Storm – Greenland Gap 500 kV Line # 572A while Possum Point Unit #5 is unavailable.	
6	Outage of Meadowbrook – Greenland Gap Line #572B while Possum Point Unit #5 is unavailable.	
7	Outage of Hatfield – Black Oak 500 kV Line # 542 while Possum Point Unit #5 is unavailable.	
8	Outage of Bedington – Black Oak 500 kV Line # 544 while Possum Point Unit #5 is unavailable.	
9	Outage of Hatfield – Black Oak 500 kV Line # 542.	Mount Storm – Pruntytown 500 kV Line #510 exceeds its emergency rating and overloads.
10	Outage of Morrisville – Meadow Brook 500 kV Line #580 and the Meadow Brook – Greenland Gap Line #572B.	The 138 kV system voltage level around Meadow Brook Substation drops below acceptable limits and could lead to a voltage collapse in the area.

	Electrical Occurrence	Electrical Result
11	Outage of the Hatfield – Black Oak 500 kV Line #542 and Mount Storm – Doubs Line #512.	The 500 kV and 138 kV system voltage levels around Meadow Brook Substation drops below acceptable limits.
12	Outage of the Black Oak – Bedington 500 kV Line #544 and Mount Storm – Doubs Line #512.	

I note that the electric reliability problems are related in some cases to single contingency events and, in some cases, to multiple contingency events.

In identifying these reliability problems, Mr. Gass begins with the NERC reliability criteria, but, as mentioned earlier, does not allow for customer to be dropped to bring the system to a stable state. NERC reliability planning standards represent the minimum required level of reliability for electric transmission systems. PJM uses more rigorous deliverability testing criteria than NERC to ensure compliance with NERC standards.[3]

Q. WHAT DO YOU MEAN BY DELIVERABILITY TESTING CRITERIA?

A. PJM tests transmission system reliability using both a load deliverability test and a generator deliverability test.

The load deliverability test looks at the transmission system's ability to deliver power at peak load periods to areas of the system that may be short of generation relative to load. It is based on having enough transmission system capacity under single contingency conditions to deliver sufficient energy to achieve a loss-of-load expectation ("LOLE") of 1 day in 25 years[4]. This compares to a LOLE of one day in ten years that is used to determine how much generation is needed for reliability.

The generator deliverability test looks at the transmission system's ability to move power at peak load periods out of areas of the system that may have excess generation relative to load. The generator deliverability does not tie explicitly with any particular

3 TrAILCo Statement No. 3, page 11, lines 1-9.

4 PJM Manual 14B Generation and Transmission Interconnection Planning, Attachment E Deliverability Testing Methods, pg. 61.

level of reliability, other than to provide for certain levels of deliverability for concentrations of generation on the system to other parts of the system.

Q. IS THE NEED FOR THE 502 JUNCTION TO LOUDOUN TRANSMISSION LINE BASED ON NERC RELIABILITY STANDARDS?

A. It is difficult to tell by how much the need for this line exceeds NERC standards. Of the entries in Figure 5, Electrical Occurrences 1 though 9 are described as violations of NERC reliability standards for single contingency events, which do not permit load or firm transmission to be dropped. (Gass, p 16 line 1-5) However, these violations are driven in part by which generating units are assumed to be serving load in eastern PJM and to what degree. Deliverability testing by design stresses the transmission system by modeling the movement of increased generation to points on the system during periods of peak load. As I mention above, the load deliverability testing provides for the transmission system to be capable of transmitting enough power to meet a higher reliability standard, a LOLE of 1 day in twenty-five years, than is provided in the capacity planning process, which targets a LOLE of 1 day in ten years. This extra strain on the transmission system increases transmission requirements. Similarly, the generator deliverability testing reflects the ability to move energy generated in areas of the system with excess generation to other areas of the system. As discussed in the direct testimony of Robert Fagan on behalf of the OCA, the TrAILCo project has been projected to increase by more than 10 million MWH per year in 2013 the amount of eastern zone generation in PJM displaced by western generation. While this may increase the

marketability of such generation, it is not tied to meeting minimum NERC reliability standards.

Q. MR. HOZEMPA TESTIFIES, ON PAGES 9 AND 10 OF TRAILCO STATEMENT NO.2, THAT FAILURE TO BUILD THE 502 JUNCTION SUBSTATION AND THE TRANSMISSION LINE TO LOUDOUN WILL PUT PENNSYLVANIA CUSTOMERS AT RISK OF SYSTEM BLACKOUTS LIKE THAT WHICH OCCURRED IN AUGUST 2003. DO YOU AGREE?

A. No. The August 2003 blackout was driven in part by failure of control room systems and personnel, and by a lack of available operating procedures needed to maintain the system during such an emergency. As noted in the Final NERC Report on the August 14, 2003 Blackout, from the Event Summary of Causal Events:

> Shortly after 14:14, the alarm and logging system in the FE control room failed and was not restored until after the blackout. Loss of this critical control center function was a key factor in the loss of situational awareness of system conditions by the FE operators. Unknown to the operators, the alarm application failure eventually spread to a failure of multiple energy management system servers and remote consoles, substantially degrading the capability of the operators to effectively monitor and control the FE system. At 14:27, the Star-South Canton 345- kV tie line between FE and AEP opened and reclosed. When AEP operators called a few minutes later to confirm the operation, the FE operators had no indication of the operation (since the alarms were out) and denied their system had a problem. **This was the first clear indication of a loss of situational awareness by the FE operators.** (p27) emphasis added
>
> Between 15:05 and 15:42, three FE 345-kV transmission lines supplying the Cleveland-Akron area tripped and locked out because the lines contacted overgrown trees within their rights-of way. At 15:05, while loaded at less than 45 percent of its rating, FE's Chamberlin-Harding 345-kV line tripped and locked out. **No alarms were received in the FE control room because of the alarm processor failure, and the operators' loss of situational awareness had grown from not being aware of computer problems to not being aware of a major system problem.** (p27) emphasis added

> **Although overgrown trees caused an unexpected rash of non-random line trips on the FE system, and FE operating personnel lost situational awareness, there could have been assistance from MISO, FE's reliability coordinator, had it not been for lack of visual tools and computer problems there as well. T**he first sign of trouble came at 12:15, when MISO's state estimator experienced an unacceptably large mismatch error between state-estimated values and measured values. The error was traced to an outage of Cinergy's Bloomington-Denois Creek 230-kV line that was not updated in MISO's state estimator. The line status was quickly corrected, but the MISO analyst forgot to reset the state estimator to run automatically every five minutes. (p28) emphasis added
>
> At 14:02, DP&L's Stuart-Atlanta 345-kV line tripped and locked out due to a tree contact. By the time the failure to reset the MISO state estimator to run automatically was discovered at 14:40, the state estimator was missing data on the Stuart-Atlanta outage and, when finally reset, again failed to solve correctly. **This combination of human error and ineffective updating of line status information to the MISO state estimator prevented the state estimator from operating correctly from 12:15 until 15:34. MISO's real-time contingency analysis, which relies on state estimator input, was not operational until 16:04. During this entire time, MISO was unable to correctly identify the contingency overload that existed on the FE system after the Chamberlin-Harding line outage at 15:05, and could not recognize worsening conditions as the Hanna-Juniper and Star-South Canton lines also failed.** MISO was still receiving data from FE during this period, but was not aware of the line trips. (p28) emphasis added
>
> **By around 15:46, when FE, MISO, and neighboring systems had begun to realize that the FE system was in serious jeopardy, the only practical action to prevent the blackout would have been to quickly drop load. Analysis indicated that at least 1,500 to 2,500 MW of load in the Cleveland-Akron area would have had to been shed. However, no such effort was made by the FE operators. They still lacked sufficient awareness of system conditions at that time and had no effective means to shed an adequate amount of load quickly.** Furthermore, the investigation found that FE had not provided system operators with the capability to manually or automatically shed that amount of load in the Cleveland area in a matter of minutes, nor did it have operational procedures in place for such an action. (p28) emphasis added

In addition to the failures and errors that helped cause the 2003 blackout, MISO and FE were, at the time, relatively inexperienced in their operating relationship. MISO the regional reliability coordinator, became reliability coordinator for FirstEnergy on

February 1, 2003, while FirstEnergy did not become a full member of MISO until October 1, 2003, six weeks after the blackout. MISO and FE now have over four years experience working with each other.

That is not to say that another system collapse could not happen. But, to base the need for new transmission on the ability to be able to survive the effects of the shortcomings chronicled above goes beyond what is reasonable. The scenario described by Mr. Hozempa where an outage of one 500 kV transmission line causes other 500 kV lines to overload and trip out, with the potential for a cascading failure could happen even with a new 500 kV transmission line, if the control systems and control personnel today perform like those for MISO and FE did back in 2003.

Q. WHAT ARE YOUR CONCLUSIONS REGARDING THE PROPOSED TRANSMISSION LINE FROM 502 JUNCTION TO LOUDOUN?

A. The specific reliability problems identified for resolution by this line in Virginia and West Virginia should be further studied by TrAILCo, Allegheny and the state commissions, including Pennsylvania, to determine whether there are acceptable less costly alternatives with fewer adverse impacts. As I noted, the planning criteria used to predict these reliability concerns may be overly conservative for this purpose. To the extent the 502 segment of the TrAILCo proposal is intended to deliver lower production cost generation to the east, the analysis discussed in OCA witness Fagan's testimony must be conducted in order to determine whether economic benefit would result in light of the likelihood of increased costs related to carbon dioxide emissions.

Aerial Spraying of Herbicides in Transmission Right-of-Way Maintenance

Q. TRAILCO WITNESS JOHN BODENSCHATZ DISCUSSES THE PLANNED USE OF AERIAL SPRAYING OF HERBICIDES TO MAINTAIN TRANSMISSION LINE RIGHTS-OF-WAY IF THE LINE IS APPROVED. PLEASE COMMENT.

A. On page 32 of TrAILCo Statement No. 7, Mr. Bodenschatz testifies (lines 12-15) that herbicide spraying using helicopters will be used to maintain the right-of-way for the proposed TrAILCo transmission line. He continues, on page 36, explaining that:

> For example, TrAILCo will use herbicides specifically designed to control unwanted plants, in a selective fashion, only in suitable portions of its rights-of-way. (lines 19-21)

People who live along the proposed right-of-way for the TrAILCo transmission line have expressed concern about the use of herbicides along the transmission line. A frequent concern voiced at site visits and public hearings was about the Company's proposed aerial spraying of herbicides and how it might affect their children, their livestock, their water supply from local wells, and their crops. It is important to recognize that many of the affected families lived along the proposed transmission lines do not have access to a public water supply.

Q. WHY ARE HERBICIDES USED IN TRANSMISSION LINE RIGHT-OF-WAY MAINTENANCE?

A. Herbicides are used to deal with particularly persistent or fast growing vegetation. They are used in some situations to reduce the use of personnel engaged in clearing or trimming vegetation from the ground, a particularly hazardous type of work. Aerial spraying may be used in situations where rights-of-way are along difficult to traverse or inaccessible terrain.

Q. DO OTHER REGIONAL ELECTRIC UTILITIES USE AERIAL SPRAYING OF HERBICIDES FOR TRANSMISSION LINE RIGHT-OF-WAY MAINTENANCE?

A. Yes, several of the transmission owners in our region use aerial spraying. In response to OCA-III-1(e), the Company responded:

> Allegheny Power is aware that the following utility organizations utilize helicopter spraying for the application of herbicides. Allegheny has no knowledge of each organization's specific application practices and this list is not intended to be all-inclusive. Pennsylvania utilities are indicated by (PA). Those utilities are American Electric Power, First Energy (PenElec and Met Ed in PA), Ameron, East Kentucky Power, Kentucky Utility, Continental Cooperative, Somerset Rural Electric (PA), and Dominion Power.

Q. WHICH HERBICIDES DOES THE COMPANY INTEND TO USE TO MAINTAIN THE TRAILCO TRANSMISSION LINES RIGHTS-OF-WAY?

A. In response to OCA-III-4(b), the Company identified the herbicides that it uses or contemplates using as follows:

> Herbicides that may be used along the TrAIL rights-of-way, and the associated application methods include:
>
> 1)Garlon 3 – Foliar application, ground or aerial
> 2) Garlon 4 – Ultra Low Volume Basal Bark application
> 3) Tordon 101 – Foliar application, ground or aerial
> 4) Tordon K – Foliar application, ground or aerial
> 5) Krenite S – Foliar application, ground or aerial
> 6) Escort XP – Foliar application, ground or aerial

7) Accord C – Foliar application – ground
8) Arsenal – Foliar application – ground
9) Stalker – Basal Bark application – ground
10) Vista – Foliar application - ground

Of these ten herbicides, five are contemplated for aerial application: Garlon 3, Tordon 101, Tordon K, Krenit S, and Escort XP.

Q. WHAT STEPS ARE TAKEN TO HELP SAFEGUARD ANIMALS WHEN HERBICIDES ARE USED?

A. The Company discussed some of these steps in response to OCA-III-4(a) as follows:

> Approved herbicides, when applied according to label directions and in the diluted forms that will be utilized, will result in significantly reduced levels of active ingredients of that herbicide within the right-of-way corridor where applied. Consequently, the amount of herbicide available for exposure will be significantly limited…….Consequently, given Allegheny Power's practices for diluting and utilizing herbicides infrequently and only where appropriate along rights-of-way, the amount of active ingredient that would be present on each pound of available forage will be so small that a foraging animal cannot physically consume and accumulate in its digestive tract enough active ingredient to adversely affect the animal.

Q. WHAT TYPES OF RESTRICTIONS ARE SPECIFIED BY THE MAKERS OF HERBICIDES REGARDING THEIR USE ON GRAZING AREAS?

A. Figure 6 below lists herbicide manufacturers' label comments regarding grazing, as provided by the Company in response to OCA-III-4(d):

Figure 6

Product	Manufacturer's Label Comments Regarding Grazing
Garlon 3A	May be used on grazing areas if not more than 10 % of total grazable area is treated; lactating animals may not graze until season following application
Garlon 4	May be used on grazing areas if not more than 10 % of total grazable area is treated; lactating animals may not graze until season following application
Tordon 101	May be used on grazing areas
Tordon K	May be used on grazing areas
Krenite S	No grazing provisions found in label
Escort XP	May be used on grazed areas
Accord C	May be used on grazed areas; some restriction for lactating animals, no more than 15-25% of the available area may be treated, depending upon amount applied/acre
Arsenal	May be used on pastured areas
Stalker	May be used on pastured and rangeland areas
Vista.	May be used on pastured and rangeland areas

Of the herbicides above with any grazing-related restriction, only Garlon 3 has been indicated by the Company for potential aerial application.

Q. WHAT TYPES OF RESTRICTIONS ARE SPECIFIED BY THE MAKERS OF HERBICIDES REGARDING THEIR USE ON AGRICULTURAL AREAS?

A. Figure 7 below lists herbicide manufacturers' label comments regarding use on agricultural areas, as provided by the Company in response to OCA-III-4(e):

Figure 7

Product	Manufacturer's Label Comments Regarding Agriculture
Garlon 3A	Use in non-crop areas and wildlife openings; do not harvest hay until 14 days after application; ag workers should not re-enter treated area until 12 hours after application unless PPE is worn
Garlon 4	Use in non-crop areas and wildlife openings; do not harvest hay until 14 days after application; ag workers should not re-enter treated area until 12 hours after application unless PPE is worn
Tordon 101	Use in non-crop areas and wildlife openings; do not apply to plants not registered for use with picloram or land that will be planted with plants not registered with picloram until picloram is absent; ag workers should not re-enter treated area until 12 hours after application unless PPE is worn
Tordon K	Use in non-crop areas and wildlife openings; do not apply to plants not registered for use with picloram or land that will be planted with plants not registered with picloram until picloram is absent; g workers should not re-enter treated area until 12 hours after application unless PPE is worn
Krenite S	Use in non-crop areas; ag workers should not re-enter treated area until 12 hours after application unless PPE is worn
Escort XP	Do not use on food or feed crops; use on non-crop areas; ag workers should not re-enter treated area until 12 hours after application unless PPE is worn
Accord C	Will not provide residual brush or weed control; ag workers should not re-enter treated area until 12 hours after application unless PPE is worn
Arsenal	Use in non-crop areas and wildlife openings; ag workers should not re-enter treated area until 12 hours after application unless PPE is worn
Stalker	Do not use on food or feed crops; ag workers should not re-enter treated area until 12 hours after application unless PPE is worn
Vista.	Targets non-crop areas; ag workers should not re-enter treated area until 12 hours after application unless PPE is worn; do not harvest grass for hay or sileage within 7 days of application;

Note that every herbicide listed, except for Accord C, either specifies use in non-crop areas or specifically specifies that they not be used on food or feed crops. All specify that agricultural workers stay out of treated areas for 12 hours unless personal protective equipment ("PPE") is used.

Q. ARE THERE LABEL RESTRICTIONS THAT ADDRESS THE USE OF THESE HERBICIDES AROUND WATER?

A. Yes. Figure 8 below lists herbicide manufacturers' label comments regarding right-of-way use after herbicide application, as provided by the Company in response to OCA-III-4(f):

Figure 8

Product	Manufacturer's General Label Comments
Garlon 3A	May be used in standing water; withdraw livestock 3 days before slaughter; non-ag workers should not enter treated area until spray is dry unless PPE is worn
Garlon 4	No open-water application; withdraw livestock 3 days before slaughter; non-ag workers should not enter treated area until spray is dry unless PPE is worn
Tordon 101	No application to water or areas below high water mark; non-ag workers should not enter treated area until spray is dry unless PPE is worn
Tordon K	No application to water or areas below high water mark; non-ag workers should not enter treated area until spray is dry unless PPE is worn
Krenite S	Ok to treat seasonal wet areas after water recedes; no application to standing water or running water; non-ag workers should not enter treated area until spray is dry unless PPE is worn
Escort XP	Ok to treat seasonal wet areas after water recedes; no application to standing water or running water; non-ag workers should not enter treated area until spray is dry unless PPE is worn
Accord C	
Arsenal	No application to water or areas below high water mark; non-ag workers should not enter treated area until spray is dry unless PPE is worn
Stalker	No application to water or areas below high water mark; non-ag workers should not enter treated area until spray is dry unless PPE is worn
Vista.	No application to water or areas below high water mark; non-ag workers should not enter treated area until spray is dry unless PPE is worn; meat animals must be withdrawn 2 days before slaughter

I note that the majority of these herbicides should not be applied to water.

Considering the prevalence of agricultural activities in Washington and Green Counties in Pennsylvania (the areas to be traversed by the proposed 500 kV transmission line to Prexy) and customers' concerns about water supplies from local wells, it is understandable that there would be concerns about the proposed aerial spraying of herbicides as part of maintaining the transmission line right-of-way.

Q. WHAT TYPES OF LIMITATIONS ARE APPLIED BY THE COMPANY TO THE AERIAL SPRAYING OF HERBICIDES IN PARTICULAR?

A. The Company discusses some of these limitations in response to OCA-III-2(a):

> Because helicopter applications cannot precisely target individual stems, only specific areas can be selected and sprayed using helicopters. For example, aerial application is not utilized where the ground line is greater than 150 feet below the conductor, which would typically include sections of transmission conductor that span a ravine or valley. Nor is aerial application utilized over open, standing, or running waters. Aerial applications usually target only areas with medium to heavy brush density. Areas that are appropriate and, thus, selected for aerial application would be sprayed with herbicides intended to control unwanted brush and allow desirable vegetation, such as grasses, to remain and grow.

In addition, the Company provided, in response to OCA-III-1 (b), sections of its standard contract for aerial spraying vendors. This contract provides that the aerial spraying vendor (referred to in the following as the Seller) shall leave buffers adjacent to certain items:

17.1 Seller shall leave buffer zones adjacent to items specified below. Seller shall not spray within buffer zones. Seller shall not leave buffer zones exceeding specified length for each item. Additionally, Seller shall not spray 1) any area in which Seller discovers conditions not conducive to herbicide application, and 2) any area Buyer instructs Seller to avoid. Any violation of these requirements and/or spraying within specified buffer zones is a breach of this contract and Seller shall be liable for any damages, claims, and related expenses resulting from such violation(s).

17.2 Pilots shall receive penalty points as specified below for infractions:

Item	Buffer Zone (Length)	Points Assessed
1. Ponds	100 Feet	3
2. Year Around Flowing Water (inc. wells, springs...)	200 Feet	3
3. Cultivated Land	100 Feet	2
4. Tobacco	500 Feet	2
5. Christmas Tree Plantations	100 Feet	1
6. Pasture Land	100 Feet	1
7. Public Recreation Areas	100 Feet	2
8. Year Around Residential Structures	150 Feet	1
9. Barns and other outbuildings where people or livestock might ordinarily be expected.	150 Feet	1

10. County, State and Federal graveled or paved road crossovers	50 Feet	1
11. Incorrect swath width or length (example: buffer zones too long)		1

The standard contract provides that spray pilots that are assessed 6 points shall be replaced for three working days, and that spray pilots assessed 12 points be permanently removed. Points assessed during the last spray season are cumulative through the current spray season.

I note that spray pilots can be assessed a point for leaving too large a buffer zone, in addition to the point system for leaving too small a buffer. I note also that a spray pilot can make an error and spray herbicide into a pond, a stream, a planted field, or anywhere else on one occasion and not suffer even a three day suspension.

Q. WHAT RECOMMENDATIONS DO YOU PROPOSE REGARDING THE COMPANY'S EXPRESSED INTENTIONS TO USE AERIAL SPRAYING OF HERBICIDES?

A. As stated above, my primary recommendation is that alternatives to the 502 Junction to Prexy 500 kV transmission line, the Prexy 500-to-138 kV substation, and the Prexy 138 kV circuits be pursued to reinforce the 138 kV system in Pennsylvania. If, however, the Commission were to approve any part of these facilities, more protective conditions should be imposed. Specifically, I propose that that the Company's policy limitations on the use of aerial spraying be considered absolutely mandatory for use along transmission rights-of-way in Pennsylvania that are part of this proceeding. I further propose that no aerial spraying of herbicides be permitted along these transmission rights-of-way unless

ground access to an area is limited by terrain contours or other features, or unless such access reflects unacceptable safety concerns. Finally, I propose that the Company's point assessment system for buffer violations be changed such that there is reduced tolerance for leaving too small a buffer. By this I mean that any instance of leaving too small a buffer should result in a suspension.

Magnetic Fields

Q. WHY IS THE SUBJECT OF MAGNETIC FIELDS EMMITTED BY TRANSMISSION LINES OF INTEREST?

A. Magnetic fields caused alternating current power lines have been suspected of having undesirable health effects. Local residents along the proposed transmission line route and those appearing at public input hearings consistently expressed misgivings about the magnetic fields from the proposed lines.

Q. WILL THE NEW TRANSMISSION LINES PROPOSED BY THE COMPANY BE A SOURCE OF MAGNETIC FIELDS?

A. Yes. Alternating electric current in electric lines and devices produces magnetic fields that vary in synch with the current and that increase or decrease proportional to current flow.

Q. HOW DOES THE DISTANCE FROM THE SOURCE AFFECT THE FIELD?

A. Magnetic field intensity decreases as you move away from the source.

Q. IS THERE ANY OTHER FACTOR THAT AFFECTS THE INTENSITY OF FIELDS?

A. Yes. Magnetic fields from the three-phases of a three-phase electric line tend to cancel each other out the further you move away, or the closer the three phases are brought to each other, as the three currents in a balanced three-phase circuit add up to zero on a vector basis.

Q. HAVE ANY DESIGN LIMITS FOR MAGNETIC FIELD EXPOSURE FROM ELECTRIC TRANSMISSION LINES BEEN SET BY THE FEDERAL GOVERNMENT OR BY THE COMMONWEALTH OF PENNSYLVANIA?

A. No.

Q. HAVE ANY STANDARDS BEEN ESTABLISHED BY OTHER GOVERNMENTAL ENTITIES?

A. Yes. Florida has set standards for maximum magnetic fields at the edge of electric transmission right-of-way at maximum load ranging from 150 mG to 250 mG depending on the voltage of the line, and its vintage. New York has a standard for maximum magnetic field at the edge of rights-of-way of 200 mG.

Q. WHAT ARE THE MAGNETIC FIELD IMPACTS OF THE COMPANY'S PROPOSAL?

A. Magnetic fields for average load conditions are presented in TrAILCo Statement No. 9, page 8, the Direct Testimony of Dr. Gary Johnson. He testifies that, for the proposed 500 kV circuit, the magnetic field at the edge of the right-of way at average load is under 16

mG, while along the 138 kV lines around Prexy, the magnetic field at the edge of the right-of-way is below 8.7 mG. Data provided in response to OCA-IV-7 by the Company indicates that the proposed 500 kV circuit would have a magnetic field of 63 mG at the edge of the right-of-way at maximum loading, while the 138 kV lines would have a magnetic field of about 12 mG at the edge of the right-of-way at maximum loading. "mG" refers to milli-gauss, a measure of magnetic field intensity.

Q. WHAT ARE THE MAGNETIC FIELD IMPACTS OF THE OCA PROPOSALS?

A. For the electric system in Green County PA and in the vicinity of the proposed Prexy substation, the impact of the OCA proposals will be varied. The OCA proposals would eliminate the 500 kV transmission line to the Prexy substation. Naturally, this would eliminate magnetic fields from this 500kV line along what would have been its transmission line right-of-way, because there would be no 500 kV transmission line.

Q. WOULD ELIMINATION OF THE PROPOSED 502 JUNCTION TO PREXY LINE AFFECT THE MAGNETIC FIELDS EMITTED FROM THE EXISTING 138 Kv LINES?

A. More power would flow over some of the 138 kV transmission lines in Washington County as a result of the OCA proposal, so magnetic fields from lines affected in this way could increase. However, the OCA proposal would eliminate the Prexy substation, and the 138 kV lines that would connect it to the system. So, in areas that would have been affected by the Prexy substation or the 138 V lines to connect Prexy to the grid, the OCA proposal could decrease EMF.

In general, moving a certain amount of power at 138 kV results in higher current flows than moving the same amount of power at 500 kV[5]. All else being equal, higher current equals higher magnetic fields. But, 138 kV transmission is different from the proposed 500 kV transmission in ways that can affect the perceived magnetic field, as explained below.

Q. HOW DOES 138 KV TRANSMISSION DIFFER FROM 500 KV TRANSMISSION?

A. 138 kV transmission lines are frequently installed on double circuit pole lines with two circuits on one set of towers, as proposed by the Company for the new 138 kV lines to run out of Prexy. Two circuits on one transmission tower can be arranged so as to increase the cancellation effects the separate phases of each circuit can have on each other. The Company's proposed 500 kV line has only one circuit on its set of towers, so the same cannot be said for it.

In addition, even under the Company's proposal for Prexy, all of the area load is carried on local 138 kV lines at some point in the delivery process. So, I would expect that some areas would experience higher magnetic fields under the OCA proposal compared to the Company's, and some areas would experience less.

Q. YOU MENTIONED WAYS TO ARRANGE MULTIPLE CIRCUITS SO AS TO REDUCE MAGNETIC FIELD. PLEASE ELABORATE.

5 Power, in MVA, equals voltage times current flow times certain constants. If the voltage increases, the amount of current needed to produce a certain power flow will, hence, decrease.

A. When there are at least two circuits on the same right-of-way, or towerline, the individual phases of these circuits can be arranged, using a technique called reverse phasing that can reduce the magnetic field at the edge of the right-of-way. The Company, in its response to OCA-IV-5 (f) discussed reverse phasing as follows:

> Reverse-phasing is a technique used on multi-line transmission rights-of-way that have similar line configurations (horizontal or vertical) across the right-of-way. In reverse phasing, the phases of an adjacent transmission line (separate circuit) are arranged so that the phasing order of the adjacent transmission line is reversed from that used on the first transmission line. An example of a reverse-phase line would be a vertical circuit with phasing CBA top to bottom adjacent to another vertical circuit that was phased ABC from top to bottom. Since the loads on the two adjacent lines are independent, direction of load flow is important for magnetic field levels. If the load flows are in the same direction for the two lines, magnetic fields may decrease with distance from a multi-line transmission right-of-way using reverse phasing for adjacent lines (ABC-CBA) more quickly than from a multi-line right-of-way using like phasing for adjacent lines (ABC-ABC). If the load flow on the adjacent line is in the opposite direction from the flow on the first line, the magnetic fields from a reverse-phased transmission lines right-of-way may actually increase over those for a like-phased lines (ABC-ABC).

Q. HAS THE COMPANY PROPOSED THE USE OF REVERSE PHASING?

A. No. The proposed 500 kV circuit from 502 Junction to Prexy is a single 500 kV circuit, so reverse phasing is not possible. The 138 kV circuits proposed by the Company in the Prexy area are double circuits and could be designed using reverse phasing with little additional material expense, however the Company has not done so. (OCA-IV-5(g))

Q. IS THE USE OF REVERSE PHASING REASONABLE FOR 138 KV LINES PROPOSED BY THE COMPANY IN THIS PROCEEDING?

A. I believe that it is. TrAILCo Witness Dr. William Bailey, in TrAILCo Statement No. 9, page 8, discuses recommendations of the Director of the National Institute of

Environmental Health Services and the World Health organization for the voluntary use of measures to minimize public exposure throughsiting practices or design.

Q. THE COMPANY EXPRESSES CONCERN THAT REVERSE PHASING COULD LEAD TO INCREASED MAGNETIC FIELD LEVELS, IF THE DIRECTION OF CURRENT FLOW ON THE CIRCUITS WERE TO REVERSE IN THE FUTURE. DO YOU HAVE ANY COMMENT?

A. I point out that the 138 kV lines proposed by the Company all lead out of the Prexy substation and would be expected to flow predominantly away from the substation under all normal operating conditions. Thus, there would be reduced chances for a reversal of current flow on these 138 kv circuits on a long-term basis that might result in an increase, rather than a decrease, in magnetic field levels.

Q. HOW ABOUT FOR THE 138 KV LINES PROPOSED BY YOU AS AN ALTERNATIVE TO THE COMPANY'S PROPOSALS FOR PREXY?

A. None of the lines I propose are double circuits themselves, although they all follow existing lines, so the potential for reverse phasing exists. However, it is not worth rebuilding the existing 138 kV lines along these routes for the sole purpose of incorporating reverse phasing. If there are compelling reasons other than to incorporate reverse phasing to rebuild any existing lines so as to incorporate a new line, or if there are double circuit tower lines with an empty circuit position that can be used for part of a new circuit, then reverse phasing should be incorporated.

While some of these circuits may actually reverse their flow under certain contingency conditions, such conditions would be short lived. I note that the Company did not calculate potential magnetic fields from the lines they proposed under contingency conditions. And if the network is to be reconfigured at some point in the future so as to change the direction of power flow, the order of the phases on the tower line can be changed by changing the connections between the lines and the substations.

Q. PLEASE STATE YOUR OVERALL CONCLUSIONS CONCERNING TRAILCO'S PROPOSAL AND EMF.

A. Magnetic field exposure along the proposed transmission line from 502 Junction to Prexy substation can obviously be eliminated by not building this line. Where new 138 kV lines are to be constructed, and where such construction will permit the use of reverse phasing without significantly increasing material costs, then reverse phasing should be used in these situations.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes. However, I reserve the right to file such additional testimony as may be necessary or appropriate.