# Mirant Potomac River, LLC
# Alexandria, VA

# Update 4 to:

# A Dispersion Modeling Analysis of Downwash from Mirant's Potomac River Power Plant

# Modeling Unit 4 Emissions at Maximum and Minimum Loads

**ENSR Corporation**
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# 1.0 INTRODUCTION

This report describes dispersion modeling performed for Unit 4 at Mirant's Potomac River Generating Station. The modeling was performed according to the Protocol approved by the Virginia Department of Environmental Quality. The purpose of the modeling was to demonstrate that Unit 4, operating alone under minimum and maximum loads will not cause or contribute to exceedances of the National Ambient Air Quality Standards (NAAQS).

Section 2 of this report presents the stack and emission parameters included in the modeling. Section 3 presents modeling results and conclusions.

# 2.0 MODEL INPUTS

Modeling was performed using the same version of AERMOD/AERMET and the same meteorological data and receptor grid used in the August, 2005 report prepared by ENSR.

Mirant is proposing to operate Unit 4 at any load between 35 MW (minimum) and 107 MW (maximum). The unit would operate up to 24-hour per day.

Stack gas flow rate and exit temperature for Unit 4 at 35 MW were derived from continuous emission monitoring data for 2004. Hourly flow rates were plotted versus load and a best fit curve was derived. Similarly, hourly temperature measured at the stack breeching was plotted versus load and a best fit curve derived. The values of ACFM and temperature on the best fit curves corresponding to 35 MW were selected and used in the modeling. Exit velocity was calculated from ACFM using the stack diameter.

Power plant personnel provided the historical heat rate versus load for Unit 4. The heat rate at 35 MW for Unit 4 is 11.3 MMBtu/MWhr. The heat rate was used to calculate $SO_2$ and $PM_{10}$ emissions at 35 MW using the following equations:

- $SO_2$ (lb/hr) = Unit 4 heat rate x 35 MW x 0.24 lb $SO_2$/MMBtu
- $PM_{10}$ (lb/hr) = Unit 4 heat rate x 35 MW x 0.06 lb $PM_{10}$/MMBtu
- NOx (lb/hr) = Unit 4 heat rate x 35 MW x 0.24 lb NOx/MMBtu

$SO_2$ emissions at 107 MW (maximum load) were calculated in exactly the same manner as the August 2005 modeling report except that an emission factor of 0.24 lb $SO_2$/MMBtu was used instead of the permit limit of 1.52 lb $SO_2$/MMBtu. Mirant plans to control $SO_2$ emissions from Unit 4 using Trona.

$PM_{10}$ emissions at 107 MW were calculated in the same manner as the August 2005 report except that an emission factor of 0.06 lb/MMBtu was used instead of the permit limit of 0.12 lb/MMBtu. Stack testing indicates that maximum PM/$PM_{10}$ emissions are 0.06 lb/MMBtu. NOx emissions at 107 MW were calculated in the same manner as the August 2005 report except that an emission factor of 0.24 lb/MMBtu was used instead of the permit limit of 0.45 lb/MMBtu. The NOx emission rate at 107 MW is 260.9 lb/hr.

Table 2-1 shows the stack and flue gas exit parameters used in modeling Unit 4 stack emissions.

Sources of $PM_{10}$ emissions include the Unit 4 combustion stack, two fly ash silos and one bottom ash silo, plus material handling sources. Table 2-1 shows the Unit 4 stack emissions plus the silos. In

modeling $PM_{10}$ emissions from PRGS when only Unit 4 is operating, Mirant assumed that emissions from all the silos and from the material handling sources are 20% of what they are when all units are operating at maximum load. This is because Unit 4 produces approximately 20% of the entire station's power output. The one exception to this is the coal pile wind erosion. We assumed that these emissions remain the same as they were in the August 2005 modeling.

The emissions shown in Tables 2-1 and 2-2 below for the non combustion sources represent 20% of the values listed in Tables 2-1 and 2-2 in the August 2005 modeling report, with the exception of the coal pile wind erosion.

**Table 2-1 - Stack and Emission Parameters Used in the Modeling**

| Point Source | Height (m) | Diam (m) | Temp (K) | | Exit Velocity (m/s) | | Emissions (g/sec) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | $SO_2$ | | $PM_{10}$ | | NOx | |
| | | | *Min Load* | *Max Load* | *Min Load* | *Max Load* | *Min Load* | *Max Load* | *Min Load* | *Max Load* | *Min Load* | *Max Load* |
| Boiler 4/Stack 4 | 48.2 | 2.4 | 410.9 | 405.4 | 15.2 | 33.2 | 11.96 | 32.87 | - | 8.2 | - | 32.9 |
| Fly Ash Silo | 33.6 | 1.0 | 293.0 | | 0.1 | | 0.0 | | 0.017 | | 0.0 | |
| Fly Ash Silo | 33.6 | 1.0 | 293.0 | | 0.1 | | 0.0 | | 0.017 | | 0.0 | |
| Bottom Ash Silo | 31.0 | 1.0 | 293.0 | | 0.1 | | 0.0 | | 0.023 | | 0.0 | |

**Table 2-2 - Stack and Emission Parameters Used in the Modeling**

| Area Sources | Size $m^2$ | Height m | $PM_{10}$ Existing Emissions | | | |
|---|---|---|---|---|---|---|
| | | | lb/hr | tpy | g/sec | g/sec-$m^2$ |
| Ash Loader Upgrade | 546 | 2.0 | 0.01 | 0.01 | 0.001 | 2.36E-06 |
| Coal Pile Wind Erosion and Dust Suppression | 17,679 | 4.6 | 0.93 | 1.12 | 0.118 | 6.66E-06 |
| Coal Stackout Conveyor Dust Suppression | 263 | 9.1 | 0.01 | 0.04 | 0.001 | 4.38E-06 |
| Coal Railcar Unloading Dust Suppression | 288 | 1.0 | 0.02 | 0.01 | 0.003 | 1.08E-05 |
| Ash trucks on Paved Roads | 5,886 | 1.0 | 0.12 | 0.24 | 0.015 | 2.57E-06 |

Notes:

Coal Pile = 4 acres = 17,679 $m^2$

Modeled height of coal pile = one half of average pile height = 30 feet x 0.5 = 15 feet (4.6 meters)

Modeled height stackout conveyor dust suppression = average height of coal pile (9.1 meters)

Resuspended roadway dust from paved roads: area = 2 x 0.3 miles x 20 feet wide = 5,886 $m^2$

# 3.0 MODELING RESULTS

## 3.1 Sulfur Dioxide ($SO_2$) Modeling Results

Tables 3-1 and 3-2 present results of modeling $SO_2$ emissions from Unit 4 at PRGS at maximum load and minimum load, respectively. Highest second highest 3-hour and 24-hour impacts and highest annual average impacts for each year are presented in the tables. Modeled impacts are added to the highest monitored background concentrations for comparison with the NAAQS. The monitored background for the 24-hour average was 60.3 $\mu g/m^3$. This represented the highest, second highest concentration over the three year (2002-2004) period used in the August 2005 report. Mirant reviewed daily monitored concentrations for this 3-year period and determined that the highest monitored background concentrations do not occur on the days when highest 24-hour $SO_2$ impacts are predicted from Unit 1. For this modeling of Unit 4, Mirant identified all the days in years 2000-2004 during which the top twenty-five 24-hour $SO_2$ concentrations were predicted for each year. Mirant then recorded the 24-hour monitored $SO_2$ concentration on these days and ranked them. The highest monitored 24-hour $SO_2$ concentration during these five years was 53 $\mu g/m^3$. This value was used in the NAAQS compliance assessment shown in Table 3-1.

As shown in Table 3-1 for maximum load, the highest second highest 3-hour average $SO_2$ concentration is 603.5 $\mu g/m^3$. This concentration is below the 1,300 $\mu g/m^3$ 3-hour NAAQS. The highest, second highest 24–hour average concentration is 250.9 $\mu g/m^3$. This concentration is below the 365 $\mu g/m^3$ 24-hour NAAQS. Finally, the highest annual average concentration of 43.2 $\mu g/m^3$ is below the 80 $\mu g/m^3$ annual NAAQS.

Table 3-2 presents results for minimum load. The highest second highest 3-hour average $SO_2$ concentration is 459.1 $\mu g/m^3$. This concentration is below the 1,300 $\mu g/m^3$ 3-hour NAAQS. The highest, second highest 24–hour average concentration is 189.7 $\mu g/m^3$. This concentration is below the 365 $\mu g/m^3$ 24-hour NAAQS. Finally, the highest annual average concentration of 40.7 $\mu g/m^3$ is below the 80 $\mu g/m^3$ annual NAAQS.

## 3.2 $PM_{10}$ Results

Table 3-3 presents results of modeling $PM_{10}$ emissions from Unit 4 plus all other non-combustion sources at PRGS. Modeling was performed for Unit 4 at maximum load because modeled impacts are highest at maximum load (compare Tables 3-1 and 3-2). The highest, second highest 24-hour average concentration is 100.2 $\mu g/m^3$. This concentration is below the 150 $\mu g/m^3$ 24-hour NAAQS. The highest annual average concentration of 32.5 $\mu g/m^3$ is below the 50 $\mu g/m^3$ annual NAAQS.

### 3.3 Nitrogen Oxides (as $NO_2$) Results

Table 3-4 presents results of modeling Unit 4 NOx emissions at maximum load. Maximum total $NO_2$ concentrations are predicted to be 69.6 µg/$m^3$. This concentration is below 100 µg/$m^3$ annual NAAQS.

### 3.4 Conclusions

Modeling results indicate that Unit 4 operating at any load produces ambient air concentrations that are better than the NAAQS for $SO_2$, $PM_{10}$ and $NO_2$.

**Table 3-1 AERMOD Modeling Results for $SO_2$**
**Unit 4 at Maximum Load, $SO_2$ Emission Rate = 0.24 lb/MMBtu**

| Year | Pollutant | Averaging Period | AERMOD-PRIME | Monitored Background | AERMOD-PRIME + Background | NAAQS | Impact Location | | Distance | Direction | Ground Elevation | Flagpole Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Concentrations ($\mu g/m^3$) | | | | X (m) | Y (m) | m | deg | m | m |
| 2000 | $SO_2$ | 3-hour | 329.0 | 238.4 | 567.4 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 197.9 | 53.0 | 250.9 | 365 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 24.8 | 15.7 | 40.5 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2001 | $SO_2$ | 3-hour | 365.1 | 238.4 | 603.5 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 178.3 | 53.0 | 231.3 | 365 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 27.5 | 15.7 | 43.2 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2002 | $SO_2$ | 3-hour | 318.2 | 238.4 | 556.6 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 186.7 | 53.0 | 239.7 | 365 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 23.5 | 15.7 | 39.2 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2003 | $SO_2$ | 3-hour | 275.6 | 238.4 | 514.0 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 140.3 | 53.0 | 193.3 | 365 | 322684.5 | 4298471.5 | 185.3 | 221 | 11.7 | 39.6 |
| | | Annual | 12.1 | 15.7 | 27.8 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2004 | $SO_2$ | 3-hour | 286.6 | 238.4 | 525.0 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 112.6 | 53.0 | 165.6 | 365 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 16.6 | 15.7 | 32.3 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |

**Table 3-2 AERMOD Modeling Results for $SO_2$**
**Unit 4 at Minimum Load, $SO_2$ Emission Rate = 0.24 lb/MMBtu**

| Year | Pollutant | Averaging Period | AERMOD-PRIME | Monitored Background | AERMOD-PRIME + Background | NAAQS | Impact Location | | Distance | Direction | Ground Elevation | Flagpole Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Concentrations ($\mu g/m^3$) | | | | X (m) | Y (m) | m | deg | m | m |
| 2000 | $SO_2$ | 3-hour | 215.0 | 238.4 | 453.4 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 136.7 | 53.0 | 189.7 | 365 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 22.4 | 15.7 | 38.1 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2001 | $SO_2$ | 3-hour | 220.7 | 238.4 | 459.1 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 131.5 | 53.0 | 184.5 | 365 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 25.0 | 15.7 | 40.7 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2002 | $SO_2$ | 3-hour | 216.1 | 238.4 | 454.5 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 129.5 | 53.0 | 182.5 | 365 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 20.1 | 15.7 | 35.8 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2003 | $SO_2$ | 3-hour | 186.8 | 238.4 | 425.2 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 91.0 | 53.0 | 144.0 | 365 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 11.4 | 15.7 | 27.1 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2004 | $SO_2$ | 3-hour | 204.9 | 238.4 | 443.3 | 1300 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | 24-hour | 85.0 | 53.0 | 138.0 | 365 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 15.0 | 15.7 | 30.7 | 80 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |

**Table 3-3 AERMOD Modeling Results for PM10**
**Unit 4 at Maximum Load, $PM_{10}$ Emission Rate = 0.06 lb/MMBtu**
**Fugitive Dust Sources Reduced to 20% except Coal Pile**

| Year | Pollutant | Averaging Period | AERMOD-PRIME | Monitored Background | AERMOD-PRIME + Background | NAAQS | Impact Location | | Distance | Direction | Ground Elevation | Flagpole Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Concentrations ($\mu g/m^3$) | | | | X (m) | Y (m) | m | deg | m | m |
| 2000 | $PM_{10}$ | 24-hour | 50.6 | 45 | 95.6 | 150 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| | | Annual | 9.5 | 21 | 30.5 | 50 | 322810.6 | 4298329.0 | 283.1 | 179 | 10.6 | 0.0 |
| 2001 | $PM_{10}$ | 24-hour | 55.2 | 45 | 100.2 | 150 | 322810.6 | 4298329.0 | 283.1 | 179 | 10.6 | 0.0 |
| | | Annual | 10.6 | 21 | 31.6 | 50 | 322904.4 | 4298462.5 | 179.5 | 146 | 10.6 | 0.0 |
| 2002 | $PM_{10}$ | 24-hour | 48.3 | 45 | 93.3 | 150 | 322810.6 | 4298329.0 | 283.1 | 179 | 10.6 | 0.0 |
| | | Annual | 9.9 | 21 | 30.9 | 50 | 322904.4 | 4298462.5 | 179.5 | 146 | 8.3 | 0.0 |
| 2003 | $PM_{10}$ | 24-hour | 41.3 | 45 | 86.3 | 150 | 322810.6 | 4298329.0 | 283.1 | 179 | 10.6 | 0.0 |
| | | Annual | 11.5 | 21 | 32.5 | 50 | 322810.6 | 4298329.0 | 283.1 | 179 | 10.6 | 0.0 |
| 2004 | $PM_{10}$ | 24-hour | 40.6 | 45 | 85.6 | 150 | 322810.6 | 4298329.0 | 283.1 | 179 | 4.1 | 0.0 |
| | | Annual | 10.3 | 21 | 31.3 | 50 | 322810.6 | 4298329.0 | 283.1 | 179 | 10.6 | 0.0 |

**Table 3-5 AERMOD Modeling Results for NOx**
**Unit 4 at Maximum Load, NOx Emission Rate for Unit 4= 0.24 lb/MMBtu**

| Year | Pollutant | Averaging Period | AERMOD-PRIME | Monitored Background | AERMOD-PRIME + Background | NAAQS | Impact Location | | Distance | Direction | Ground Elevation | Flagpole Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Concentrations ($\mu g/m^3$) | | | | X (m) | Y (m) | m | deg | m | m |
| 2000 | $NO_2$ | Annual | 18.6 | 48.9 | 67.5 | 100 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2001 | $NO_2$ | Annual | 20.7 | 48.9 | 69.6 | 100 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2002 | $NO_2$ | Annual | 17.6 | 48.9 | 66.5 | 100 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2003 | $NO_2$ | Annual | 9.0 | 48.9 | 57.9 | 100 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |
| 2004 | $NO_2$ | Annual | 12.5 | 48.9 | 61.4 | 100 | 322787.7 | 4298786.0 | 174.8 | 354 | 4.6 | 39.6 |

NOx concentrations were multiplied by 0.75 to obtain $NO_2$ estimates in accordance with USEPA guidelines.