MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Office of Air Data Analysis and Planning

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TO: David Paylor, DEQ Director
FROM: Mike Kiss, Coordinator - Air Quality Assessments Group
THROUGH: Jim Sydnor, Air Division Director
DATE: August 9, 2007
SUBJECT: Summary of Mirant PRGS Modeling Results and Permit Options

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1. BACKGROUND

Mirant Potomac River, LLC (Mirant) submitted a modeling analysis for SO_2, PM10, CO and NO_2 to DEQ on August 3, 2007 for the following plant configurations:

- Five existing stacks representative of current plant operations
- Two combined flue stacks in support of the stack merge project

Mirant's environmental consultant, ENSR International, conducted the analysis in accordance with the modeling protocol entitled *"Revised Protocol for Modeling Ambient Pollutant Concentrations from the Existing Stacks and from the Proposed Stack Merge Project at the Potomac River Power Plant" (July 2007).* ENSR applied the latest version of EPA's AERMOD model using the same model options and receptor grid employed in the August, 2005 modeling study. Additionally, the analysis incorporates the following updates and revisions:

- Modeling for a total of 25 existing stack configurations (45 modeling scenarios) and for a total of 11 merged stack configurations (22 modeling scenarios). Previous modeling in 2005 for the existing stacks was performed only for five units operating at full load.

- Use of year 2006 continuous emission monitoring (CEM) data to establish flue gas exit temperature and stack gas flow rate at minimum, maximum and mid-range loads for each stack (2004 CEM data was used in the previous analysis);

- Modeling of startup and shutdown conditions will be performed **(has not yet been completed)**;

- Modeling of mid-range load conditions will be performed **(has not yet been completed)**;

- Use of EPA-approved equivalent building dimensions (EBDs) for the existing and merged stack scenarios instead of BPIP-PRIME dimensions;

- Use of more recent meteorological data from Reagan International Airport (2001, 2003 – 2006); Year 2001 is still included because it was the worst case year in the previous (August 2005) modeling;

- Use of more recent background ambient monitoring data (2004 – 2006) for SO_2, NO_2, PM10 and CO;
- Nearby sources that could cause a significant concentration gradient in the vicinity of the source will be modeled in the NAAQS compliance analysis;
- The 3km radius for determining ground surface characteristics to be utilized by AERMOD has been relocated to the meteorological station at Reagan International Airport from the Potomac River power plant per recent EPA guidance;
- Modeling of the toxic pollutants HF and HCl in addition to the previously modeled toxic pollutant mercury will be performed; and
- Fugitive PM10 emissions have been adjusted downward to reflect pollution controls installed in 2005 and adjusted upward to reflect additional emissions from the use of Trona.

Mirant is proposing to modify flue gas ductwork at all five Potomac River Generating Station (PRGS) units. Starting in the fall of 2007, Mirant plans to duct the flue gases from Unit 2 into the Unit 1 stack. Flue gases from Units 3 and 5 would be ducted into the Unit 4 stack. The 8.5-foot diameter nozzle in stack 1 would remain. The 8.0-foot diameter nozzle in stack 4 would be replaced with a 10-foot diameter nozzle. Should the project be delayed or not happen, dispersion modeling must still be performed to establish final emission limits for the existing stacks.

The primary focus of this memo is to provide an analysis of the proposed SO_2 permit limitations that could be expected based on the modeling results, although a summary of CO, NO_2 and PM10 modeling results is provided as well. **<u>It is imperative to understand that the results presented in this memo are those provided by Mirant and do not necessarily represent DEQ-approved modeling results.</u>** The modeling staff will be reviewing these results over the next couple of weeks. There are also a few elements of the modeling analysis that have yet to be submitted (see above). Lastly, all aspects of the permit and modeling are subject to change as a result of public comments and SAPCB direction.

2. <u>MODELING RESULTS</u>

2.1. COMPLYING SO_2 SHORT-TERM LIMITS

Table 2-1 provides the range of complying SO_2 short-term emission rates:

Table 2-1
Range of Complying SO_2 Short-Term Emission Rates

Scenario	Short-Term SO_2 Rate (lbs/MMBtu)	Complying Hourly SO_2 Rate (lbs/hr)	Complying Daily SO_2 Rate (lbs/day)
Existing Stacks (Current SOP)	0.26-1.26	764-1,327	11,544-20,892
Existing Stacks (Revised Modeling)	0.28-1.64	805-1,727	12,454-27,639
Merged Stacks	0.42-1.72	621-4,693	7,447-57,297

It is quite evident from these results that the complying emission rate is highly dependent on the specific units in operation as well as the number of hours that each unit operates during a calendar day. Section 3 of this memo evaluates possible strategies for the comprehensive permit ranging from the use of the worst-case limit to the continuation of multiple operating scenarios.

Another important observation is the increase in emissions from the previous modeling to the current modeling for the existing 5-stack plant configuration. This increase in the complying emission limitations appears to be primarily the result of an increase in stack gas exit velocity from the two cycling units (Units 1 and 2). This current modeling uses 2006 CEM stack parameter data versus the 2004 data used in the analysis which formed the basis of the existing June 1, 2007, State Operating Permit. The reasons for the increase in exit velocity are being examined and discussed with Mirant. The use of the 2006 CEM data was based on a recommendation from the City of Alexandria.

2.2. REGULATORY BASIS FOR SO_2 ANNUAL LIMITS

In order to understand the basis for establishing an annual emissions limit, there are a couple of key points that need to be understood:

2.2.1. The short term limits are protective of the annual NAAQS.

The current annual permit limit of 3,813 tons per year was derived by taking the short-term daily emissions from Scenario 8b (the highest daily emissions for any of the 45 existing stack modeling scenarios) and multiplying by the number of days in a year as follows:

$$20892 lbs / day \div 2000 lbs / ton \times 365 days / yr = 3813 tons / yr$$

However, when annual modeling was conducted for this scenario, the emission rate necessary to comply with the NAAQS, assuming Scenario 8b was in effect for an entire calendar year, is 12,514 tons per year. It is clear that the limit that is necessary to comply with the 3-hour and 24-hour NAAQS is much more restrictive when projected to an annual limit. In effect, the 3-hour and 24-hour complying emission rates represent a limiting factor on annual emissions.

This is the case for all of the 45 modeling scenarios for the existing stacks as well as the 22 merged stack scenarios.

2.2.2. The regulations prohibit the establishment of an emissions limit that does not protect the NAAQS or is greater than the "potential to emit" (PTE).

The basis for the existing permit limit of 3,813 tons per year is not due to the fact that it is necessary to protect the annual NAAQS. Pursuant to 9 VAC 5-80-850 (Standards and conditions for granting permits), a permit may be granted if it is shown to the satisfaction of the board that the following standards and conditions will be met:

"The stationary source or emissions unit shall operate without causing a violation of the applicable provisions of regulations of the board." This includes the NAAQS. In the event that Mirant emitted greater than 3,813 tons per year, it would have to violate one of its short term emission limits necessary to protect the 3-hour and 24-hour NAAQS.

"In no case shall a standard result in emissions which would exceed the lesser of the following:

- *Allowable emissions for the emissions unit based on emission standards applicable prior to the date the permit is issued; or*
- *The emissions rate based on the potential to emit of the emissions unit."*

The regulations further define "potential to emit" as follows:

"Potential to emit" means the maximum capacity of a stationary source or emissions unit to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the stationary source or emissions unit to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is state or federally enforceable. Secondary emissions do not count in determining the potential to emit of a stationary source or emissions unit."

It is clear that the short term limitations necessary to protect the 3-hour and 24-hour NAAQS are operations limitations that must be treated as part of the potential to emit or design limitation. Any limit greater than 3,813 tons, which is the highest possible annual emissions achievable under this permit, would be inconsistent with the requirements of 9 VAC 5-80-850.

2.3. SO_2 ANNUAL LIMITS

Table 2-2 provides the range of SO_2 annual emission rates based on the regulatory considerations described in Section 2.2:

Table 2-2
Range of SO_2 Annual Emissions Limits

Scenario	Annual SO_2 Rate (tons/yr)
Existing Stacks (Current SOP)	3,813
Existing Stacks (Revised Modeling)	5,044
Merged Stacks	10,457

These numbers represent the highest allowable emission rate that is achievable under each of the modeling scenarios (i.e., it is an emissions cap). It is important to also reiterate that the limit is not necessary to protect the annual NAAQS. The more restrictive short-term limits as described in Section 2.2 accomplish this task.

As previously stated in Section 2.1, the increase in the emissions limit based on the revised modeling of the existing 5-stack configuration appears to be primarily the result of an increase in exit velocity from the two cycling units (Units 1 and 2).

Lastly, an increase from 3,813 tons per year in the existing SOP to either 5,044 tons per year or 10,457 tons per year may trigger NSR requirements and associated control technology analysis. This is discussed further in Section 3.

2.4. OTHER POLLUTANTS – CO, NO_2, PM10

Table 2-3 provides the estimated range of NAAQS compliant emission rates for CO, NO_2 and PM10 based on Mirant's modeling assessment:

Table 2-3
Range of Modeled Short-Term Emission Rates [1]

Scenario	Pollutant	Modeled Short-Term Rate (lbs/MMBtu)	Modeled Hourly Rate (lbs/hr)	Modeled Annual Rate (tons/yr)
Existing Stacks (Current SOP)	CO	---	---	---
	NO_2	---	---	---
	PM10	---	---	---
Existing Stacks (Revised Modeling)	CO	---	802-3,083	1,791-11,427
	NO_2	0.45	458-1,461	984-4,989
	PM10[1]	0.055	56-179	120-610
Merged Stacks	CO	---	880-4,765	1,285-15,210
	NO_2	0.45	474-2,382	1,014-6,987
	PM10[1]	0.055	58-291	124-854

(1) Limits are for stacks only and do not include fugitive emissions. Fugitive emissions were modeled, however, as part of this assessment.

Again, the results demonstrate that the complying emission rates are highly dependent on the specific units in operation as well as the number of hours that each unit operates during a calendar day. It is also important to note that certain limitations such as the annual PM10 and CO do not have a corresponding annual NAAQS. Furthermore, any emission cap must be viewed in the context of a selected baseline of actual emissions. The baseline emissions would be subtracted from any proposed emissions cap to determine if NSR is triggered.

3. PERMIT CONSIDERATIONS

The following section discusses some of the concerns related to permit development, including options for proceeding with the development of the comprehensive permit. Depending on the option selected, additional modeling may need to be performed.

3.1. COMPLIANCE ISSUES WITH CURRENT STATE OPERATING PERMIT

The DEQ Northern Virginia Regional Office staff on July 17, 2007 and again on July 27, 2007 conducted Partial Compliance Evaluations (PCE) to determine compliance with the June 1, 2007 State Operating Permit issued for the Mirant Potomac River Generating Station (PRGS). The compliance status of the two PCE are currently under review, both requiring additional modeling information to clarify the operational scenarios identified in the permit in order for staff to definitively associate the permit limits with the actual plant emissions (CEM data). The following issue was identified by DEQ compliance staff during the review of the initial PCE: Without defining the minimum and maximum load in the permit, relative to the operation of the plant, the compliance staff can't determine if the operating scenario chosen by the plant complies with that of the permit and associated emission limits. This situation may not constitute non-compliance but requires additional information to complete the review and make a determination. Identifying areas of ambiguity is not unprecedented with newly issued permits or regulations and additional clarification or guidance is often required. The facility has been operating mainly under scenario 6a of permit condition 9 since July 1, 2007. Daily records of the operating scenario are required by permit to be kept by the plant. Once the additional information is provided, reviewed, and approved by the DEQ staff a compliance determination will be made.

In response to concerns mentioned above by the DEQ air compliance staff regarding the operating scenarios at the PRGS, the modeling group has recommended additional runs be conducted to provide assurance of NAAQS compliance at operations that are between the maximum and minimum generation levels identified in the permit. For example, the existing State Operating Permit has several scenarios that specify a set number of hours at maximum and minimum load, although rarely is a plant operating precisely at these load levels. The plant may in fact be operating closer to mid-load at times. Although the emissions at these mid-range loads are at or below the maximum hourly and daily emission rates specified in the permit, stack parameters and the distribution of hourly emissions may differ slightly. As a result, the DEQ modeling group has recommended that either a set of representative mid-load scenarios be modeled or perhaps a mid-load condition for each of the approximately 45 scenarios be run to verify that there are no NAAQS compliance issues. It is anticipated these results will be available for DEQ by Friday, August 10, 2007.

The aforementioned issues indicate that it may be preferable in the comprehensive permit to move away from the concept of defining minimum and maximum loads conditions and to simply define plant operations based on the units that are on-line and the total number of hours each unit may operate on a given day. This approach would help clarify future compliance determinations and the staff recommends consideration of this option. Additional modeling may also need to be conducted during the August timeframe to further streamline the operating scenarios.

3.2. PERMIT OPTIONS

There are at least 4 permit options available moving forward:

<u>Option A – Continue with the concept of multiple operating scenarios as in the current SO_2 SOP.</u>

PROS: Provides flexibility to operate under a wide range of scenarios.

CONS: Challenging in terms of tracking compliance, particularly with respect to the concept of maximum and minimum load definitions along with the unusually large number of operating scenarios.

<u>Option B - Continue with the concept of multiple operating scenarios as in the current SO_2 SOP but eliminate the concept of maximum and minimum load.</u>

PROS: Similar to Option A. Easier to track compliance due to elimination of maximum and minimum load definitions.

CONS: Still presents a challenge when tracking compliance due to the large number of operating scenarios. This option may also be more restrictive because it would be accepting emissions limits based on the worst case load scenario (i.e., minimum, mid-range or maximum).

<u>Option C – Continue with the concept of multiple operating scenarios as in the current SO_2 SOP, but reduce or streamline the number of scenarios.</u>

PROS: Similar to Option A with a reduced set of operating scenarios. This could possibly be accomplished by accepting limits on the basis of the combination of cycling and base load units on-line at any given time. For example, 1 cycling + 1 base load could have a limit, 2 cycling +1 base load would have another limit, etc...

The reduced number of scenarios would make it potentially easier to track compliance.

CONS: Presents some difficulties in terms of tracking compliance, particularly with respect to the concept of maximum and minimum load scenarios.

Option D - Continue with the concept of multiple operating scenarios as in the current SO_2 SOP, but reduce or streamline the number of scenarios and eliminate the concept of maximum and minimum load.

PROS: Similar to Option A with a reduced set of operating scenarios. This could possibly be accomplished by accepting limits on the basis of the combination of cycling and base load units on-line at any given time. For example, 1 cycling + 1 base load could have a limit, 2 cycling +1 base load would have another limit, etc... The reduced number of scenarios would make it potentially easier to track compliance. Furthermore, elimination of the concept of maximum and minimum load definitions would facilitate compliance review.

CONS: This would establish the most restrictive emissions limit based on the possible combinations of cycling units and base load units under each permit scenario.

Option E – Utilize the worst-case complying emissions limit for each pollutant regardless of scenario and apply this rate on a continuous basis.

PROS: Method most often used to derive permit limits for other stationary sources or air pollution. Would provide the easiest and most straightforward approach to determine compliance.

CONS: This would create very restrictive permit limits that would further reduce the plant's ability to operate unless significant control measures were implemented at the plant, the stacks were merged and the heights of the stacks were increased.

4. EMISSIONS CAP ESTIMATES

The proposed emission caps are provided in Table 4-1 were estimated by DEQ modeling staff and are solely based on the preliminary revised modeling provided by Mirant on August 3, 2007. Mirant's modeling has not been quality assured by DEQ modeling staff. Also, it should be noted that the increase in the SO_2 annual limit from 3,813 tons per year to 5,044 tons per year is subject to the resolution of the increased exit velocity for Units 1 and 2 as described in Section 2 of this memo. All other limits were also derived based on the revised exit velocities.

The numbers in Table 4-1 represent the maximum emissions cap estimates that could be achieved under any of the modeled operating scenarios and that demonstrate compliance with the applicable NAAQS. The only limit that has some dependency on the percentage of time the plant operates under each scenario is NO_2. The range of complying caps for NO_2 is provided in the table.

Table 4-1
Annual Emissions Cap Estimates [1]

Scenario	Pollutant	Modeled Annual Rate (tons/yr)
Existing Stacks (Revised Modeling)	SO_2	5,044
	CO	11,427
	NO_2	984-4,989
	PM10[1]	610
Merged Stacks	SO_2	10,457
	CO	15,210
	NO_2	1,014-6,987
	PM10[1]	854

(1) Consideration of the baseline emissions must be accounted for when defining the annual cap because it could trigger NSR requirements. Also, dispersion credit must be evaluated for each pollutant in order to allow the less restrictive limits resulting from the stack merge.