



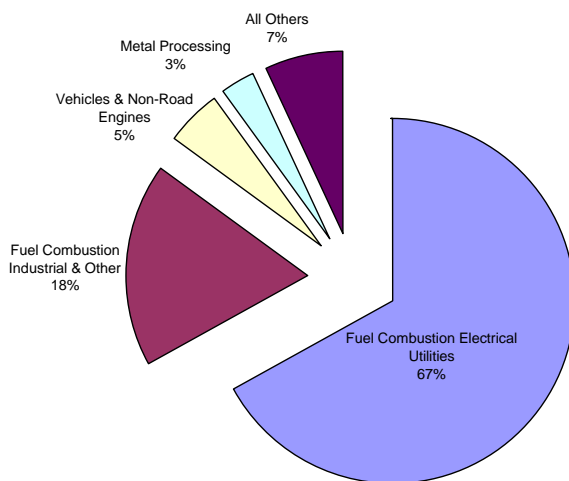
2005 Sulfur Dioxide Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Sulfur dioxide (SO₂) is a heavy, colorless gas with a suffocating odor that easily dissolves in water to form sulfuric acid. SO₂ gases can be formed when fuels containing sulfur are burned, or when gasoline is extracted from oil. Most of the sulfur dioxide released into the air comes from electric utilities, especially those that burn coal with a high sulfur content. Sulfur is found in raw materials such as crude oil, coal, and ores that contain metals such as aluminum, copper, zinc, lead and iron. Industrial facilities that derive their products from these materials may also release SO₂. A pie chart summarizing the major sources of SO₂ is shown in Figure 1.

Figure 1
National Summary
SO₂ Emissions by Source Category



Source: USEPA website
<http://www.epa.gov/air/urbanair/so2/what1.html>
Last updated, Monday, July 23, 2007

SO₂ concentrations in New Jersey are generally higher in the winter than in the summer due to higher emissions from space heating and other sources. This is shown in the chart depicted in Figure 2 (page 2). The chart also shows that SO₂ levels tend to peak in the morning as emissions accumulate prior to being more effectively dispersed when wind speeds increase and atmospheric mixing increases later in the day.

HEALTH AND ENVIRONMENTAL EFFECTS

Sulfur dioxide causes irritation of the mucous membranes. This is probably the result of the action of sulfurous acid that is formed when the highly soluble SO₂ dissolves at the surface of the membranes. Groups that are especially susceptible to the harmful health effects of SO₂ include children, the elderly, and people with heart or lung disorders such as asthma. When SO₂ concentrations in the air become elevated, people belonging to these sensitive groups and those who are active outdoors may have trouble breathing. The International Agency for Research on Cancer (IARC) evaluated SO₂ and based on available information, determined that no conclusion can be made as to the carcinogenicity of SO₂ to human beings.

Sulfur dioxide reacts with other gases and particles in the air to form sulfates that can be harmful to people and the environment. Sulfate particles are the major cause of reduced visibility in the eastern United States. SO₂ can also react with other substances in the air to form acids, which fall to the earth in rain and snow. Acid rain damages forests and crops, can make lakes and streams too acidic for fish, and speeds up the decay of building materials and paints.

STANDARDS

There are three National Ambient Air Quality Standards (NAAQS) for SO₂. There is an annual average health standard of 0.030 parts per million (ppm). This is based on a calendar year average of continuously monitored levels. There is also a 24-hour average health based standard of 0.14 ppm which is not to be exceeded more than once a year, and a secondary (welfare based) standard of 0.5 ppm, 3-hour average concentration that is also not to be exceeded more than once per year.

New Jersey has also set state air quality standards for SO₂. They are similar to the federal standards but are expressed in micrograms per cubic meter (µg/m³) instead

of ppm. They are also based on rolling averages rather than block averages. So, for example, the state's primary 12-month standard is based on any twelve-month average recorded during the year, while the federal standard is based solely on the calendar

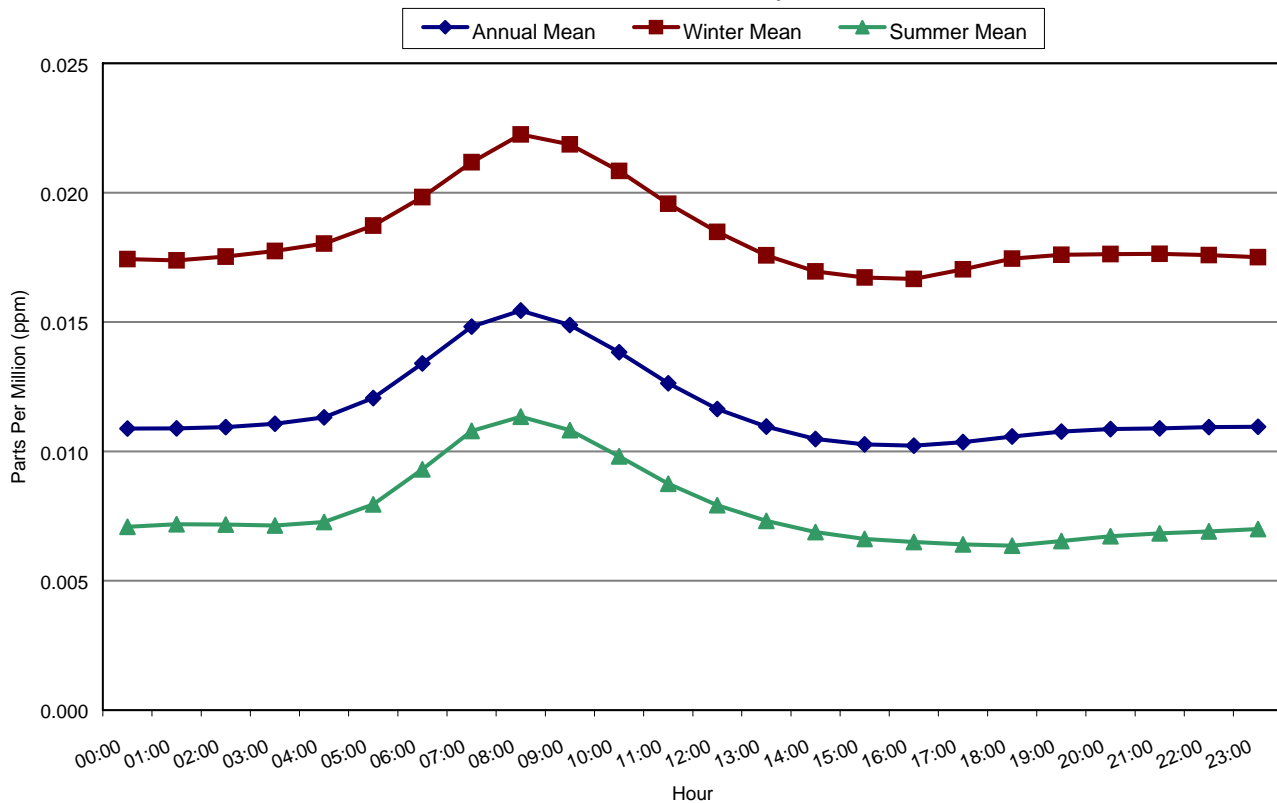
year average. The state also has secondary 12-month, 24-hour, and 3-hour average standards. Table 1 summarizes the NAAQS and the New Jersey Ambient Air Quality Standards (NJAAQS) for SO₂.

Table 1
National and New Jersey Ambient Air Quality Standards for Sulfur Dioxide

Averaging Period	Type	Parts Per Million (ppm)	
		Micrograms Per Cubic Meter (µg/m ³)	
		New Jersey	National ^a
12-month average	Primary	80 µg/m ³ (0.03 ppm)	0.030 ppm
12-month average	Secondary	60 µg/m ³ (0.02 ppm)	---
24-hour average	Primary	365 µg/m ³ (0.14 ppm)	0.14 ppm
24-hour average	Secondary	260 µg/m ³ (0.10 ppm)	---
3-hour average	Secondary	1300 µg/m ³ (0.5 ppm)	0.5 ppm

^a – National standards are block averages rather than moving averages

Figure 2
Sulfur Dioxide Concentration - New Jersey
1967-1999
Seasonal and Hourly Variation



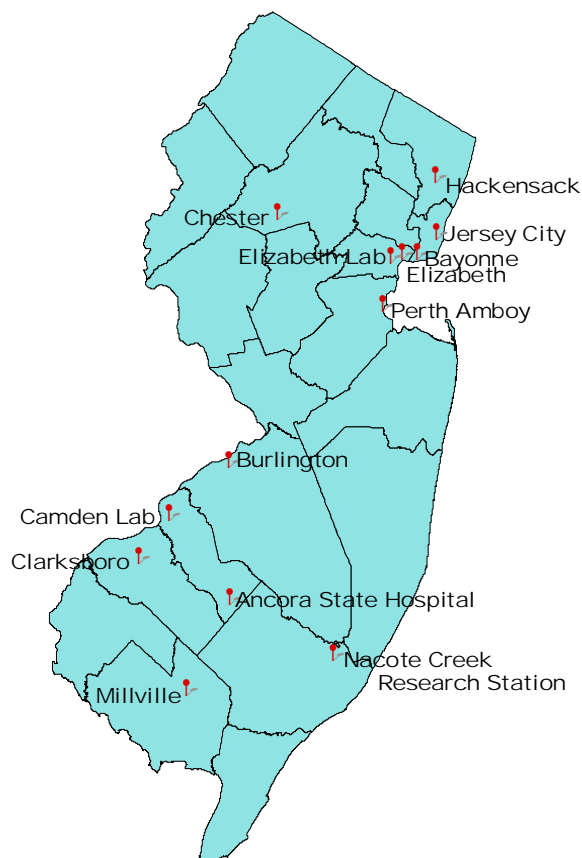
MONITORING LOCATIONS

The state monitored SO₂ levels at 13 locations in 2005. These sites are shown in the map in Figure 3.

SO₂ LEVELS IN 2005

None of the monitoring sites recorded exceedances of the primary or secondary SO₂ standards during 2005. The maximum 12-month average concentration recorded was 0.008 ppm in Bayonne, Elizabeth Lab, and Jersey City. The maximum 24-hour average level recorded was 0.044 ppm which was recorded in Clarksboro. The highest 3-hour average recorded was 0.164 ppm at Clarksboro. Summaries of the 2005 data are provided in Table 2 below, Table 3 (page 4) and Figure 4 (page 4).

**Figure 3
2005 Sulfur Dioxide
Monitoring Network**



**Table 2
Sulfur Dioxide Data – 2005
3-Hour and Annual Averages**

Parts Per Million (ppm)

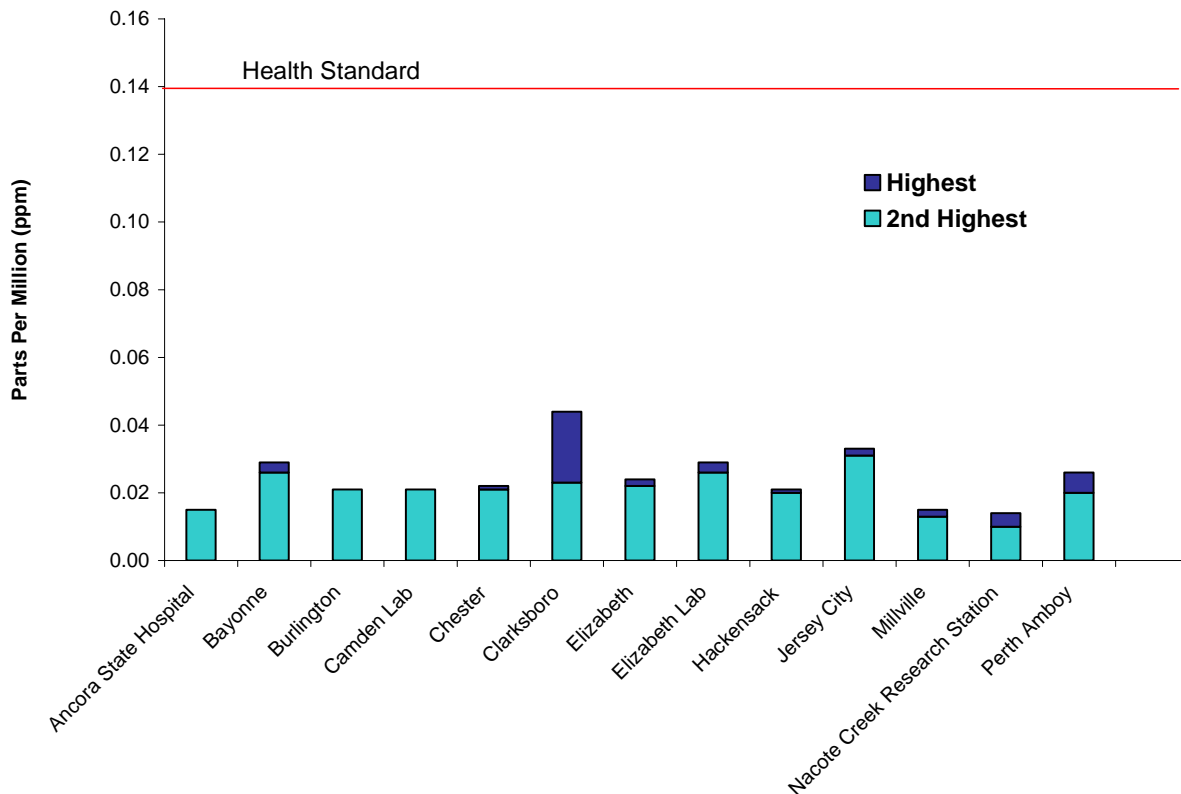
Monitoring Sites	3-Hour Average Maximum	3-Hour Average 2 nd Highest	12-Month Average Maximum	Average Calendar Year
Ancora State Hospital	0.031	0.025	0.003	0.003
Bayonne	0.055	0.051	0.008	0.008
Burlington	0.035	0.031	0.004	0.004
Camden Lab	0.038	0.036	0.006	0.005
Chester	0.051	0.047	0.004	0.004
Clarksboro	0.164	0.128	0.005	0.005
Elizabeth	0.045	0.045	0.006	0.006
Elizabeth Lab	0.048	0.045	0.008	0.007
Hackensack	0.034	0.032	0.004	0.004
Jersey City	0.055	0.050	0.008	0.008
Millville	0.025	0.024	0.004	0.004
Nacote Creek Research Center	0.032	0.019	0.002	0.002
Perth Amboy	0.054	0.042	0.004	0.004

Table 3
Sulfur Dioxide Data – 2005
24-Hour and Daily Averages

Parts Per Million (ppm)

Monitoring Sites	24-Hour Average Maximum	24-Hour Average 2 nd Highest	Daily Average Maximum	Daily Average 2 nd Highest
Ancora State Hospital	0.015	0.015	0.015	0.014
Bayonne	0.029	0.026	0.029	0.026
Burlington	0.021	0.021	0.017	0.016
Camden Lab	0.021	0.021	0.020	0.018
Chester	0.022	0.021	0.021	0.018
Clarksboro	0.044	0.023	0.044	0.017
Elizabeth	0.024	0.022	0.024	0.021
Elizabeth Lab	0.029	0.026	0.028	0.027
Hackensack	0.021	0.020	0.019	0.016
Jersey City	0.033	0.031	0.032	0.029
Millville	0.015	0.013	0.013	0.013
Nacote Creek Research Station	0.014	0.010	0.012	0.009
Perth Amboy	0.026	0.020	0.025	0.021

Figure 4
Highest and 2nd Highest 24-Hour Averages
of SO₂ in New Jersey - 2005



TRENDS

Since the implementation of regulations requiring the use of low sulfur fuels in New Jersey, SO₂ concentrations have improved significantly. The last time an exceedance of any of the National SO₂ standards was recorded in the state was in 1980. A trend graph of SO₂ levels showing the daily average concentrations recorded since 1975 from the highest, average, and lowest of all sites is shown in Figure 5 below. The graph uses the second highest daily value, as this is the value that determines if the national

health standard is being met (one exceedance per site is allowed each year).

Although there has not been a measured exceedance of the NAAQS in over two decades, there is still a small area of New Jersey that is classified as a non-attainment area for SO₂. This is the result of air quality modeling studies that predicted non-attainment of the standard within a small area of Warren County. The area is shown in the map in Figure 6 (page 6).

Figure 5
Sulfur Dioxide Concentrations in New Jersey
1975-2005
Second Highest Daily Average

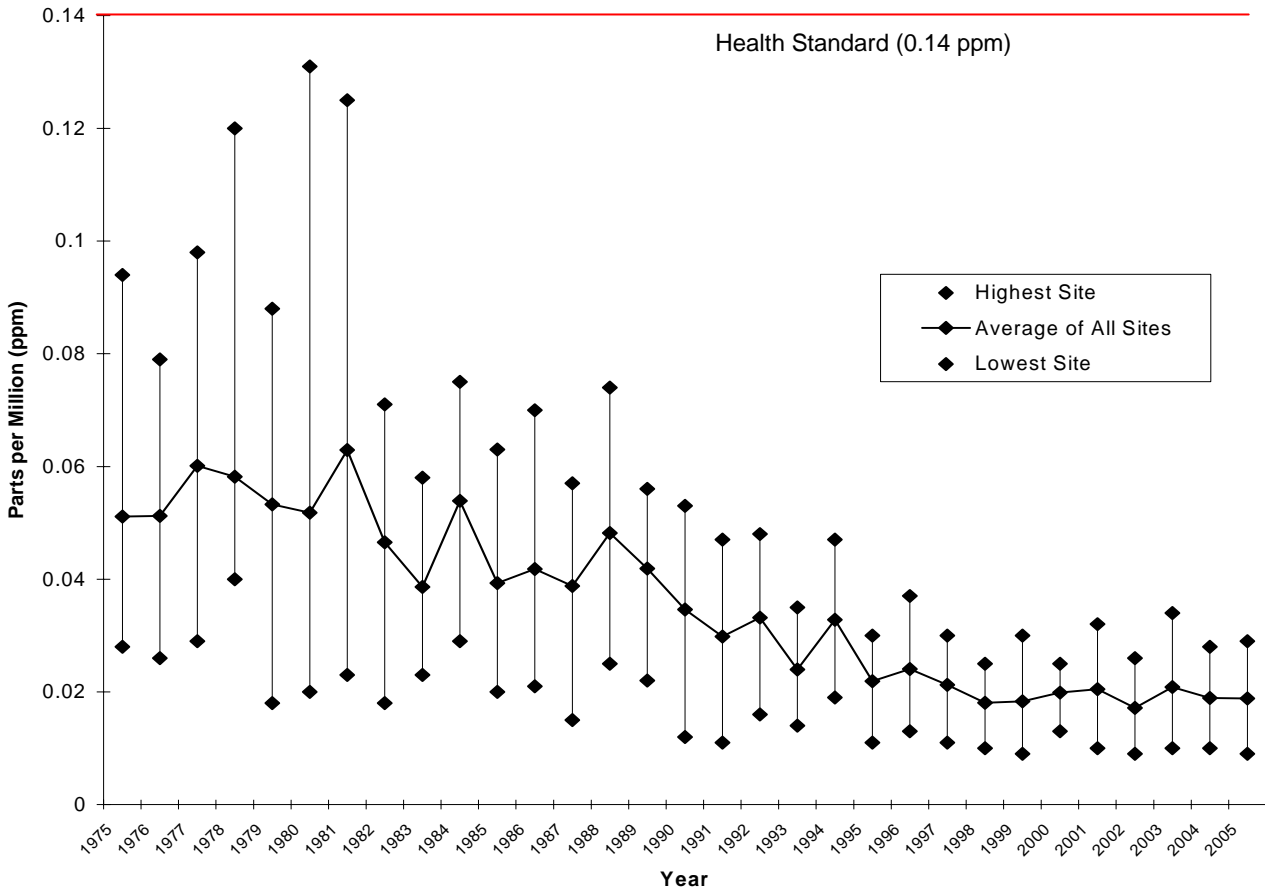
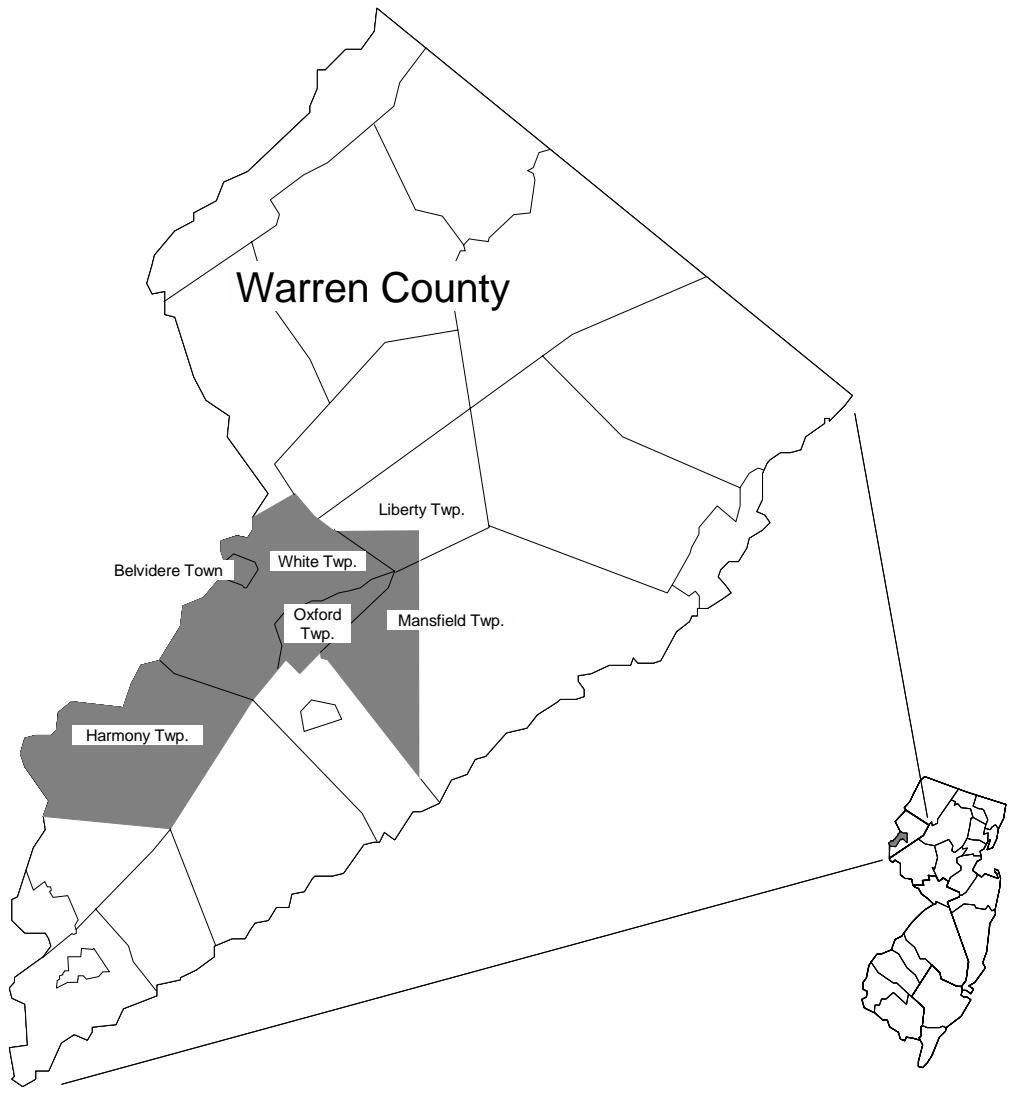


Figure 6
Sulfur Dioxide Non-Attainment Areas* in New Jersey



Legend

■ Sulfur Dioxide Nonattainment Area
(includes Belvidere Town; Harmony Township; Oxford Township;
White Township; the portion of Liberty Township south of
UTM northing 4,255,000 and west of UTM easting 505,000;
and the portion of Mansfield Township west of UTM easting 505,000).

*Nonattainment of the National Primary (Health) and Secondary (Welfare) Standards

FIVE MINUTE AVERAGE SO₂ MONITORING

A 1992 court decision compelled the USEPA to review, and if appropriate, revise the NAAQS for SO₂. After soliciting comments from the public and evaluating several options, the USEPA determined that high short-term SO₂ concentrations are a local problem rather than a widespread national concern. The USEPA Administrator decided in May 1996 not to revise the NAAQS for SO₂, but concluded that in some local areas, 5-minute SO₂ concentrations greater than 0.6 ppm pose a health threat to sensitive persons. In January 1997, the USEPA published proposed revisions to the regulations that would establish “concern and intervention levels (IL).” This IL would have a lower range of 0.6 ppm and an upper range of 2.0 ppm of SO₂. These levels are based on a 5-minute SO₂ concentration that is the highest of the 5-minute averages from the 12 possible non-overlapping periods during a clock hour. Under the proposed regulations, the USEPA would leave the responsibility of assessing the health risk and implementing corrective measures to the States. Also, the USEPA recommended that States evaluate the need to monitor 5-minute SO₂ averages around sources based on citizen complaints, the actual emissions of a source, the population in the vicinity of the source, and environmental justice issues.

The USEPA published a draft “Guideline Document for Ambient Monitoring of 5-Minute SO₂ Concentrations” on July 20, 2000. This guidance is intended to assist State and local agencies in determining whether 5-minute SO₂ monitoring should be established in their jurisdictions, and how to redesign an existing SO₂ network to fulfill these additional needs.

In October 2002, an air monitoring project was established in Warren County, New Jersey to evaluate the feasibility of monitoring 5-minute SO₂ concentrations in the vicinity of local point source. This is the first time since the publication of USEPA’s draft “Guideline Document for Ambient Monitoring of 5-Minute SO₂ Concentrations” that SO₂ concentrations anywhere in New Jersey are being directly compared to the 5-minute SO₂ guideline IL. Warren County was selected for this study as the Belvidere area of the county is the only SO₂ non-attainment area in the state (see Figure 6 – page 6). The study had broad community involvement in its design and implementation. It is primarily being supported by a local industrial facility as part of a Supplemental Environmental

Project (SEP). SEPs are sometimes part of settlement agreements between the DEP and a regulated facility. They are projects deemed to have an environmental benefit for the community, and are supported by a facility in lieu of, or in addition to, direct monetary penalties. The results of the monitoring study are available on the World Wide Web at www.airgap.com

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