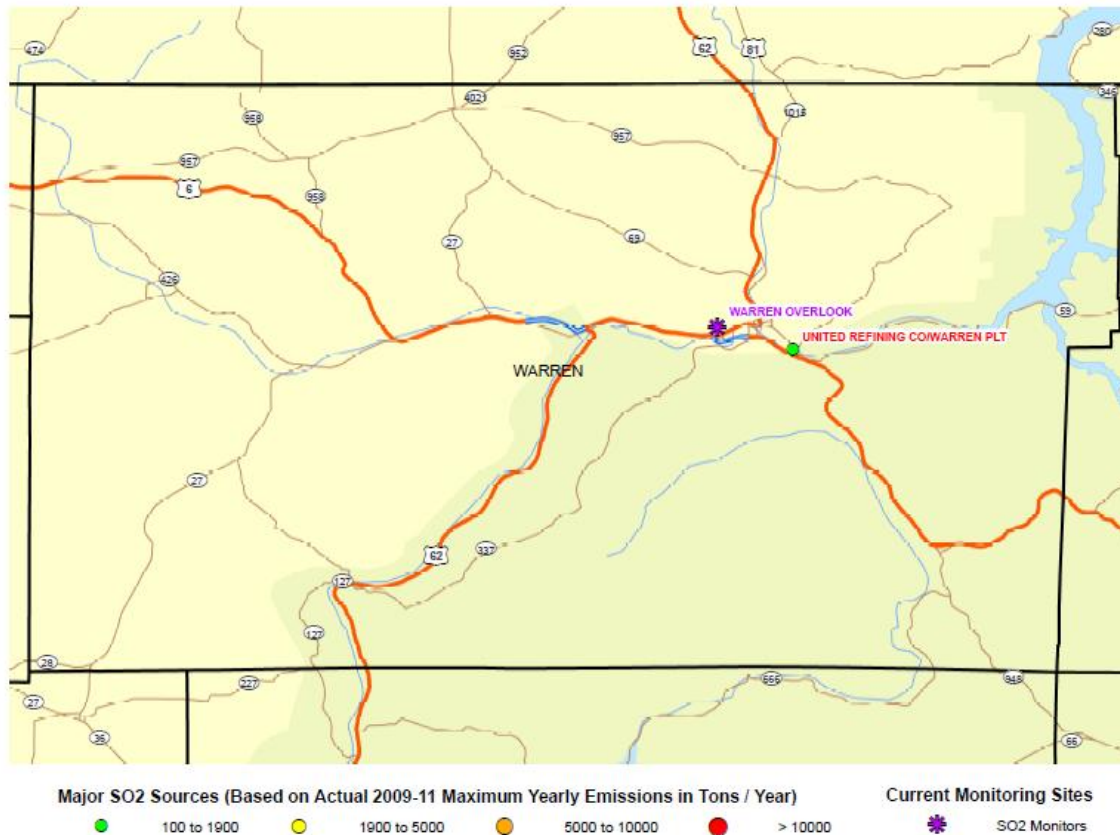ENCLOSURE 4
Pennsylvania's April 8, 2013 Letter
Regarding 1-hour SO_2 Designations

WARREN COUNTY

On February 7, 2013, the EPA released its proposal for 1-hour SO_2 designation areas across the Commonwealth of Pennsylvania. With the exception of EPA's addition of portions of Armstrong County, EPA's intended designations agreed with the Department's original 1-hour SO_2 nonattainment area recommendation, submitted on June 23, 2011. This includes designating all of Warren County as a 1-hour SO_2 nonattainment area. In its June 23, 2011, letter, the Department also stated that it may alter its recommendations after performing additional analyses. After further consideration and analysis, the Department recommends reducing the Warren County 1-hour SO_2 nonattainment area to four municipalities. The Department's revised 1-hour SO2 designation recommendation includes: Conewago, Glade and Pleasant Townships and the City of Warren. The reasons for reducing the Warren County nonattainment area are described in the following sections.

Overview

The Department recommended in its June 23, 2011, letter to EPA that Warren County be designated as nonattainment for 1-hour SO_2 (of 75 parts per billion (ppb)) because the county contains an air monitoring station that is violating the NAAQS, namely the Warren-Overlook monitor. At the end of 2012, the Warren-Overlook monitor (AIRS ID 421230004), situated in the central portion of Warren County, had a 1-hour SO_2 design value of 102 ppb. Warren County also contains one major SO_2 source that reported over 100 tons per year of SO_2 emissions in the 2009 to 2011 period: United Refining, which is located approximately 2.5 miles to the east-southeast of the Warren-Overlook monitor. A map displaying the major SO_2 source proximity to the Warren-Overlook monitor is provided below.

Major SO2 Sources (Based on Actual 2009-11 Maximum Yearly Emissions in Tons / Year)

● 100 to 1900   ○ 1900 to 5000   ● 5000 to 10000   ● > 10000

Current Monitoring Sites

✳ SO2 Monitors

The following analysis will focus on the significance of the United Refining facility's proximity to the Warren-Overlook monitor.

1. Warren County has been previously classified as nonattainment for SO_2

On March 3, 1978, the EPA designated Conewago Township in Warren County nonattainment for SO_2 (43 FR 8962). The Commonwealth of Pennsylvania initiated the discussion on designating this area as nonattainment based on dispersion modeling that demonstrated exceedances of the primary SO_2 NAAQS then in effect. Furthermore, on December 21, 1993, the EPA designated the City of Warren and Glade and Pleasant Townships as nonattainment for SO_2 (58 FR 67334). Consistent with the March 3, 1978 designation, the 1993 designation was based upon conservative modeling that demonstrated modeling exceedances at the United Refining facility in Glade Township. On July 1, 2004, the EPA redesignated Conewago, Glade, and Pleasant Townships and the City of Warren to attainment of the primary SO_2 NAAQS (69 FR 39860).

Therefore, there is precedent in Warren County to have an area defined as nonattainment for SO_2 that is smaller than the county boundary.

2. Analysis of Daily Timing of 1-hour SO$_2$ Exceedances at the Warren-Overlook Monitor

For the Department's June 23, 2011, 1-hour SO$_2$ nonattainment area recommendation, the Department analyzed the Warren-Overlook monitor's hourly SO$_2$ monitoring data from 2008 through 2010 to determine the time of day that the 1-hour SO$_2$ exceedances were occurring. The following graph displays when the Warren-Overlook monitor was measuring exceedances of the 1-hour SO$_2$ NAAQS from 2010 through 2012.

No. of Hourly SO2 Exceedances at Warren-Overlook
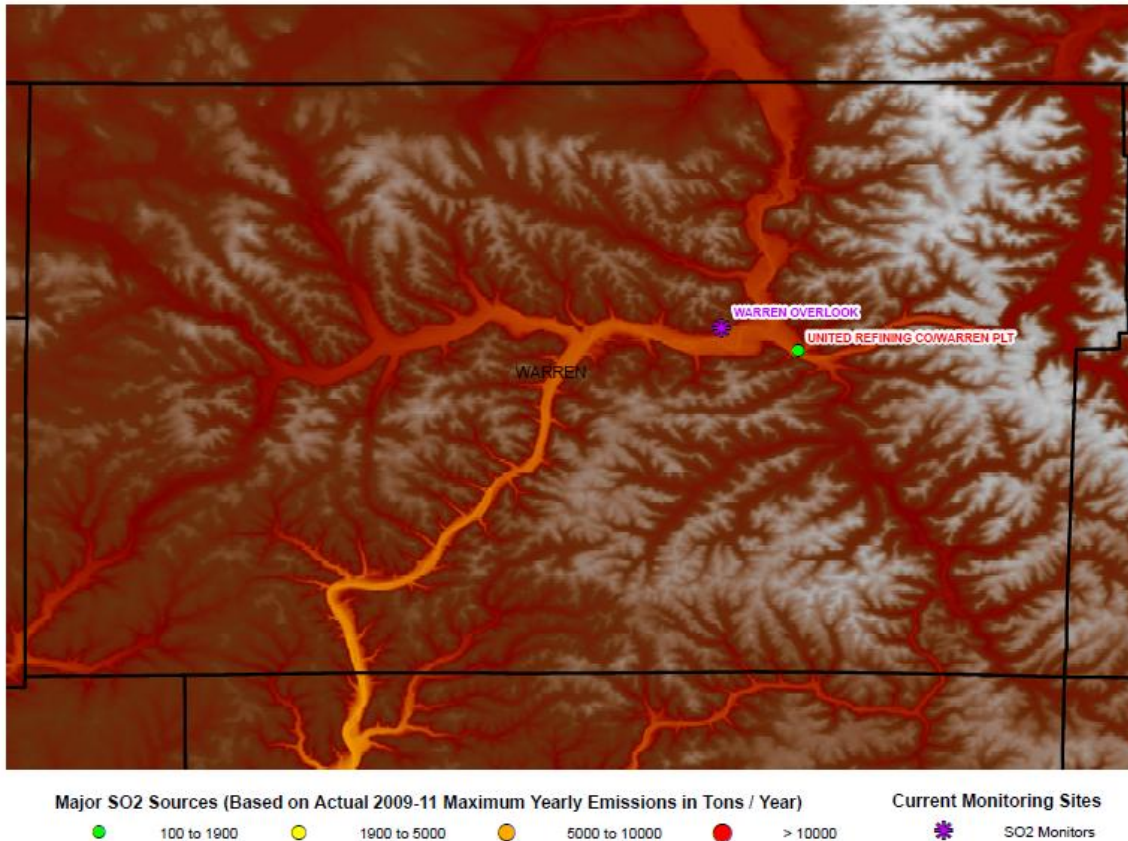**2010-2012**
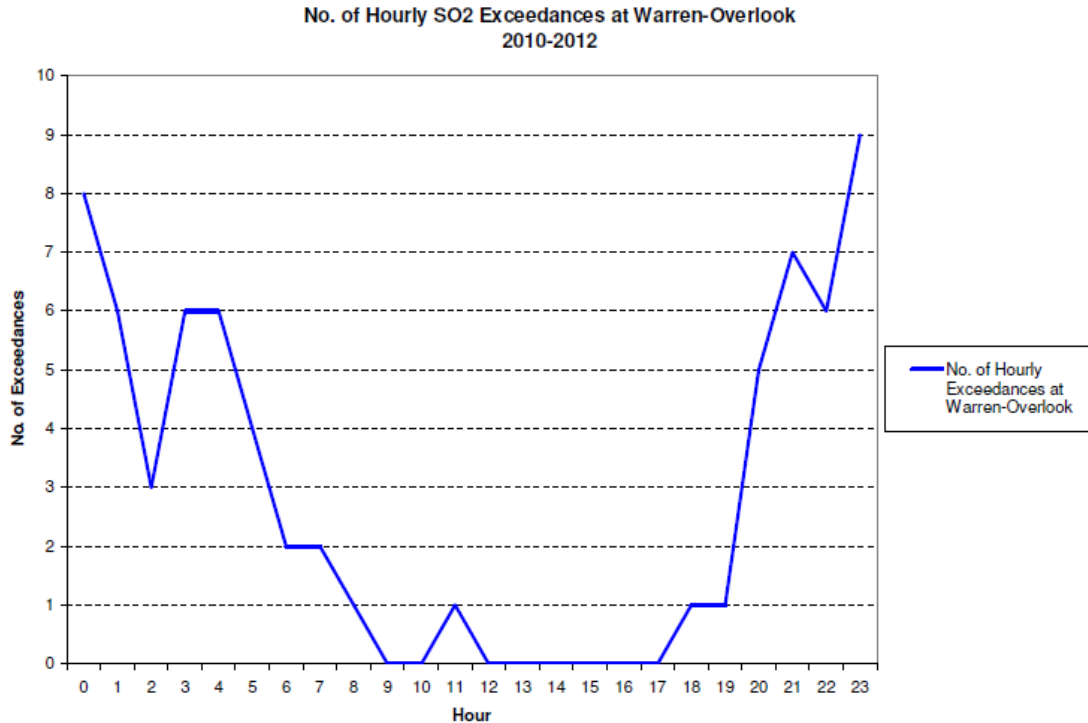
Consistent with the 2008 through 2010 time period, all of the exceedances from 2010 through 2012 occurred during the late night to early morning period. This indicates inversions are occurring and are contributing to the higher SO2 concentrations. The highest 1-hour SO$_2$ concentrations were occurring during this is the time of the of day when the air undergoes the least amount of vertical mixing. The daily weather on these days can be viewed as follows: during the early morning hours under the influence of high pressure and clear skies, the ground is able to cool more than the air aloft, forcing an inversion to set up over the region. An illustration of this phenomenon appears below:

Temperature profile

Top

Inversion layer

Base

Altitude

Mixing depth

Temperature →
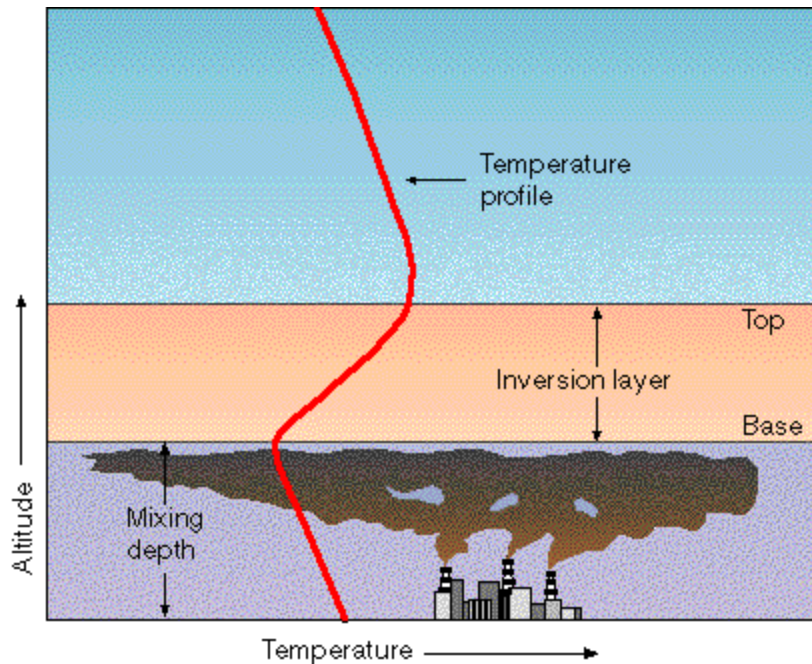
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Pollution originating from within the boundary layer will effectively be trapped near the surface. Such is the case for Warren County's Warren-Overlook Monitor during an inversion. In addition, the area's terrain contributes to this phenomenon. The United Refining facility is situated within a river valley (surrounded by higher terrain to its north and south). A map displaying Warren County's terrain is below.

Major SO2 Sources (Based on Actual 2009-11 Maximum Yearly Emissions in Tons / Year)   Current Monitoring Sites

● 100 to 1900   ○ 1900 to 5000   ● 5000 to 10000   ● > 10000   ✳ SO2 Monitors

The Warren-Overlook monitor is situated at an elevation of 1560 feet. In contrast, the United Refining facility is situated at an elevation of approximately 1190 feet. Any emissions that are exhausted from United Refining under stable atmospheric conditions (in an inversion) are likely to rise to the base of the inversion layer and then disperse (as the illustration above shows). The complex terrain surrounding the river valley strengthens the inversions in the region. Because the Warren-Overlook monitor sits at an elevation 370 feet above the United Refining facility, the pollution from United Refining is likely to impact Warren-Overlook as it rises in the river valley as long as the wind travels from east to west in the river valley (because the United Refining facility to the east of the Warren-Overlook monitor). Reason 3 below will discuss the importance of this observation. Overall, the frequencies of inversions along with the complex terrain in the Warren County are two driving factors that influence the level of the 1-hour SO_2 concentrations.

3. Analysis of the Wind Direction and Wind Speed Associated with 1-hour SO_2 Exceedances

In the Department's June 23, 2011, 1-hour SO_2 nonattainment area recommendation, the Department analyzed the 2008 through 2010 wind direction and wind speed at the Warren-Overlook monitor during the hours when 1-hour SO_2 exceedances occurred. The following map displays a wind rose of the times when the Warren-Overlook monitor experienced exceedances of the 1-hour SO_2 standard from 2010 through 2012.

Wind Rose (in miles per hour)

| 0 to 1 | 1 to 2 | 2 to 3 | 3 to 4 | 4 to 5 | 5 to 6 |
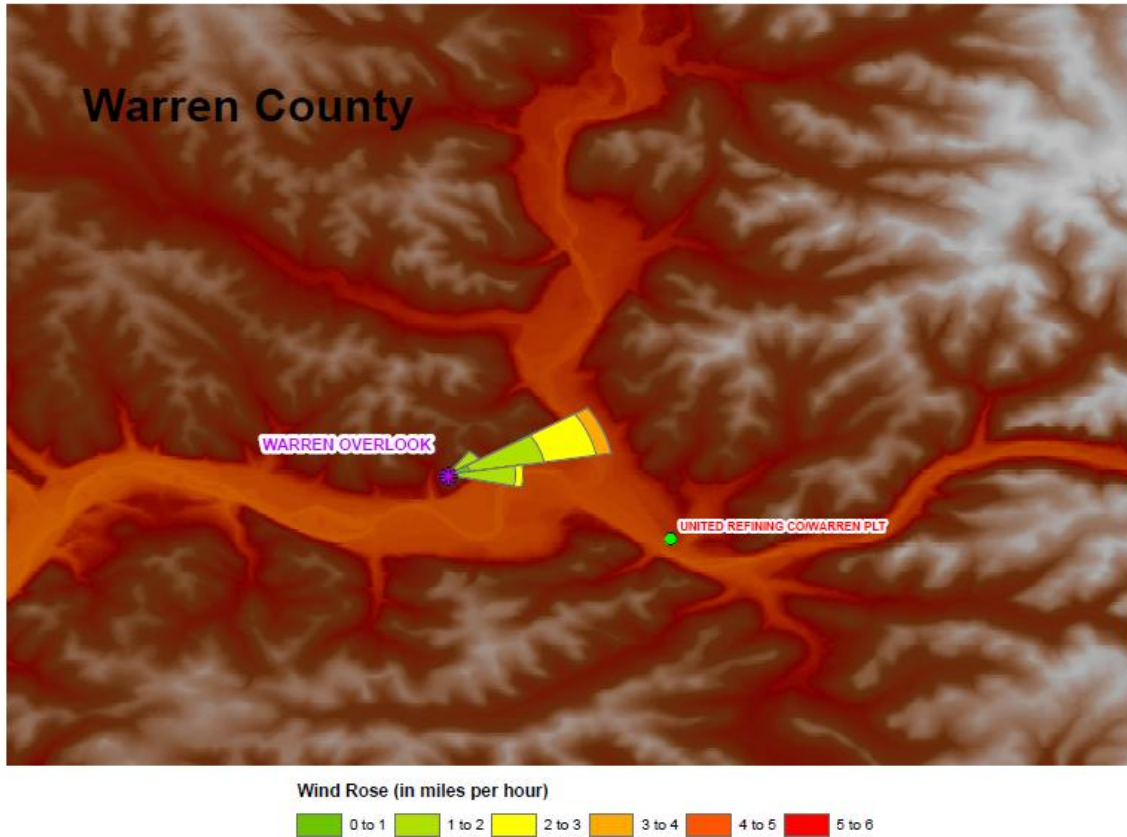
The trend is the same as in the 2008 through 2010 time period. The winds are light and from an easterly direction. The light winds are indicative of conditions during inversions and the easterly winds indicate that pollution coming from the direction of the United Refining facility is impacting 1-hour SO_2 concentrations being measured at the Warren-Overlook monitor. Contrast this map with the wind rose during all hours of the 2010 through 2012 period.

Wind Rose (in miles per hour)

| 0 to 1 | 1 to 2 | 2 to 3 | 3 to 4 | 4 to 5 | 5 to 6 |
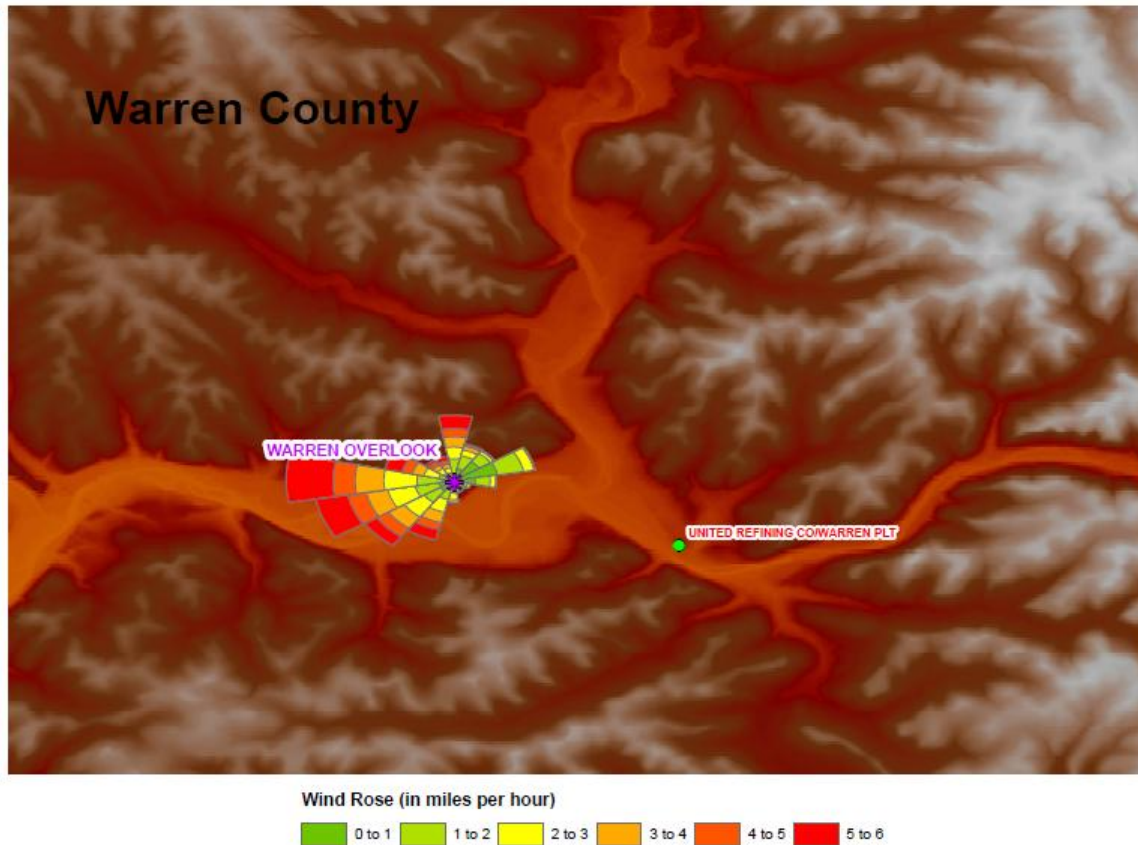
The "all hours" wind rose indicates that the hourly winds varied evenly from all directions during the 2010 through 2012 time period. This strongly indicates that the winds measured at the Warren-Overlook monitor are representative of the local meteorological conditions that are occurring with the river valley and are causing the 1-hour SO_2 NAAQS exceedances.

Conclusion

After considering the facts as described above, the Department is recommending reducing the nonattainment area within Warren County to the Conewago, Glade and Pleasant Townships and the City of Warren. The municipalities the Department recommends EPA designate as nonattainment for SO_2 follows an outline similar to that which EPA has used in the past. In addition, the analysis of the time of day of the 1-hour SO_2 exceedances, coupled with an analysis of the topography and the wind speed and direction during the 1-hour SO_2 exceedances, results in the conclusion that the Warren County 1-hour SO_2 nonattainment area should be reduced to the four municipalities listed above. A map of the proposed reduced 1-hour SO_2 nonattainment area is provided below.

Warren County

CONEWANGO

GLADE

WARREN OVERLOOK

WARREN

UNITED REFINING CO/WARREN PLT

PLEASANT
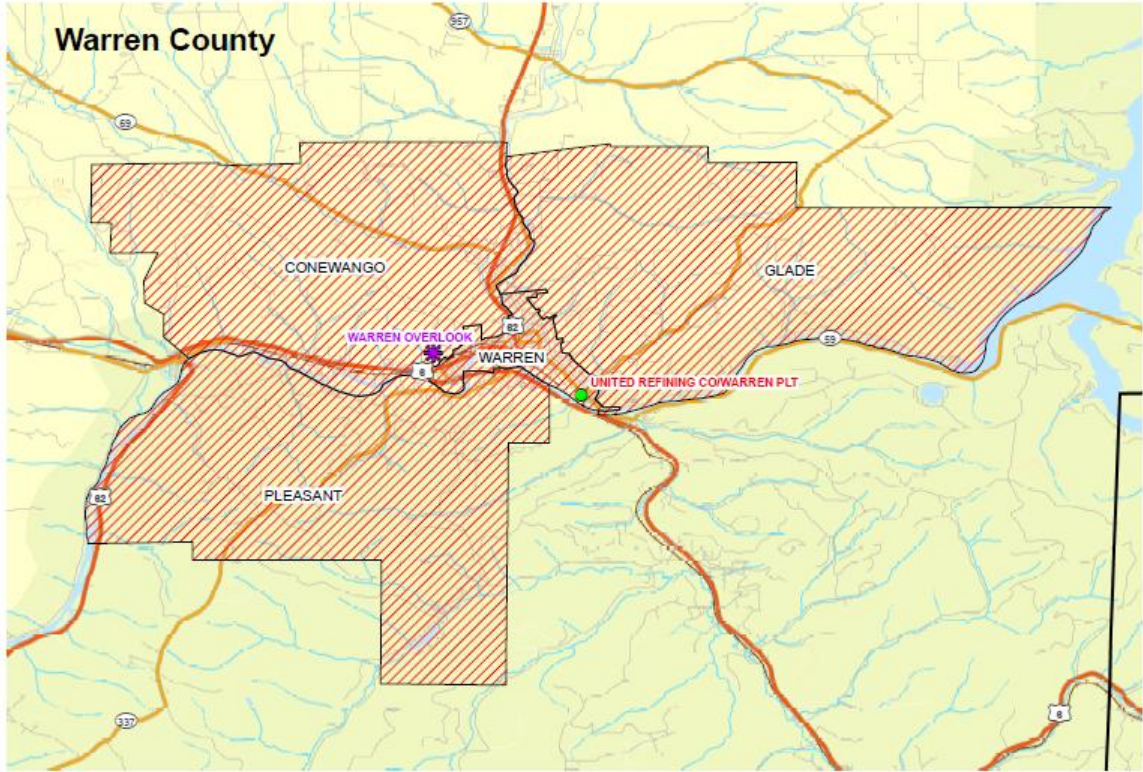
Proposed SO2 Nonattainment Area

Warren

Current Monitoring Sites

SO2 Monitors