Attachment B2

DEPARTMENT OF TRANSPORTATION
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January 5, 2007

Donald S. Welsh
Regional Administrator
US EPA Region 3
1650 Arch Street
Philadelphia, PA 19103-2029

David K. Paylor
Director
Virginia Department of Environmental Quality
629 East Main Street, P.O. Box 10009
Richmond, VA 23240-0009

Re: Wind Tunnel Modeling Evaluation for the Mirant Potomac River Generating Station – Final Report

Dear Mr. Welsh and Mr. Paylor:

On behalf of the City of Alexandria, we have reviewed the Mirant Potomac River, LLC's Wind Tunnel Modeling Evaluation for the Mirant Potomac River Generating Station, Final Report ("Wind Tunnel Study"), dated August, 29, 2006 and prepared by CPP, Inc. Our review reveals several erroneous assumptions from which the equivalent building dimensions ("EBDs") were derived. Since the use of these dimensions will lead to higher output rates for the Potomac River Generating Station ("PRGS") under the EPA's Administrative Compliance Order by Consent ("ACO"),[1] you should withhold approval of the Wind Tunnel Study and use of the EBDs set out therein pending a full review and resolution of the issues we raise in this letter. Specifically, we identify the areas where the Wind Tunnel Study simulations will need to be refined to more accurately characterize the actual airflow around the PRGS. Some of these areas relate to the scope of the study, while others address the inaccurate assumptions related to the model inputs.

In contrast to the real world where practical constraints limit the number of monitors deployed around a facility, a wind tunnel study is a highly controlled and precisely reproduced environment that provides the opportunity to document a facility's full range of impacts at all possible points. One of the most striking results of the Mirant Wind Tunnel Study, therefore, is

[1] Administrative Compliance Order by Consent, United States Environmental Protection Agency, Region III, Issued to Mirant Potomac River, LLC, June, 2006.

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the documentation of the severity of the historical impacts on Marina Towers for criteria pollutants emitted by PRGS for frequently occurring meteorological events and historically common operational scenarios, *i.e.,* four boilers running at mid-load and combusting coal with 0.9% sulfur content. Not surprisingly, such documentation is not featured prominently in either CPP, Inc.'s report (Appendix I of the Wind Tunnel Study) or Mirant's transmittal letter. Furthermore, even without fully accounting for all the possible worst-case conditions, the Wind Tunnel Study demonstrates that PRGS's current operational scenarios pose significant risk to the health of the nearby residents.

1. The Wind Tunnel Study Mischaracterizes Real-world Windflow and Underestimates PRGS's Impacts.

Any wind tunnel study must, first and foremost, accurately simulate the actual operations, configuration and real world environment of the subject facility. In the wind tunnel, concentration profiles are first measured for each wind sector using the real-world shape and size of the facility and nearby structures. Second, simply-shaped buildings are employed as substitutes to develop EBDs that will lead to a match to the actual wind-tunnel concentration profile within a pre-determined error margin. This is not an explicit solution, but instead is an iterative and empirical process whereby different building shapes and sizes are placed in the wind tunnel and the concentration results compared against the site's actual concentration profile.

Finally, and most importantly, because it is the basis upon which all EBDs are measured, the actual concentration profile must be re-created in the wind tunnel accurately or the subsequent results will be inaccurate. Put simply, any EBD solution derives from the actual concentration profile that the wind tunnel study provides. Figures in Appendices E and G of the Mirant Wind Tunnel Study illustrate that if the overall maximum concentrations are mischaracterized in the simulation, the EBDs also will be in error. Consequently, this will lead to a mischaracterization of concentrations in subsequent air quality simulations, with the potential to substantially understate estimated concentrations and the true public health risks of such concentrations.

With respect to the PRGS, the EBDs will be used to design the emission and operational limitations of the plants pending Permit to Operate, based on the overall maximum impacts of the plant's operations on locations of public access. The boiler and turbine tier structures of the PRGS create downwash and cavity effects. Immediately adjacent to PRGS, however, is Marina Towers, a residential structure which also forms a cavity that influences the PRGS's boilers' exhaust dispersion. The outcome of the Wind Tunnel Study – dimensions intended to accurately characterize the effect of these multiple structures' cavities on the plume height and spread – has significant bearing on the results of subsequent AERMOD simulations and the adequacy of the

attainment demonstration. In the case of the PRGS, any mischaracterizations of the EBDs would significantly affect stack downwash and plume impaction on the elevated receptors.[2]

2. ***The Mirant Wind Tunnel Study Did Not Simulate a Range of Loads and Potential Worst-Case Operational Scenarios.***

Each of the PRGS boilers operates within a wide range of loads, from approximately 30% to 110%. Despite the ACO's requirement for a range of maximum to minimum loads, the Wind Tunnel Study simulated only one load for all of the boilers. The simulated load at 65 MW is approximately equivalent to mid-range load. This limited analysis provides no assurance that EDBs will be protective of the health of nearby residents for the full range of operational levels allowed in the ACO.

The Wind Tunnel Study also fails to include any demonstration that the 65 MW load operating configuration is the worst-case operational scenario for offsite impacts. Limiting this important analysis to only one load is not an acceptable technique within US EPA's "Guideline on Air Quality Models," which specifies that for purposes of determining permit limitations for major sources, the load that produces the worst concentration must be determined and used within all ambient air quality simulations. Notwithstanding EPA's guidance, the Wind Tunnel Study does not determine worst concentrations.[3]

This determination should not be dismissed. For many boilers, even though emissions for some pollutants may linearly fall with load levels, actual pollutant impacts increase because of the non-linear losses in plume buoyancy and momentum that occur with reductions in stack exhaust velocities and temperature. Review of the Wind Tunnel Study's Figures 16(a) – 16(r) suggests that if each of the stack's plume rise was more limited, as it would be for minimum load conditions versus the mid-load conditions simulated, then PRGS's plume capture in the cavity between Marina Towers and PRGS caused by downwash effects of the structures will be significantly more severe.

Consequently, the development of the actual concentration profiles with all site structures in place significantly underestimates the concentration profiles and overall maximum concentration values for each wind sector. For example, if actual concentrations at Marina Towers are indeed higher than the Wind Tunnel Study results show for the all-site-structures-in-place scenario, then all the concentration profiles in the Wind Tunnel Study's Figures G(1)

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[2] In a recent peer-reviewed evaluation of AERMOD's performance against 17 field study databases, the authors state that *"al though it seems rather obvious, the [performance] results here strongly suggest that specification of the cavity extent and plume material height and spread (near the building) is critical to appropriately simulating the downwash effect."* AERMOD: A Dispersion Model for Industrial Applications. Part II: Model Performance against 17 Field Study Databases, S. Perry, et. al., J. of Applied Meteorology, Volume 44, pp. 694-708, May, 2005.

[3] Appendix W to Part 51 – Guideline on Air Quality Models, 40 CFR Ch. 1 (7-1-03 Edition).

through G(34) will shift to a higher level, leading to selection of EBDs that would produce higher modeled concentrations than the iterative process has yielded to date.

The results in Table 1 (set out below) illustrate why performing a full load analysis within the Wind Tunnel Study is an essential component of this air quality analysis. This table repeats some of the sulfur dioxide ("SO_2") results shown in Appendix I of the Wind Tunnel Study (Full Scale Concentration Results for Various Stack Combinations Operating Together). Page 6 of Appendix I of the Wind Tunnel Study shows that for winds of 8.8 mps from 160-degree direction, the maximum overall SO_2 concentrations equal 5437.9 $\mu g/m^3$ when four boilers are operating at 65 MW each. The table below shows that while the trona injection process may yield SO_2 reductions which may bring the facility closer to compliance with SO_2 National Ambient Air Quality Standards ("NAAQS") with relatively minor curtailment in operations, fine particulate matter ("$PM_{2.5}$") impacts may far more excessively contribute to violations of the respective NAAQS, thereby becoming a critical pollutant in determining the facility's operational limits. Both the Wind Tunnel Study and the Mirant forecasting approach, as documented in a memorandum from Mirant to Mr. Richard Baier, dated August 4 and November 28, 2006, erroneously ignore consideration of this critically important factor. For example, Mirant's November 28th submittal states that "on the days during which the follow-up model showed potential NAAQS exceedances, the actual monitors demonstrated that, in fact, there was no NAAQS exceedance or even the threat of a NAAQS exceedance." There is no factual basis for such an expansive claim by Mirant. Even a cursory analysis of the Wind Tunnel Study shows that placement of only two monitors on the rooftop of Marina Towers with measurements limited to SO_2 provides no assurance for all Marina Towers' residents against NAAQS violations of SO_2, $PM_{2.5}$ and other criteria pollutants.

TABLE 1

Four Boilers Operating at 65 MW - Estimated Maximum SO_2 and $PM_{2.5}$ Impacts ($\mu g/m^3$) on Marina Towers based on the Maximum Wind Tunnel Full Scale 1-Hour Concentration Result of 5437.9 ($\mu g/m^3$) [a, b]

	SO_2 – 3 hour	SO_2 – 24 hour	$PM_{2.5}$ -24 –hour	$PM_{2.5}$ - annual
	Scaled to 3-hour Impact using US EPA Screening Factor of 0.9 [c]	Scaled to 24-hour Impact using US EPA Screening Factor of 0.4 [c]	Scaled to $PM_{2.5}$ Emission Rate 0.03 lb per MMBtu and to 24-hour impact using US EPA Screening Factor of 0.4 [d]	Scaled to $PM_{2.5}$ Annual Impacts [f]
Historical Four-Boiler Impact	4,894	2,175	48	7
w. Trona Reduction at 80%	979	435	--	--
Background	238	60	39	15
Total	***1,217***	***495***	***87***	***22***
NAAQS [e]	***1,300***	***365***	***35***	***Impact must be insignificant (<1.0) in this non-attainment area.***

Notes:

a. Wind Tunnel Study results for 1-hour maximum SO_2 impact on Marina Towers equals 5,438 $\mu g/m^3$ (see Appendix I) for 4 boilers operating at 65 MW each. Impacts from Boiler 4 were not included in the presentation of impacts in Appendix I.

b. Although not explicitly stated in Appendix I, the gram per second emission rates correspond to an average emission factor of 1.37 lb per MMBtu: this translates to approximately 0.9% fuel sulfur content, which is equivalent to the sulfur content of many coal shipments delivered to the PRGS in the years 2002 and 2003 (as shown by US Department of Energy records).

c. "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised," US EPA, EPA-454/R-92-019, www.epa.gov/ttn/scram.

d. "Summary of Results – Mirant – Potomac – Unit 5 Stack, Alexandria, Virginia," shows a total PM_{10} result of 0.023 lb per MMBtu from Unit 5 with trona injection. Test results show that condensable PM is a very large fraction of the total value and a large portion of total mass is expected to be $PM_{2.5}$. Therefore, we assume here a value of 0.03 lb per MMBtu for $PM_{2.5}$ to account for contributions by soot blowing and ESP rapping and to reflect average operating conditions over a 24-hour period.

e. On September 21, 2006, US EPA reduced the 24-hour $PM_{2.5}$ NAAQS to 35 $\mu g/m^3$. See http://epa.gov/pm/naaqsrev2006.html.

f. For this facility, the ratio of the five-year average of maximum 24-hour $PM_{2.5}$ impacts to the five year average of maximum annual $PM_{2.5}$ impacts equals 0.15, using AERMOD results from "Ambient Air Quality Analysis – Potomac River Generating Station – Alexandria, Virginia," AERO Engineering Services, August, 2005.

These results show that in this analysis where existing background concentrations of $PM_{2.5}$ are so high, leaving little margin for additional impacts, there is similarly little margin for error within the characterization of downwash effects. Therefore, EBDs used in any AERMOD simulations for the design of operational limits for the facility must accurately represent the air flow around the existing site simulation for all potential worst-case conditions of PRGS's operation.

Mirant should conduct a new wind tunnel analysis with the actual site concentrations re-measured for all site structures in place, for each boiler, for each of 36 wind directions (see item 8 below), and for each of three load conditions (minimum, mid-load, and maximum). Future AERMOD simulations should either use load-specific EBDs or use the overall largest EBDs for each boiler and 10-degree wind direction.

Importantly, the Wind Tunnel Study provides significant evidence that, relative to the Wind Tunnel Study results, AERMOD results derived using the default BPIP-PRIME building dimensions do not significantly overstate impacts. Note that Mirant's baseline analysis for the PRGS using AERMOD with BPIP-PRIME dimensions (referred to as AERMOD Default) produced a maximum 3-hour SO_2 impact on Marina Towers that, without accounting for background, exceeded the NAAQS by seven times (9,025 vs 1,300 $\mu g/m^3$).[4]

This 3-hour maximum value assumes that all five boilers are operating at the maximum permitted emission rate. When this maximum 3-hour result from AERMOD-Default is scaled down to reflect a similar four-boiler, reduced emission configuration that is simulated in the Wind Tunnel Study, we see that AERMOD-Default calculated a maximum impact that is only about 30% higher than what the Wind Tunnel Study shows (7,230 versus 5,438 $\mu g/m^3$) as set out in Table 2 below. If Wind Tunnel Study exhaust flow parameters do not accurately represent reduced load or worst-case load, as described below, the degree of differential between AERMOD-Default and the Wind Tunnel Study will be even less. We stress that, relative to the Wind Tunnel Study results, the use of AERMOD-Default to calculate the facility's maximum design concentrations *and* operational limits under the ACO does not lead to significant overstatement of the PRGS's impacts, but instead provides a degree of protection which should be continued due to other aspects of operations under the ACO which, as described below, fail to protect the public against violations of all NAAQS at offsite locations.

[4] "Mirant Potomac River, LLC, Alexandria, VA – A Dispersion Modeling Analysis of Downwash from Mirant's Potomac River Power Plant," ENSR Corporation, August, 2005. See Table 5-1, for year 2001, AERMOD-PRIME without background.

TABLE 2

SO2 Impacts – AERMOD Default vs. Wind Tunnel Study Results	AERMOD-Default Result, Scaled Estimates ($\mu g/m^3$)	Wind Tunnel Study Result
Max. 3-hour Impact for 5 Boilers, Permitted Emission Rate	9,025	--
Max. 1-hour Impact for 5 Boilers, Permitted Emission Rate (scaled by 1/0.9)	10,028	--
Max. 1-hour Impact for 4 Boilers (scaled by 4/5)	8,022	--
Maximum 1-hour Impact for 4 Boilers, Reduced Emission Rate	7,230	5,438

3. *The Wind Tunnel Study Used Stack-exhaust Velocity That Significantly Overstates Plume Momentum.*

As shown in Table 1a of the Wind Tunnel Study ("Actual Full-scale Exhaust and Modeling Information"), the assumptions for exit velocities exceed actual exit velocities for these mid-load conditions. Despite the City of Alexandria's request for comprehensive historical stack exhaust flow data as a function of load, the only data available showing stack exhaust rates derive from recent stack tests and concurrent continuous emissions monitoring ("CEM") data. Note that the Wind Tunnel Study assumes an output power of 65 MW: when actual test results for velocity are scaled to reflect an equivalent load, it shows that estimates used in the Wind Tunnel Study overstate rates by almost 100%. The extent by which the assumed velocity overstates actual values may be even worse because velocity measured during Method 201A/202 procedures, as is the case with the stack test results presented here, may be higher than the actual velocity due to flow disturbance created by the in-stack cyclone. This is supported by CEM data measured concurrently with the April, 2006 test results: CEM velocity equals 12.7 meter per second, versus 14.7 meter per second measured during the Method 201A/202 test.

These CEM data also show a lower stack temperature than either the test result or the value assumed in the Wind Tunnel Study. An overestimate of flue gas flow rate or temperature leads directly to overestimation of plume momentum, and to overestimation of plume rise within the wind tunnel's simulation of the actual flow characteristics. Put simply, the Wind Tunnel Study underestimates the effects of downwash. Additionally, temperatures used in the Wind Tunnel Study are similar to results from stack tests even though load conditions are very different, *i.e.*, 65 MW for the Wind Tunnel Study versus 84 to 103 MW for stack tests. Stack temperature is not necessarily independent of boiler load. (See Table 3 below.)

TABLE 3

Stack Test Results (Jan., and Apr., 2006)[a,b]					Values Used in Wind Tunnel Study[c]			
	Load (MW)	Exit Velocity, mps	Stack Exhaust Temp.	Stack Exit Dia., m	Load (MW)	Exit Velocity, mps	Stack Exhaust Temp.	Stack Exit Dia., m
Blr 1 [(a)]	84	17.5	345 F	3.11	65	25.5	338 F	2.59
Blr 5 [(b)]	96 - 103	14.6	289 F	3.81	65	21.5	285 F	2.44

Notes:
a. Stack test performed December 20-21, 2005 and reported in "Final Report – Particulate Emissions Testing – Unit 1 – Potomac River Generating Station – Alexandria, Virginia," TRC Environmental Corp., January, 2006. Velocity was calculated here from each test's measured flowrate and diameter.
b. "Summary of Results – Mirant – Potomac – Unit 5 Stack – Alexandria, VA," for test dates of April 25 and 27, 2006.
c. From Table 1a of the Wind Tunnel Study, "Actual Full-scale Exhaust and Modeling Information."

The optimum means to accurately define each boiler's stack parameters for the range of loads is to review recorded values of the existing in-stack flow and temperature during an extended historical period. Mirant should relay historical flow and temperature data, measured by in-stack monitors for each of the five boilers, in electronic format, to US EPA and VDEQ, or alternately, perform stack velocity and temperature measurements for a range of loads on one of each of its peaking and baseline boilers during ongoing stack testing. Additionally, stack diameter must be corrected within the Wind Tunnel Study to reflect test results. These data should then be used within a more comprehensive Wind Tunnel Study that includes a range of load conditions. [5]

4. *The Wind Tunnel Study Failed to Identify Roof-top Receptors on Buildings West of Marina Towers.*

Figure 6a of the Wind Tunnel Study shows that the buildings located on Slater's Lane immediately to the west of Marina Towers, were included within the tunnel simulation for the all-site-structures-in-place scenario. However, there were no concentration measurements made at the rooftop locations for these buildings. While these are commercial buildings, and therefore access to outside patios at varying levels is not expected, intakes on the rooftops may supply air to building occupants Currently, concentration profiles for the 120 degree to 160 degree wind directions were derived using only ground-level measurements of concentrations. Actual concentration profiles for these wind directions should be re-measured in the wind tunnel with receptors placed at rooftop locations, and the new concentration profiles should be used as the criteria for EBDs for these wind directions.

[5]Mirant is conducting $PM_{2.5}$ stack tests in response to a request by VDEQ dated August 18, 2006.

5. *The Wind Tunnel Study Incorrectly Identified Scales and Direction Indicators.*

The scales on several of the figures labeled as Figure 5 in the Wind Tunnel Study are significantly incorrect, indicating that the buildings are at least twice as close and half as large than actual conditions. Additionally, the direction indicators on Figures 6(b) and (d) are incorrect, and should instead indicate all views from the west and east, respectively. The analysis should be re-checked to ensure that incorrect scales or assumptions were not used, and scales and direction indicators should be corrected on the next submittal.

These incorrect scales may explain why the Wind Tunnel Study does not measure ground level concentrations at the closest points of public access to the PRGS for many wind directions, including for southerly, northeasterly and westerly directions (see Appendix D). While the shortest distance between the fenceline and the PRGS structure equals only about 30 meters to the north, less than five meters to the east, and about 60 meters to the southwest, the Wind Tunnel Study did not measure concentrations at any point closer than 90 meters. Impacts along a facility's fenceline often rank among the highest, thereby representing design concentrations for the facility's permit limits. Lack of analysis at these points would similarly understate maximum ground-based impacts and lead to underestimation of EBDs for many wind directions. Therefore, the analysis of ground-based concentrations within the Wind Tunnel Study should be re-performed with concentration measured at the closest points of public access, *i.e.,* starting at points along the facility's fenceline for the wind directions of 10 through 100 degrees and 150 through 340 degrees.

6. *Surface Roughness Is Inconsistent With Actual Conditions for Both Water and Land Approaches.*

The most critical sector for flow from Mirant towards Marina Towers is 155^0 through 175^0. Land trajectories with fetch of approximately 750 m or more start at 159^0. On this basis, over water trajectories would only be applicable to 25 percent of the sector of concern, i.e. 155 through 158^0. The Wind Tunnel Study has incorrectly assumed over-water trajectories through 170 degrees. According to the AERMET user's guide (Page 5-9) for trajectories with surface roughness values in the range of 0.5 to 1.5m, land influences up to 100m would occur by 700 m of fetch. Applying the same slope factor to the actual stack top would show a distance of approximate 335 m to equilibrate to overland conditions. Applying a methodology from Panofsky & Dutton (1984) shows the estimated height of the interface change as a function of fetch produced, an estimate of 285m. The wind tunnel results are based, therefore, on a much smoother surface than is actually encountered. Figure 1, taken at the roof of Marina Towers facing south-southwest, and Figure 2 show the view from the overland fetches that actually influence the transport and dispersion conditions upwind of key trajectories from Mirant towards Marina Towers. Tree cover and multi-level structures are encountered along the overland fetches. There is no technical justification for using such a smooth, *i.e.*, 15 cm, surface roughness value within the overland range of 159^0 through 175^0 – and beyond on a clockwise basis. The wind tunnel analysis, therefore, should assume overland fetches from 159^0 and onward on a clockwise basis.

The primary objective of any air quality analysis is to represent site-specific conditions as accurately as possible, as is stated in the EPA Guideline on Air Quality Models. The trajectories from the Mirant facility towards Marina Towers are very unusual in that the closest stack height (48m) and the nearby highrise, Marina Towers (43m) are only approximately 105 m apart. The potential for severe plume impaction is pronounced. It is very important, therefore, that the rate of dispersion be defined as accurately as possible, especially for the most critical trajectories. The primary concern is that by defining most of the critical wind flows as over-water flow, with very smooth surfaces, the rate of dispersion is reduced. The affect that this understatement will have on the analysis needs to be determined once the other issues noted in this review are resolved, because the present approach has a high potential to significantly understate maximum impacts at Marina Towers.

Figure 1 - View from Marina Towers Facing South-Southwest.

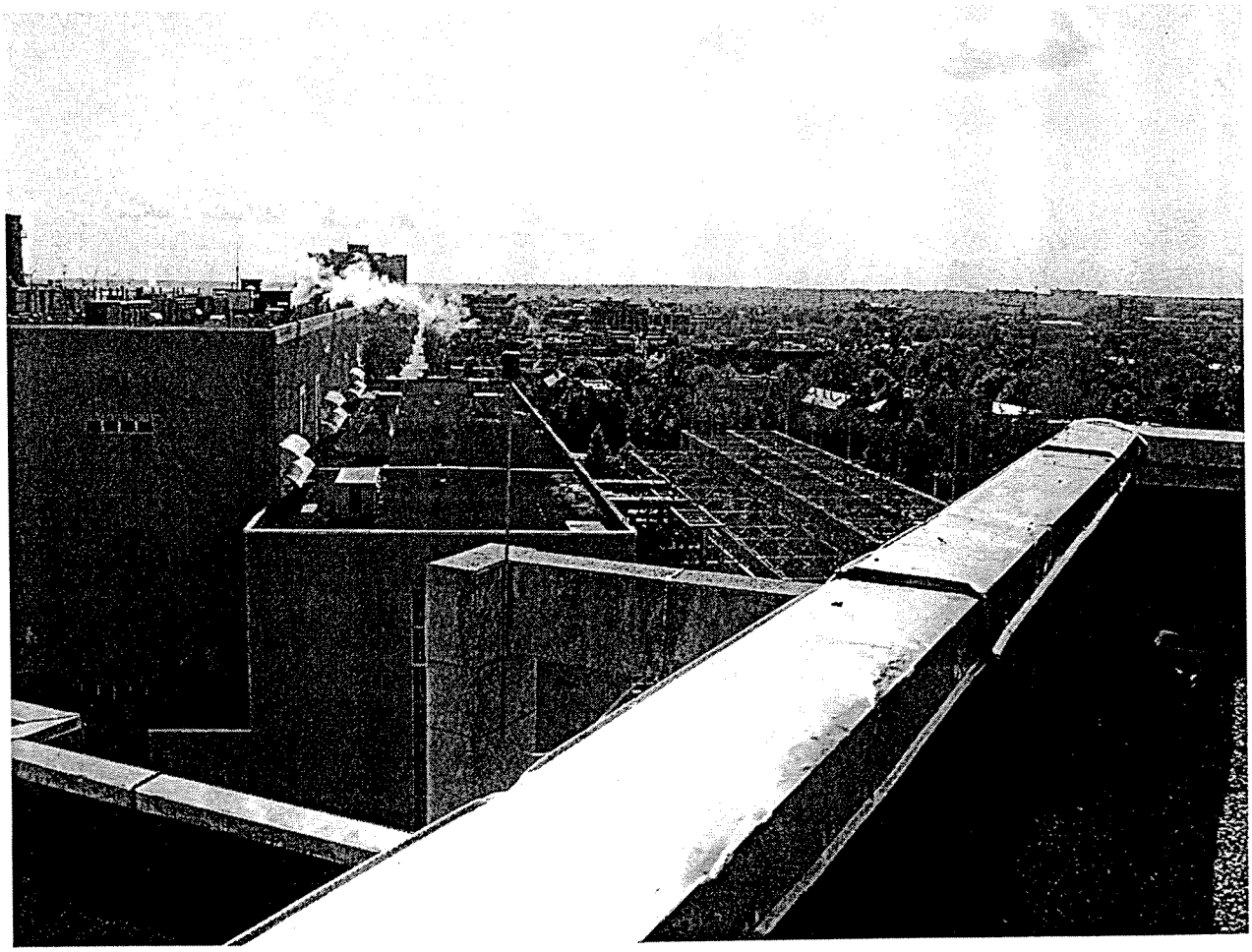

Figure 2- Aerial View Showing Trajectories and Upwind Fetch.

Also, the heading of the Wind Tunnel Study's Table 2 indicates that the surface roughness values are calculated by AERMET. This is incorrect – these values are user-selected inputs to AERMET.

7. *Due to Complexity and Number of Structures, Relationship between Buildings to Each Stack's Exhaust Dispersion Pattern is Unique - The Wind Tunnel Study Failed to Analyze Wind Direction for Each Stack.*

Page 14 of the Wind Tunnel Study states: "[T]he EBD values determined for BS1 and BS4 for all wind directions could theoretically be used for their comparable stack." The analysis then continues by calculating EBDs for BS2, BS3 and BS5 at only 40-degree increments and only for the wind directions of 160 to 360 degrees, *i.e.*, only for wind directions ranging from the southeast to the north (clockwise), while analysis of wind directions ranging from 10 to 150 degrees, *i.e.*, from the northeast, east and southeast, are absent. The lack of analysis for these three boilers for these wind directions is especially troublesome given that application of AERMOD for at least one full annual meteorological period shows that the overall maximum 1-hour impact for BS5 occurs for winds from the northeast, *i.e.*, along the facility's southwest fenceline, instead of on Marina Towers' rooftop.[6]

Due to the complexity and proximity to each other of the Marina Tower, PRGS and the other Slater Lane structures, and the significant distance between each stack, there is no theoretical basis for assuming that the EBDs that result for BS1 are equivalent to those for BS2, or that EBDs for BS4 are equivalent to those for BS3 and BS5. Review of the orientation of the Marina Towers structure relative to PRGS indicates that the cavity extent of the taller Marina Towers structure affects different stacks and for different wind directions. Review of the BPIP-PRIME for this site configuration supports this, showing significant variation among controlling tier heights and widths among all boilers and with respect to all wind directions.[7]

While a Wind Tunnel Study limited to only boiler stacks BS1 and BS4 may have been warranted if the stack merge project were complete, that project's completion is delayed by at least one year.[8] Impacts on Marina Towers by the PRGS's emissions continue to be defined according to the plant's current five-stack configuration. Therefore, the Wind Tunnel Study should be re-simulated, and concentration profiles measured for all boilers, all wind directions and the full range of loads. Only then can Mirant and the regulatory agencies rely on the EBDs established through the analysis to determine a valid attainment strategy.

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[6] These results derive from application of AERMOD for the year 2002 using BPIP-PRIME dimensions for the PRGS that assumes a simplified tier structure, *i.e.*, ESP heights were assumed equal to the lower turbine tier height.

[7] "Ambient Air Quality Analysis – Potomac River Generating Station – Alexandria, Virginia," AERO Engineering Services, August, 2005.

[8] VDEQ has requested that Mirant apply for a construction permit for the stack merge project. Due to operational constraints, Mirant will not commence construction until the latter part of 2007.

8. The Wind Tunnel's Flow Visualization Exercise Illustrated Only Rare or Non-existent Scenarios.

Page 18 of the Wind Tunnel Study describes the flow visualization exercise and states that photographs of "selected" cases are provided in Figures 16, 17 and 18. These photographs depict, however, flow visualization for scenarios that either never or rarely occur. For the most part, these photographs show scenarios with only one boiler operating, an extremely infrequent event. They also show photographs of plume flow from only one stack, even though the scenario is described as all boilers operating. This is a misleading visualization exercise, and significantly mischaracterizes the effect on overall dispersion of multiple, independent stacks operating simultaneously. The flow visualization portion of the Wind Tunnel Study should either be repeated, using all possible five-separate stack operating scenarios, or if these scenarios have already been included in the visualization exercise, then their photographs should be presented.

9. Similarity Parameters Developed Using Incorrect Anemometer Height.

The Wind Tunnel Study uses meteorological observations from the Reagan National Airport for the period 1964 – 2002. While the anemometer height for observations after May, 1996 equaled the 10 meter value CPP, Inc. assumed, the height of observations prior to that date was 6.1 meters.[9] CPP, Inc. should identify how this will affect Wind Tunnel Study results, and re-perform any section of the analysis for which results will differ.

10. Full Scale Concentration Results indicate Historical Severe Violations of NAAQS; West and Northern Wings Also Experience Very High Impacts.

Appendix I of the Wind Tunnel Study shows full-scale SO_2 concentration impacts on Marina Towers for various operational scenarios of the PRGS. Review of these tables shows several operating scenarios where, historically, impacts on Marina Towers led to severe violations of ambient air quality standards.[10] This is based on the assumption that meteorological periods occurred when winds of approximately 8 meters per second with a southerly direction persisted for a 3-hour period. Review of Figure 4 in the Wind Tunnel Study shows this to be a reasonable assumption, given that southerly winds in the category labeled 8.0 meter per second occur with the second-highest frequency among all categories for this 39-year locally-observed data set. Furthermore, as shown in Table 1, large exceedances of SO_2 (even with Trona reduction) and $PM_{2.5}$ standards are shown based on the scaling of the wind tunnel results for maximum hourly SO_2 to 24-hour averages of $PM_{2.5}$.

Review of the results in Appendix I also indicates that impacts on Marina Towers are not highest on the southeastern tier and center, where ambient monitors are currently located. Rather, they show that the overall highest impact on Marina Towers occurs on the northern side

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[9] Correspondence with Scott Stephens, Meteorologist, National Climatic Data Center, National Oceanic and Atmospheric Administration, December 7, 2005.

[10] "Screening Procedures for E stimating the Air Quality Impact of Stationary Sources, Revised," US EPA, EPA-454/R-92-019, from www.epa.gov/ttn/scram.

of the western wing. They also show that impacts among rooftop monitors for any one combination of wind speed, direction and operating scenario vary significantly, so that any one rooftop monitor cannot accurately characterize overall impacts on the structure. For example, for one set of wind speed and directions, the simultaneously-measured rooftop impact on the west wing was more than six times the value measured at the location where the southeast rooftop monitor is currently located.

Table 4 below shows the number of scenarios where impacts were highest on each of the wings of Marina Towers, and values at several of the lower-level heights for the operating scenarios when maximums occurred.

TABLE 4

Number of Scenarios where Maximum Impact Occurred and 1-Hour SO_2 Impacts			
	North Wing	West Wing	South Wing
No. of Scenarios out of 20 Simulated	3	7	10
1-Hour SO_2 Values on Other Wings when Overall Maximum Occurred on West Wing	3,006 $\mu g/m^3$	5,438 $\mu g/m^3$ (overall maximum)	893 $\mu g/m^3$
Selected Values at Lower-level Heights	2,081 $\mu g/m^3$	4,604 $\mu g/m^3$	3,907 $\mu g/m^3$

These actual full-scale simulation results from the Wind Tunnel Study clearly show that monitoring of the facility's operation through placement of only two monitors on Marina Towers -- on the rooftop at the southeastern-most point and center -- is grossly inadequate. This error is compounded in light of the intention to use this monitored data in the highly unorthodox manner of serving as the basis to determine the level of plant operation for SO_2 compliance. Furthermore, without ongoing coverage of $PM_{2.5}$ and similar curtailments placed into effect, the current forecast approach with monitor "safeguards" is clearly inadequate to protect the public health and welfare of local residents. For even the limited loads and meteorological conditions studied here, which likely do not capture worst-case conditions due to the factors discussed above, maximum impacts on Marina Towers occur at locations other than where monitors are placed approximately half of the time and, overall, maximum impacts occur on Marina Towers' west wing where no monitor is located.

Additionally, it is not clear why full-scale concentration results at every one of the 46 receptors studied were not included in Appendix I (see pages 8 and 9). Nor were full-scale concentration results for Boiler 4 (BS4) presented for review. The tables on these pages should be modified to include these results and disseminated for public review.

11. The Wind Tunnel Study Illustrates Failure of the ACO to Adequately Protect Public Health Against NAAQS Violations.

The Clean Air Act permitting procedures require that power plant operators design their facility's constant, daily emission limits under the premise that each day's meteorological events could result in that "worst-case" set of daily conditions, determined from simulation of the plant's impacts using a full five-year historical record of meteorological conditions for the site. Through this procedure, in the event that worst-case meteorological conditions actually do occur, the public is protected at offsite locations from exceedances of the health-based standards due to a plant's impacts.

The ACO releases Mirant from this constraint. Instead, it allows the PRGS to design a new day-by-day maximum output on the basis of the next day's forecasted conditions. Furthermore, due to the densely settled and complex, elevated residential structures adjacent to the PRGS to the south, west and north, there are significant gaps in the public health protection offered by the ACO's limited number of monitors. These gaps are even more pronounced when one considers that no monitors are required or in place anywhere along the facility's southwest, west or northwest boundaries. Therefore, in the event that PRGS's operations are designed *a priori* to forecasted meteorological conditions that vary from those that actually occur, there are no means to identify impacts in excess of health-based standards if they occur in these areas. Put simply, operation under the ACO poses risks for other Alexandria residents in addition to those in Marina Towers, including residents of Harbor Terrace, located immediately adjacent to the PRGS's southwest fenceline, and for occupants of the office complex to the west of Marina Towers on Slater's Lane. Table 5 below illustrates this showing that for at least several ACO-approved operational scenarios, impacts measured in the Wind Tunnel Study or predicted by AERMOD (for wind directions that were not analyzed in the Wind Tunnel Study) exceed NAAQS for SO_2 in areas where no monitors are present.

TABLE 5

ACO Scenario	Total SO_2 emission rate allowed by ACO[a]	1-Hour Unit-rate Impact from Wind Tunnel Study (See App. D-4)	SO_2 1-hour impact from Wind Tunnel Study	SO_2 3-hour impact (without background) vs. NAAQS
BS1 and BS4 at 0.54 lb/MMBtu	145 grams/sec.	29.48 $\mu g/m^3$ for 1.0 grams/sec.[b]	4,275 $\mu g/m^3$ to northwest of facility	3,847 $\mu g/m^{3,c}$ to northwest of facility
BS5 at 0.9 lb/MMBtu	125 grams/sec.	No Wind Tunnel Analysis for Impacts to the Southwest, where AERMOD shows Maximum Impact for BS5	--	1,729 $\mu g/m^3$ (3-hour result from AERMOD along southwest fenceline)
3-hour SO_2 NAAQS				**1,300 $\mu g/m^3$**

Notes:
a. Assumes maximum load of each boiler, as allowed by ACO for short-term operation, equal to 1053, 1087 and 1107 MMBtu per hour for BS1, BS4 and BS5, respectively.
b. See Table D-119 of Wind Tunnel Study, where at 309m, -25m total impact from BS4 and BS1 equals 29.48 $\mu g/m^3$ for a wind direction of 140 degrees for a unit emission rate.
c. Scaled using 0.9 times the 1-hour impact.

*12. **Health Analyses.***

The magnitude of the wind tunnel modeled concentrations that were used to represent actual SO_2 concentrations at Marina Towers showed estimated concentrations that are more than three times the 3-hour SO_2 standard. Once the deficiencies in the wind tunnel analysis are corrected, there are two health-related issues that should be explored as high priorities:

(i) Based on EPA 5-minute SO_2 considerations, historical SO_2 exposures at Marina Towers likely have exceeded both the level of concern (1,567 $\mu g/m^3$) and level of endangerment (5,223 $\mu g/m^3$).[11] Also, in the event of Trona failure or variability, there will be the potential for exposures at concentrations that exceed the level of endangerment. The Wind Tunnel Study results available to date understate actual maximum values and, therefore, predict the long-term severity of impacts caused by the PRGS.

[11] EPA, "Guideline Document for Ambient Monitoring of 5-Minute SO_2 Concentrations," Office of Air Quality Planning and Standards, July 20, 2000.

(ii) It is significant that the wind tunnel analysis is limited to SO_2 and ignores $PM_{2.5}$ impacts. The ratio of $PM_{2.5}$ to SO_2 emissions (matched to the actual wind tunnel estimate assumptions) shows a value of (0.03 / 1.37) = 0.022. Applying this value to the maximum value observed at the top of Marina Towers (5,438 $\mu g/m^3$) would show an estimated maximum hourly $PM_{2.5}$ concentration of 119 $\mu g/m^3$. Applying a standard screening factor to convert maximum hourly to a daily estimate (a factor of 0.4) would show a screening-level estimate of 48 $\mu g/m^3$. This concentration is almost 50 percent higher than the $PM_{2.5}$ 24-hour standard, even without consideration for the background levels that are nearly equal to the standard as the baseline. Pending more definitive data to the contrary, the Mirant facility is seriously endangering the health and welfare of the residents of Marina Towers. Yet, the analysis presented here focuses only on the primary components of $PM_{2.5}$ emitted by the PRGS. When the PRGS's impacts are more fully evaluated to include the substantial contribution to secondary formation of $PM_{2.5}$ by the stacks' nitrate- and sulfate-laden gas stream, it is likely that such a demonstration, given the high regional background levels of $PM_{2.5}$, will show that the PRGS's emissions also pose endangerment to the health of residents in broader reaches of Alexandria and in the District of Columbia. The lack of mitigation measures for fine particulates is an obvious and unacceptable flaw in the control strategy for the PRGS.

13. Summary of Deficiencies and Modifications.

The above items delineate areas where the current Wind Tunnel Study either falls short of the full scope of analysis required to capture the worst-case downwash scenarios of the PRGS and Marina Towers structures, or where assumptions should be revised to ensure accurate simulations. Furthermore, approval of the EBDs set out in the Wind Tunnel Study would lead to higher power output rates by the PRGS and higher impacts at places of public access that substantially exceed health-based standards. Accordingly, we suggest the following:

(i) The Wind Tunnel Study should present $PM_{2.5}$ full-scale concentrations results.

(ii) Mirant should relay historical measurements by in-stack monitors for flow rate and temperature to US EPA and VDEQ, in digitized format, in order to determine agency-approved representative conditions of velocity and temperature for each of the low, mid- and high range loads. The Wind Tunnel Study should be re-simulated using these representative load parameters.

(iii) The wind tunnel analysis is inconsistent with stack testing results that show significantly different exit velocities than were modeled in the wind tunnel. Differences also were noted between the stack diameters modeled in the wind tunnel and those measured in stack tests conducted recently. Mirant should resolve these inconsistencies and propose their correction to US EPA and VDEQ

prior to relying on the results of the wind tunnel analysis for any regulatory purpose.

(iv) Mirant should expand the number of monitors on Marina Towers to encompass all possible points of maximum impact, including on the rooftop at the ends of the western and northern wings, at approximately mid-level height in each of the faces of the wings, and at several locations between the PRGS and Marina Towers at ground location. $PM_{2.5}$ instrumentation should employ continuous sampling methods. Mirant should also place SO_2 and $PM_{2.5}$ monitors along the southwest and northwest fencelines.

(v) Mirant should perform all resimulations in the wind tunnel analysis by correcting the treatment to overland trajectories starting from 159 degrees and onward on a clockwise basis. Dispersion modeling also should be consistent with actual surface conditions along this critical trajectory, and all trajectories.

(vi) In all resimulations in the wind tunnel, Mirant should include rooftop receptors on other multi-story structures in the vicinity, including buildings to the west of Marina Towers on Slaters Lane.

(vii) In all re-simulations in the wind tunnel, Mirant must measure full-scale concentration results and develop unique equivalent building dimensions for each wind direction and for each of the five stacks. For ground-based measurements, the Wind Tunnel Study must measure concentrations starting at the closest points of public access for each wind direction, *i.e.,* starting at the fenceline.

(viii) All full-scale concentrations results of re-simulations in the wind tunnel must be presented, including impacts by BS4, and impacts on all receptors.

(ix) In the revised Wind Tunnel Study report, visualizations of flow for wind directions of 150 through 180 degrees for all of the operating scenarios that are simulated should be presented, including the scenario where the five boiler stacks are operating simultaneously.

CONCLUSION

For the above reasons, the City of Alexandria respectfully requests that you reject the current Wind Tunnel Study results and that Mirant be advised either (i) to use BPIP-PRIME results in all AERMOD simulations, both to conform to the US EPA's ACO requirements and for subsequent design of facility permit limits or (ii) conduct a new wind tunnel analysis with the modifications as recommended herein.

Sincerely,

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Attachment C1

OVERVIEW OF CITY OF ALEXANDRIA'S COMMENTS ON DOE'S SPECIAL ENVIRONMENTAL ANALYSIS

The U.S. Department of Energy's ("DOE") Special Environmental Analysis ("SEA") fails on a fundamental level because it ensures that the burden of the DOE's stated "emergency" will continue to be borne almost exclusively by the residents of Alexandria and is calculated more to ensuring the continued operation of the PRGS than the protection of the health, safety and welfare of the residents of Alexandria.

The SEA Endorses the U.S. Environmental Protection Agency's ("EPA") Administrative Consent Order ("ACO") – An Unorthodox Procedure That is Not Protective of all National Ambient Air Quality Standards ("NAAQS").

- Contrary to DOE statements, there is only one set of regulation-approved air quality assessment procedures, called Guidelines on Air Quality Modeling, for major sources like the PRGS. The City's comments judge the SEA's procedures against these Guidelines.

- This standard EPA methodology of establishing emissions limits for power plants is to set daily limits based on the worst-case set of atmospheric conditions.

- Standard EPA methodology of establishing emissions limits for power plants is to assume the worst-case set of atmospheric conditions.

- The ACO, by contrast, permits PRGS to emit maximum emissions on any given day based on the previous day's weather forecasts with limited protections to ensure compliance with the NAAQS if forecasts are inaccurate.

- The ACO and the predictive modeling methodology fail to model and establish operating limits related to emissions of particulate matter, including especially fine particulate matter ("PM2.5"), and simply dismisses the 3-hour sulfur dioxide ("SO_2") standard, which is more likely to be exceeded due to higher allowed short-term output limits allowed under the ACO.

The SEA Underestimates SO_2 and Particulate Matter ("PM_{10}") Emissions.

- SEA erroneously assumes an SO_2 emission rate and annual output that are too low – for the years 2002-2005, the average SO_2 emission rate ranged from 1.12 to 1.15 lb per MMBtu versus the 1.05 assumed in the SEA.

- SEA underestimates PM_{10} emission rates because DOE relies on test results not accepted as valid by any regulatory agency and without accounting for contributions due to soot-blowing, ESP-rapping or the increased fugitive emissions due result from trona use.

The SEA Fails to Adequately Assess the Impacts of $PM_{2.5}$.

- Although SEA confirms that PRGS emissions of $PM_{2.5}$ cause or contribute to violations of NAAQS, actual impacts are likely to be even more severe than reported because the SEA fails to specifically model $PM_{2.5}$ emissions and instead assumes a $PM_{2.5}$ emission rate of 76% of PM_{10}. The SEA did not consider, however, certain kinds of $PM_{2.5}$ emissions (condensable emissions and secondarily formed $PM_{2.5}$) that make the actual ratio more than 90% $PM_{2.5}$.

- SEA inappropriately assumes a ratio of fugitive emissions of $PM_{2.5}$ as 15% of PM_{10}, which applies only to re-suspended roadway dust, rather than the more accurate ratio of 30% which applies to fugitive dust from coal and ash handling, coal dumping and wind erosion.

SEA Fails to Analyze Impacts of Hazardous Air Pollutants.

- Despite AERO Engineering's air quality analysis that showed elevated levels of hazardous air pollutants such as hydrogen fluoride, hydrogen chloride and trace metals, the SEA fails to provide any analysis whatsoever of these pollutants.

- SEA fails to assess impacts of air impacts associated with Trona's hazardous component silica.

SEA Fails to Independently Assess Impacts.

- SEA inappropriately relies on data provided exclusively by Mirant.

- SEA used meteorological data from Reagan National Airport that fails to record wind speeds of 2-3 knots which are critical in assessing air pollution because the highest offsite impacts often occur at these wind speeds due to decreased pollutant dispersion.

SEA's Determination Regarding Compliance with the Virginia State Implementation Plan ("SIP") is Flawed.

- SEA disingenuously concludes that the DOE Emergency Order is in conformity with the SIP on the grounds that the Order "does not cause or contribute to new emissions not already accounted for in the SIP" because there is no SIP currently for $PM_{2.5}$.

- The DOE Order causes or contributes to violations of the NAAQS for $PM_{2.5}$ and SO_2 and conformity analysis requires an assessment of whether the DOE Order interferes with Virginia's efforts to achieve "timely attainment of any standard."

SEA Fails to Adequately Address High Water Quality Impacts from the PRGS.

- PRGS discharges approximately the same quantity of effluent as the Blue Plains Wastewater Treatment Plant, yet discharges considerably higher concentrations of many harmful pollutants.

- The SEA fails to analyze the impacts of these adverse effects on the Potomac River.

The SEA Permits Excessive Operation of PRGS.

- Notwithstanding acknowledged violations of NAAQS and adverse health impacts, the SEA permits PRGS to operate at levels considerably higher than necessary to ensure reasonable reliability and the actual demand for power in D.C.

- During times when both 230-kV transmission lines providing power from alternative sources are fully operational, PRGS is nevertheless permitted to operate at a very high rate so that, in the rarest of occasions when both lines are down and the demand in D.C. is at its highest, the PRGS could provide the necessary power.

The SEA Imposes the Full Burden of the DOE "Emergency" on Alexandria Residents.

- SEA pays lip service to the identification and analysis of alternatives and mitigation measures.

- If there truly is an "emergency" then extraordinary protective measures are appropriate – SEA dismisses as impractical most alternatives suggested by Alexandria and others, including demand management programs and providing notice to residents when emissions may contribute to violations of NAAQS for not only one, but several pollutants. Even the SEA acknowledges that routine ACO-approved operations can contribute to violation of the $PM_{2.5}$ standard.

- It is unacceptable that the brunt of an electric reliability "emergency" in Washington, D.C. should fall entirely on Alexandria's residents, especially when the burden they must bear is paid for with their health and their lives.

- At the very least, once the additional 230 kV transmission lines are up and running this summer, the DOE should terminate its Order and prohibit the PRGS from operating except in strict compliance with <u>all</u> air quality standards.