

## **Review of Mirant Five-Minute SO<sub>2</sub> Data**

### **Background**

The National Ambient Air Quality Standards for sulfur dioxide (SO<sub>2</sub>) address exposures applicable to averaging times of 3 hours, 24 hours, and an annual basis. These standards were developed to protect public health and welfare. While such standards are generally protective, there are special-case circumstances where particularly high short-term concentrations can be of concern for individuals that are particularly sensitive to such exposures. EPA identified a level of concern of 0.6 ppm based on five-minute averaging. This equates to approximately 1,570 µg/m<sup>3</sup> at typical ambient conditions. The proximity of residential areas to the Mirant Potomac River Generating Stations, especially high rise exposures, creates the special-case situation for which EPA developed the five-minute SO<sub>2</sub> level of concern. This document provides a summary of the results of the five-minute monitoring in relation to the EPA proposed level of concern for SO<sub>2</sub>.

### **Mirant SO<sub>2</sub> Monitoring Network**

Figure 1 shows the location of monitoring stations that are associated with the Mirant monitoring network in the vicinity of the Potomac River Generating Station. The five SO<sub>2</sub> monitors are logged and stored on a five-minute averaging basis.

Figure 4-1 SO<sub>2</sub> and Meteorological Monitoring Sites around Potomac River Power Plant



**Overview of Findings**

EPA has established a 5-minute level of concern threshold for ambient SO<sub>2</sub> exposures of 1,572 µg/m<sup>3</sup> (EPA, 1996)<sup>1</sup>. This document summarizes a review of available 5-minute measured SO<sub>2</sub> data from five monitoring stations around the Mirant facility, applicable to the period of April 2007 through July 2008. The analysis shown below shows that peak measured SO<sub>2</sub> 5-minute average values approached the level of concern at Marina Towers (reached to within approximately 87 percent of the threshold), but did not exceed the threshold based on available data during this reporting period. The SE site, on the other hand, showed a greater frequency of elevated concentrations on a short-term basis, but the peak values were not as high as those observed at the rooftop of Marina Towers. Data recovery overall was reasonably good, with all monitoring location showing greater than 90 percent data recovery. If the facility were to operate on a similar basis and a longer record were available, such as a 2-3 year records, it would be reasonable to conclude that short-term concentrations would likely exceed the level of concern due to random variability in emissions and transport/dilution conditions. Since enhanced mitigation is planned to substantially reduce the SO<sub>2</sub> emissions from this facility, however, this concern will be substantially reduced.

**Perspective on Mirant SO<sub>2</sub> Hourly Monitoring Versus Regional Measured Data**

First, to provide perspective, the 5-minute records from the Mirant network were processed to match the hourly resolution of regional SO<sub>2</sub> monitoring stations in the region. The following table compares the measured concentration values from the Mirant network with regional data. As shown, the peak values are more than four-fold higher than the regional peak hourly values.

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Alexandria (517 N St. Asaph)	11577	.00	138.80	8.1474	9.80472
Washington DC (34 <sup>th</sup> & Dix Street)	11577	.00	123.10	13.3880	8.99258
Site_1 (MTWRc – Marina Central)	11507	.80	505.50	18.7356	25.65512
Site_2 (MTWRs – Marina South)	10307	.50	618.90	12.7726	21.99981
Site_3 (SE – East of ESP1)	10868	.90	449.70	20.6599	27.68694
Site_4 (SW – Holiday Inn)	11102	2.60	184.60	15.1186	11.79948
Site_5 (ND – Dangerfield Island)	11326	1.10	158.00	12.7545	10.44476
Site_6 (NE – East of ESP5)	11219	2.60	361.60	11.4212	11.43964
Valid N (listwise)	8979				

<sup>1</sup> Federal Register, Volume 61, No. 100, May 22, 1996, 40 CFR Part 50.

**Review of Five-Minute SO<sub>2</sub> Measured Concentrations Versus EPA Established Level of Concern**

The following provides summary statistics for all cases of 5-minute SO<sub>2</sub> data from April 6, 2007 through July 31, 2008

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_1 (MTWRc)	120140	.00	1368.90	12.7779	26.10177
Site_2 (MTWRs)	134074	.00	1327.00	18.7153	30.98418
Site_3 (SE)	126658	.00	1053.20	20.7076	33.80920
Valid N (listwise)	112150				

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_4 (SW)	129421	2.60	493.90	15.1130	13.31097
Site_5 (ND)	132208	.00	296.10	12.7480	11.70973
Site_6 (NE)	131041	2.60	852.80	11.4397	13.41675
Valid N (listwise)	119649				

The following provides subdivision by wind direction quadrant (from which wind flows):

**Eastern Quadrant (45-135):**

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_1 (MTWRc)	18355	.00	525.30	10.4255	12.02430
Site_2 (MTWRs)	20356	.00	394.30	15.0837	14.05939
Site_3 (SE)	19302	.00	196.50	15.0295	11.91331
Valid N (listwise)	17355				

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_4 (SW)	19739	2.60	195.20	16.3734	13.46094
Site_5 (ND)	20005	1.30	212.20	12.4007	10.87733
Site_6 (NE)	20062	2.60	78.60	11.0023	6.23945
Valid N (listwise)	18431				

**Southern Quadrant (135-225):**

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_1 (MTWRc)	49124	.00	1368.90	17.5493	38.63418
Site_2 (MTWRs)	53328	1.30	1327.00	25.4583	46.45360
Site_3 (SE)	51587	.20	213.50	13.5416	9.77752
Valid N (listwise)	46579				

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_4 (SW)	52140	2.60	187.30	13.2766	10.16657
Site_5 (ND)	52979	.00	296.10	14.0253	14.55418
Site_6 (NE)	52314	2.60	500.40	9.7964	6.49414
Valid N (listwise)	47955				

**West Quadrant (225-315):****Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_1 (MTWRc)	19613	1.30	102.20	8.0955	7.25352
Site_2 (MTWRs)	22514	.00	201.70	12.9869	8.67122
Site_3 (SE)	21294	1.30	1053.20	29.9657	50.80371
Valid N (listwise)	18308				

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_4 (SW)	21334	2.60	394.30	13.1796	10.02451
Site_5 (ND)	22142	1.30	100.90	10.5535	7.21940
Site_6 (NE)	21641	2.60	852.80	16.8676	28.69639
Valid N (listwise)	19908				

**Northern Quadrant:****315-360:****Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_1 (MTWRc)	20681	1.30	382.50	10.2135	9.41452
Site_2 (MTWRs)	24219	.00	277.70	15.2013	9.86684
Site_3 (SE)	22331	1.30	987.70	36.5770	55.70774
Valid N (listwise)	18985				

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_4 (SW)	23128	2.60	493.90	16.6171	12.68662
Site_5 (ND)	23747	1.30	83.80	12.7441	9.04762
Site_6 (NE)	23497	2.60	294.80	10.9073	7.87144
Valid N (listwise)	21271				

**1-45:****Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_1 (MTWRc)	11933	.00	115.30	9.0950	9.23215
Site_2 (MTWRs)	13223	.00	148.00	13.5914	10.32021
Site_3 (SE)	11952	1.30	592.10	14.8282	11.80282
Valid N (listwise)	10731				

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Site_4 (SW)	12777	2.60	368.10	21.1765	23.78517
Site_5 (ND)	12812	1.30	124.50	12.0128	9.64397
Site_6 (NE)	13016	2.60	119.20	10.5449	6.15844
Valid N (listwise)	11793				

Table 1: Highest Rank-Ordered Values from Site #1 (MTWRc)

<b>Date</b>	<b>Site #1</b>	<b>Wind Direction</b>	<b>Knots</b>
6/3/2008 12:55	1368.90	170.0	16.0
6/3/2008 12:50	1054.60	170.0	19.0
7/13/2008 13:20	911.80	180.0	16.0
6/3/2008 10:40	907.80	180.0	9.0
6/3/2008 14:20	886.90	170.0	15.0
7/13/2008 12:50	825.30	170.0	14.0
7/13/2008 12:05	775.50	170.0	13.0
12/23/2007 13:05	751.90	170.0	19.0
6/3/2008 13:00	716.60	180.0	16.0
5/30/2008 14:15	711.30	160.0	10.0
7/13/2008 15:25	707.40	170.0	13.0
7/13/2008 13:55	702.20	190.0	15.0
7/13/2008 14:50	687.80	170.0	15.0
6/3/2008 14:30	677.30	170.0	16.0
6/3/2008 14:55	666.80	170.0	15.0
6/3/2008 14:25	662.90	170.0	16.0
7/13/2008 15:50	657.60	180.0	14.0
6/3/2008 13:10	648.50	180.0	13.0
6/3/2008 14:40	640.60	170.0	17.0

Table 2: Highest Rank-Ordered Values from Site #2 (MTWRs)

<b>Date</b>	<b>Site 2</b>	<b>Wind Direction</b>	<b>Knots</b>
5/1/2007 17:10	1327.00	160.0	9.0
12/23/2007 12:55	1099.10	160.0	19.0
5/1/2007 17:00	958.90	170.0	13.0
6/3/2008 12:55	932.70	170.0	16.0
5/1/2007 16:40	926.20	170.0	13.0
7/13/2008 12:05	919.60	170.0	13.0
6/3/2008 14:10	882.90	180.0	16.0
5/1/2007 17:05	880.30	160.0	12.0
6/3/2008 14:20	858.10	170.0	15.0
5/1/2007 17:15	789.90	150.0	12.0
5/1/2007 16:15	766.30	160.0	13.0
12/23/2007 12:45	759.80	170.0	19.0
6/3/2008 12:50	754.60	170.0	19.0
7/7/2008 13:35	744.10	170.0	15.0
7/13/2008 14:45	744.10	170.0	15.0
7/12/2008 12:25	740.10	180.0	11.0
7/8/2008 12:45	732.30	160.0	13.0
7/13/2008 12:10	731.00	170.0	14.0
7/13/2008 11:25	699.50	170.0	13.0

Table 3: Highest Rank-Ordered Values from Site #3 (SE)

<b>Date</b>	<b>Site #3</b>	<b>Wind Direction</b>	<b>Knots</b>
4/30/2007 16:00	1053.20	310.0	11.0
4/30/2007 15:00	1046.70	310.0	17.0
6/6/2007 13:25	987.70	330.0	9.0
6/22/2007 17:15	979.90	320.0	18.0
6/22/2007 17:10	931.40	320.0	18.0
4/30/2007 15:55	839.70	320.0	13.0
6/20/2007 14:50	837.10	340.0	16.0
4/30/2007 13:20	829.20	300.0	16.0
4/29/2007 12:45	826.60	290.0	7.0
6/22/2007 15:50	817.40	330.0	16.0
6/20/2007 13:55	799.10	330.0	14.0
6/6/2007 9:30	795.20	330.0	13.0
4/13/2007 11:10	715.30	286.0	18.0
4/15/2007 23:30	706.10	330.0	26.0
6/20/2007 15:15	706.10	340.0	8.0
6/20/2007 14:00	704.80	340.0	16.0
4/29/2007 8:25	699.50	300.0	10.0
6/6/2007 8:55	691.70	320.0	13.0
4/30/2007 17:10	681.20	320.0	15.0

Table 4: Highest Rank-Ordered Values from Site #4 (SW)

<b>Date</b>	<b>Site #4</b>	<b>Wind Direction</b>	<b>Knots</b>
4/30/2007 23:00	493.90	340.0	6.0
4/30/2007 23:05	493.90	350.0	5.0
4/30/2007 14:15	394.30	300.0	17.0
7/28/2008 12:25	368.10	18.0	.0
4/30/2007 22:55	361.60	340.0	6.0
5/6/2007 8:35	353.70	20.0	14.0
5/28/2008 4:15	302.60	20.0	16.0
5/6/2007 6:45	300.00	30.0	15.0
5/6/2007 8:30	300.00	10.0	18.0
5/6/2007 4:00	298.70	20.0	23.0
4/30/2007 14:20	297.40	280.0	22.0
5/6/2007 8:40	285.60 1	0.0	18.0
10/10/2007 8:45	280.30	280.0	4.0
5/6/2007 6:05	276.40	20.0	16.0
5/28/2008 2:40	275.10	10.0	19.0
5/6/2007 7:20	268.60	30.0	16.0
5/6/2007 3:50	259.40	10.0	18.0
5/6/2007 6:40	245.00	20.0	19.0
5/6/2007 2:50	242.40	20.0	17.0

Table 5: Highest Rank-Ordered Values from Site #5 (ND)

<b>Date</b>	<b>Site #5</b>	<b>Wind Direction</b>	<b>Knots</b>
3/19/2008 19:05	296.10	190.0	22.0
5/26/2008 12:50	269.90	180.0	14.0
3/19/2008 19:00	241.00	190.0	21.0
3/19/2008 19:10	239.70	190.0	23.0
7/13/2008 7:25	226.60	180.0	13.0
5/15/2007 13:35	224.00	188.0	17.0
5/26/2008 17:25	224.00	190.0	13.0
5/26/2008 17:30	222.70	180.0	15.0
3/25/2008 19:50	218.80	190.0	13.0
3/19/2008 19:25	214.80	190.0	20.0
3/25/2008 19:00	214.80	190.0	13.0
5/26/2008 15:45	214.80	180.0	14.0
10/4/2007 10:00	212.20	86.0	.0
5/26/2008 16:10	212.20	180.0	15.0
6/3/2008 13:50	210.90	180.0	15.0
5/26/2008 12:45	208.30	180.0	13.0
3/25/2008 21:05	205.70	200.0	15.0
5/15/2007 13:30	203.00	187.0	16.0
10/22/2007 13:50	201.70	190.0	13.0

Table 6: Highest Rank-Ordered Values from Site # 6 (NE)

<b>Date</b>	<b>Site #6</b>	<b>Wind Direction</b>	<b>Knots</b>
4/30/2007 13:30	852.80	280.0	15.0
4/30/2007 12:55	696.90	280.0	19.0
4/30/2007 11:00	584.30	260.0	17.0
6/5/2007 13:10	583.00	230.0	15.0
4/30/2007 11:50	530.50	280.0	17.0
4/30/2007 11:45	525.30	270.0	18.0
4/30/2007 14:00	517.50	280.0	16.0
7/16/2008 22:00	500.40	210.0	3.0
7/16/2008 22:05	499.10	220.0	3.0
6/5/2007 16:20	486.00	280.0	12.0
6/5/2007 14:10	483.40	260.0	15.0
4/30/2007 12:00	482.10	270.0	15.0
4/30/2007 11:10	475.50	240.0	14.0
4/30/2007 11:55	453.30	290.0	15.0
4/30/2007 13:00	446.70	280.0	19.0
4/13/2007 13:45	444.10	310.0	17.0
7/16/2008 21:55	441.50	220.0	3.0
4/30/2007 12:20	432.30	260.0	14.0
4/30/2007 14:05	427.10	280.0	12.0

### Conclusions

Based on the approximate 16-month period of data reviewed in this document, the level of concern was approached at the monitors on the rooftop of Marina Towers but not exceeded. The maximum value of  $1,369 \mu\text{g}/\text{m}^3$  is approximately 87 percent of the proposed EPA level of concern. Considering the relatively small margin shown with this comparison, it would appear likely that if the facility were to operate similar to this review period on a long-term basis, the level of concern would likely be exceeded. Only four of the monitors had peak  $\text{SO}_2$  concentrations that were substantially higher than the regional monitors, i.e. the two Marina Towers monitors, the NE site, and the SE site. The two Marina Towers monitors showed the highest values, which would have the greatest potential for exceeding the level of concern likely based on random variability of emissions and meteorological conditions on a long-term basis. With plans to further mitigate emissions of  $\text{SO}_2$ , and other pollutants, from this facility, however, it would appear likely that such exceedances would be unlikely once these changes come on line. It would be advisable to maintain the network in its current state until the City of Alexandria is confident that the changes have resulted in  $\text{SO}_2$  peak exposures dropping to the point that further concerns with peak  $\text{SO}_2$  exposures would no longer exist.