Mirant Potomac River, LLC
Alexandria, VA

Update 6 to:

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

Modeling Baseload Units 3,4,5

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1.0 INTRODUCTION

This report describes dispersion modeling performed for simultaneous operation of three baseload units at Mirant's Potomac River Generating Station (PRGS). The units (3,4,5) would operate at maximum load (107 MW) for up to 12 hours and minimum load (35 MW) 12 hours or more in a calendar day. This mode of operation is also referred to as Option B in Mirant Potomac River LLC's December 30, 2005 letter to the U.S. Department of Energy regarding District of Columbia Public Service Commission, Docket No. EO-05-01. The modeling was performed according to the Protocol approved by the Virginia Department of Environmental Quality. The modeling demonstrates that Option B operations will not cause or contribute to exceedances of the National Ambient Air Quality Standards (NAAQS) for the pollutants PM_{10} and NO_2 . The modeling also demonstrates that Option B operations will not cause or contribute to exceedances of the 3 hour or the annual NAAQS for SO_2 and predicts only marginal exceedances of the 24 hour SO_2 NAAQS. The 24 hour SO_2 NAAQS exceedances are predicted only at the top level and roof of the nearby Marina Towers building and only under a limited set of meteorological conditions. In addition, the marginal exceedances of the 24 hour SO_2 NAAQS are predicted to be within the required "margin of safety".

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 the baseload units simultaneously for up to 12 hours at maximum load and 12 hours or more at minimum load. When operating, Mirant will use trona injection and a blend of the Appalachian coal generally used at the plant and lower sulfur coal to manage SO_2 emissions.

Stack gas flow rates for all units operating below maximum load 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 for units operating at minimum load. Exit velocity was calculated from ACFM using the stack diameter.

Power plant personnel provided the historical heat rate versus load for all units. The heat rate for Unit 3 at 35 MW is 10.8 MMBtu/MWh. The heat rate for Unit 4 at 35 MW is 11.3 MMBtu/MWh. The heat rate for Unit 5 at 35 MW is also 11.3 MMBtu/MWh. The heat rate was used to calculate SO_2, PM_{10} and NOx emissions at 35 MW using the following equation:

- SO_2 (lb/hr) = Unit heat rate x 35 MW x 0.22 lb SO_2/MMBtu
- PM_{10} (lb/hr) = Unit heat rate x 35 MW x 0.048 lb PM_{10}/MMBtu
- NOx (lb/hr) = Unit heat rate x 35 MW x 0.24 lb NOx/MMBtu

SO_2 emissions for all units at maximum load (107 MW for Units 3,4,5) were calculated in exactly the same manner as the August 2005 modeling report except that an emission factor of 0.22 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 all baseload units using Trona.

PM_{10} emissions for all units at maximum load were calculated in the same manner as the August 2005 report except that an emission factor of 0.048 lb/MMBtu was used instead of the permit limit of 0.12 lb/MMBtu. The most recent stack testing indicates that maximum PM/PM_{10} emissions are less than 0.048 lb/MMBtu.

NOx emission rates at maximum load are 0.24 lb/MMBtu for Units 3, 4, 5 based on CEMS data.

Table 2-1 shows the stack and flue gas exit parameters used in modeling all units.

Sources of PM_{10} emissions include the combustion stacks, two fly ash silos and one bottom ash silo, plus material handling sources. Table 2-1 shows the Units' stack emissions plus the silos. In modeling PM_{10} emissions from PRGS when only three units are operating, Mirant assumed that emissions from all the silos and from the material handling sources are 60% of what they are when all units are operating at maximum load. This is because three units operating produce approximately 60% 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.

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 3/ Stack 3	48.2	2.4	413.2	405.4	15.3	30.8	10.48	28.22	2.286	6.157	11.431	30.784
Boiler 4/ Stack 4	48.2	2.4	411.3	405.4	15.1	33.2	10.96	30.13	2.392	6.574	11.960	32.871
Boiler 5/ Stack 5	48.2	2.4	406.0	405.4	13.9	33.8	10.96	30.69	2.392	6.695	11.960	33.476
Fly Ash Silo	33.6	1.0	293.0		0.1		0.0		0.051		0.0	
Fly Ash Silo	33.6	1.0	293.0		0.1		0.0		0.051		0.0	
Bottom Ash Silo	31.0	1.0	293.0		0.1		0.0		0.070		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	0.03	0.024	0.0036	7.08E-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	0.03	0.12	0.0036	1.31E-05
Coal Railcar Unloading Dust Suppression	288	1.0	0.072	0.036	0.0096	3.23E-05
Ash trucks on Paved Roads	5,886	1.0	0.36	0.73	0.046	7.72E-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

Table 3-1 presents results of modeling the three baseload Units 3,4,5 for 12 hours at maximum load (107 MW) and 12 hours at minimum load (35 MW).

3.1 SO_2 Results

Highest second highest 3-hour and 24-hour impacts and highest annual average impacts for each year are presented in Table 3-1. 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 μg/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 the entire 5-year period 2000-2004 and determined that the highest monitored background concentrations do not occur on the days when highest 24-hour SO_2 impacts are predicted from these three units. For this modeling of Units 3, 4, and 5, 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 μg/m^3. This value was used in the NAAQS compliance assessment shown in Table 3-1.

As shown in Table 3-1, the highest second highest 3-hour average SO_2 concentration is 1,090 μg/m^3. This concentration is below the 1,300 μg/m^3 3-hour NAAQS. The highest, second highest 24–hour average concentration is 495 μg/m^3. This concentration is above the 365 μg/m^3 24-hour NAAQS but below the 500 ug/m^3 level at which no health effects were observed. Finally, the highest annual average concentration of 60 μg/m^3 is below the 80 μg/m^3 annual NAAQS. For the annual averaging period, a scaling factor of 65% was applied to the predicted concentrations, which represent the actual operating capacity factor for the units.

The AERMOD model predicted exceedances of the 365 ug/m^3 24-hour average NAAQS on the roof and at the top floor balcony of the nearby Marina Towers building. Figure 3-1 shows the locations of the predicted non-complying concentrations for the worst-case year 2000. The model predicted a total of 26 non-complying concentrations for the 24-hour averaging period, 20 of which were predicted on the roof and 6 of which were predicted on the top floor balcony.

ENSR emphasizes that the predicted non-compliance with the 24-hour average NAAQS are “modeled” exceedances, not actual exceedances, and that the predicted concentrations represent conservative overestimates of actual air quality levels. Also, the 24-hour NAAQS of 365 ug/m^3 was set with a margin of safety to protect populations that may be particularly sensitive to air pollution. The standard was set at 365 ug/m^3, although health effects were observed only when SO_2 concentrations exceeded 500 ug/m^3.[1]

3.2 PM_{10} Results

Table 3-1 presents results of modeling PM_{10} emissions from Units 3,4, 5 plus all other non-combustion sources at PRGS. The highest, second highest 24-hour average concentration is 145.0 µg/m^3. This concentration is below the 150 µg/m^3 24-hour NAAQS. The highest annual average concentration of 34 µg/m^3 is below the 50 µg/m^3 annual NAAQS.

3.3 Nitrogen Oxides (as NO_2) Results

Table 3-1 presents results of modeling NOx emissions from Units 3,4,5. Maximum total NO_2 concentrations are predicted to be 85 µg/m^3. This concentration is below 100 µg/m^3 annual NAAQS.

3.4 Conclusions

Modeling results indicate that Units 3,4,5 operating simultaneously will not cause or contribute to exceedances of the National Ambient Air Quality Standards (NAAQS) for the pollutants PM_{10} and NO_2 or 3-hour and annual SO2. Only marginal exceedances of the 24-hour NAAQS for SO_2 are predicted, all below 500 ug/m^3, the level at which health effects appear to be likely. Further, the SO_2 NAAQS exceedances are predicted only at the top level and roof of the nearby Marina Towers building.

[1] Review of the National Ambient Air Quality Standards for Sulfur Dioxides: Updated Assessment of Scientific and Technical Information-Addendum to the 1982 OAQPS Staff Paper, December 1986, P. 48

Figure 3-1 Locations of the Predicted Non-Complying Concentrations for the Worst-Case Year 2000

Table 3-1 AERMOD Modeling Results

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	720	238.4	958	1300	322787.7	4298786.0	174.8	354	4.6	39.6
		24-hour	442	53.0	495	365	322787.7	4298786.0	174.8	354	4.6	39.6
		Annual	40	15.7	55	80	322787.7	4298786.0	174.8	354	4.6	39.6
2001	SO_2	3-hour	852	238.4	1,090	1300	322787.7	4298786.0	174.8	354	4.6	39.6
		24-hour	417	53.0	470	365	322787.7	4298786.0	174.8	354	4.6	39.6
		Annual	45	15.7	60	80	322787.7	4298786.0	174.8	354	4.6	39.6
2002	SO_2	3-hour	784	238.4	1,022	1300	322787.7	4298786.0	174.8	354	4.6	39.6
		24-hour	391	53.0	444	365	322787.7	4298786.0	174.8	354	4.6	39.6
		Annual	36	15.7	52	80	322787.7	4298786.0	174.8	354	4.6	39.6
2003	SO_2	3-hour	550	238.4	789	1300	322787.7	4298786.0	174.8	354	4.6	39.6
		24-hour	262	53.0	315	365	322787.7	4298786.0	174.8	354	4.6	39.6
		Annual	20	15.7	35	80	322787.7	4298786.0	174.8	354	4.6	39.6
2004	SO_2	3-hour	687	238.4	925	1300	322787.7	4298786.0	174.8	354	4.6	39.6
		24-hour	242	53.0	295	365	322787.7	4298786.0	174.8	354	4.6	39.6
		Annual	26	15.7	42	80	322787.7	4298786.0	174.8	354	4.6	39.6

Table 3-1 Cont.

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	PM10	24-hour	100	45	145	150	322787.7	4298786.0	174.8	354	4.6	39.6
		Annual	11	21	32	50	322810.6	4298329.0	283.1	179	10.6	0.0
2001	PM10	24-hour	99	45	144	150	322810.6	4298329.0	283.1	179	10.6	0.0
		Annual	11	21	32	50	322810.6	4298329.0	283.1	179	10.6	0.0
2002	PM10	24-hour	87	45	132	150	322787.7	4298786.0	174.8	354	4.6	39.6
		Annual	12	21	33	50	322810.6	4298329.0	283.1	179	10.6	0.0
2003	PM10	24-hour	83	45	128	150	322810.6	4298329.0	283.1	179	10.6	0.0
		Annual	13	21	34	50	322810.6	4298329.0	283.1	179	10.6	0.0
2004	PM10	24-hour	71	45	116	150	322810.6	4298329.0	283.1	179	10.6	0.0
		Annual	12	21	33	50	322810.6	4298329.0	283.1	179	10.6	0.0

Table 3-1 Cont.

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	33	48.9	81	100	322787.7	4298786.0	174.8	354	4.6	39.6
2001	NO_2	Annual	37	48.9	85	100	322787.7	4298786.0	174.8	354	4.6	39.6
2002	NO_2	Annual	30	48.9	79	100	322787.7	4298786.0	174.8	354	4.6	39.6
2003	NO_2	Annual	16	48.9	65	100	322787.7	4298786.0	174.8	354	4.6	39.6
2004	NO_2	Annual	22	48.9	71	100	322787.7	4298786.0	174.8	354	4.6	39.6

NOx concentrations were multiplied by 0.75 to obtain NO2 estimates in accordance with USEPA guidelines.