Knoxville, Tennessee
Area Designations for the
2008 Ozone National Ambient Air Quality Standards

The table below identifies the counties or parts of counties in Tennessee that EPA is designating as "nonattainment" for the 2008 ozone national ambient air quality standards (2008 ozone NAAQS) as part of the Knoxville, TN area. In accordance with section 107(d) of the Clean Air Act, EPA must designate an area (county or part of a county) "nonattainment" if it is violating the 2008 ozone NAAQS or if it is contributing to a violation of the 2008 ozone NAAQS in a nearby area. The technical analyses supporting the boundaries for the individual nonattainment areas are provided below.

Table 1: Final Nonattainment Area for Knoxville, TN

Area	Tennessee's Recommended Nonattainment Counties[1]	EPA's Final Nonattainment Counties
Knoxville, TN	Blount (partial)	Anderson (partial) Blount Knox

EPA is designating the remaining counties in Tennessee that are not included in the table above or in the Memphis, TN-MS-AR nonattainment area (see the separate technical support document for this area) as "unclassifiable/attainment" for the 2008 8-hour ozone NAAQS.

The analysis below provides the basis for the Knoxville, TN nonattainment area boundary. It relies on EPA's analysis of whether and which monitors are violating the 2008 ozone NAAQS, based on certified air quality monitoring data from 2009-2011, and an evaluation of whether nearby areas are contributing to such violations. EPA has evaluated contributions from nearby areas based on a weight of evidence analysis considering the factors identified below. EPA issued guidance on December 4, 2008, that identified these factors as ones EPA would consider in determining nonattainment area boundaries and recommended that states consider these factors in making their designations recommendations to EPA.[2]

1. Air quality data (including the design value calculated for each Federal Reference Method or Federal Equivalent Method (FEM) monitors in the area);
2. Emissions and emissions-related data (including location of sources and population, amount of emissions and emissions controls, and urban growth patterns);
3. Meteorology (weather/transport patterns);
4. Geography and topography (mountain ranges or other basin boundaries);
5. Jurisdictional boundaries (e.g., counties, air districts, existing nonattainment areas, Indian country, metropolitan planning organizations (MPOs))

Ground-level ozone generally is not emitted directly into the air, but is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight. Because NOx and VOC emissions from a broad range of sources over a wide area typically contribute to violations of the ozone NAAQS, EPA believes it is important to consider whether there are contributing

[1] Tennessee provided several alternatives but this reflects the State's first preference.

[2] The December 4, 2008 guidance memorandum "Area Designations for the 2008 Revised Ozone National Ambient Air Quality Standards" refers to 9 factors. In this technical support document we have grouped the emissions-related factors together under the heading of "Emissions and Emissions-Related Data," which results in 5 categories of factors.

emissions from a broad geographic area. Accordingly, EPA chose to examine the 5 factors with respect to the larger of the Combined Statistical Area (CSA) or Core Based Statistical Area (CBSA) associated with the violating monitor(s).[3] All data and information used by EPA in this evaluation are the latest available to EPA.

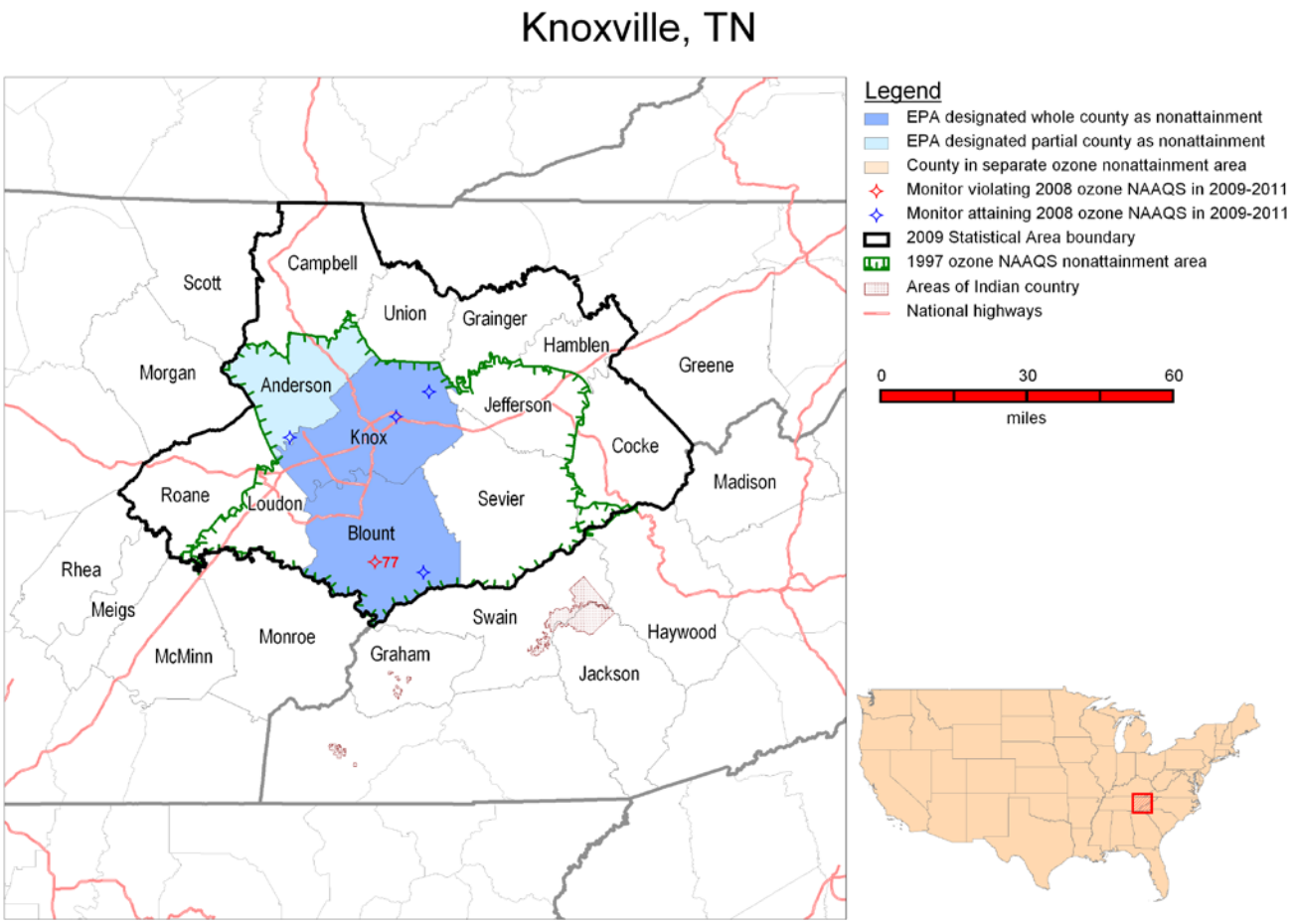
In EPA's designations guidance for the 2008 ozone NAAQS, EPA recommended examining CSA/CBSAs because certain factors used to establish CSAs and CBSAs are similar to the factors EPA is using in this technical analysis to determine if a nearby area is contributing to a violation of the 2008 ozone NAAQS. Congress required a similar approach in 1990 for areas classified as serious or above for the 1-hour ozone NAAQS and EPA used the same basic approach in the designation process for the 1997 ozone NAAQS. Where a violating monitor is not located in a CSA or CBSA, EPA's guidance recommended using the boundary of the county containing the violating monitor as the starting point for considering the nonattainment area's boundary.

[3] Lists of CBSAs and CSAs and their geographic components are provided at www.census.gov/population/www/metroareas/metrodef.html . The lists are periodically updated by the Office of Management and Budget. EPA used the most recent update, based on 2008 population estimates, issued on December 1, 2009 (OMB Bulletin No. 10-02).

Technical Analysis for Knoxville, TN

Figure 1 is a map of the Knoxville, TN nonattainment area. The map also shows locations and design values of air quality monitors, county and other jurisdictional boundaries, the nonattainment area boundary for 1997 ozone NAAQS, and major transportation arteries.

Figure 1. Knoxville-Sevierville-La Follette CSA



For purposes of the 1997 8-hour ozone NAAQS, EPA designated the following counties as nonattainment: Anderson, Blount, Jefferson, Knox, Loudon, and Sevier Counties, and a portion of Cocke County, Tennessee.

In March 2009, Tennessee recommended that Anderson, Blount, Knox, Loudon, and Sevier Counties in their entireties, and a portion of Cocke County be designated as the "Knoxville" nonattainment area for the 2008 8-hour ozone NAAQS based on air quality data from 2006-2008. In March 2009, Tennessee also recommended that Jefferson County be designated as the "Morristown" nonattainment area, separate from a Knoxville nonattainment area, for the 2008 8-hour ozone NAAQS based on air quality data from 2006-2008. Letter from James H. Fyke, Commissioner, State of Tennessee Department of Environment and Conservation to A. Stanley Meiburg, Acting Regional Administrator, US EPA Region 4 (March 10, 2009) (on file with US EPA Region 4).

In November 2011, Tennessee provided an update to their 2009 original recommendation based on preliminary air quality data from 2009-2011. In its updated recommendation, Tennessee recommended that the portions of Blount, Cocke, and Sevier Counties that comprise the Tennessee portion of the Great Smoky Mountains National Park be designated "nonattainment" for the 2008 ozone NAAQS. Letter from Robert J. Martineau Jr, Commissioner, State of Tennessee Department of Environment and Conservation to Gwen Keyes Fleming, Regional Administrator, US EPA Region 4 (November 8, 2011) (on file with US EPA Region 4). The March 2009 and November 2011 recommendations were based on data from FEM monitors sited and operated in accordance with 40 CFR Part 58.

On December 9, 2011, EPA initiated the 120 day consultation process by notifying the State of Tennessee that based on EPA's technical analysis of the 12-county Knoxville-Sevierville-La Follette CSA, EPA intended to designate five whole counties and one partial county in Tennessee (identified in Table 2 below) as "nonattainment" for the 2008 ozone NAAQS as part of the Knoxville, TN nonattainment area. In this December 2011 letter, EPA also requested that if Tennessee wished to provide comments on EPA's intended designation or to use early certified data for designation, they should provide comments or early certify by February 29, 2012.

Table 2. State's Recommended and EPA's Intended Designated Nonattainment Counties for Knoxville, TN from December 9, 2011

Knoxville, TN	State-Recommended Nonattainment Counties*	EPA Intended Nonattainment Counties**
Tennessee	Anderson (partial) Blount (partial) Knox	***Anderson**** Blount ***Cocke (partial)*** Knox ***Loudon*** ***Sevier***

* Based on 2008 -2010 data
****bold italics*** represent counties (or portion of counties) that were not included in the final boundary for the nonattainment area.
*** EPA proposed nonattainment for all of Anderson County which is different from the final partial county designation.

In February 2012, during the 120 day comment period, Tennessee submitted an updated recommendation for nonattainment. In it Tennessee preferred that 2009-2011 data be used for designations and recommended, if 2009-2011 data could be used, nonattainment for that portion of Blount County that contains the Great Smoky Mountains National Park and attainment for the rest of the area.[4] Tennessee's February 2012 update also recommended, if 2008-2010 data must be used, nonattainment for the entire counties of Blount, Knox and Loudon and that portion of Anderson County limited to the census tract(s) including the Tennessee Valley Authority's (TVA's) Bull Run Fossil Plant.

On April 5, 2012, Tennessee submitted additional technical information to support a revised nonattainment boundary based on 2009-2011 design values. Tennessee's recommendations are listed below based on order of preference:

[4] In a letter dated April 10, 2012, EPA approved the use of Tennessee's 2009-2011 data which was originally certified on November 28, 2011. See docket for approval letter.

A) Portion of Blount County containing the Great Smokey Mountains National Park as nonattainment and the rest of the Blount and all of Anderson, Cocke, Knox, Loudon, and Sevier Counties as attainment; or
B) Portions of Blount, Cocke, and Sevier Counties comprising the Great Smokey Mountains National Park nonattainment and the rest of the Blount, Cocke, and Sevier and all of Anderson, Knox and Loudon Counties attainment; or
C) Knox County and the portions of Blount, Cocke, and Sevier Counties nonattainment and the rest of Blount, Cocke, and Sevier and all of Anderson and Loudon Counties attainment.

Tennessee also recommended that, if 2008-2010 were used, that EPA consider the following recommendations, listed in order of preference:

D) Knox County and portions of Blount, Cocke, and Sevier Counties comprising the Great Smokey Mountains National Park nonattainment and the rest of the Blount, Cocke, and Sevier and all of Anderson and Loudon Counties attainment; or
E) Knox County, portions of Blount and portions of Anderson Counties as nonattainment, and the rest of the area attainment. Their recommended boundary for Anderson is centered on two census tracts encompassing the TVA Bull Run Facility, a coal-fired power plant located in the southern portion of the county bordering Knox County. Their recommended boundary for Blount County consists of two partial nonattainment boundaries- the area north of US Highway 411 and the census tract encompassing the Alcoa South property and the property in between Alcoa South and US Highway 411 and the portion of Blount located in the Great Smokey Mountains National Park. The rest of Blount County would be classified as attainment/unclassifiable. The State attributes the violating monitor to long range transport only.

EPA begins with the CSA or CBSA areas for purposes of evaluating what areas violate and or contribute to a nearby violation of the ozone NAAQS. We have refined the evaluation made available to the State in December 2011 by considering additional technical information provided by the states and tribes. After considering the information available to us for the Knoxville, TN area, EPA is designating two entire counties and one partial county in Tennessee (identified in Table 1 above) as "nonattainment" for the 2008 ozone NAAQS as part of the Knoxville, TN nonattainment area.

Based on data from 2009-2011, only one monitor in the area is violating the NAAQS as compared with three violating the NAAQS based on data from 2008-2010, which was the most recent data available at the time we notified the state of our intended modifications in December 2011. Therefore, EPA conducted a revised analysis on whether to include Cocke, Knox, Loudon and Sevier County as part of the nonattainment area. EPA also considered Tennessee's assertion that the violations at the one violating monitor, which is located in Blount County, were attributable to long range transport and not significantly impacted by localized emissions from counties within the CSA.

Factor Assessment

Factor 1: Air Quality Data

For this factor, EPA considered 8-hour ozone design values (in parts per billion (ppb)) for air quality monitors in counties in the Knoxville-Sevierville-La Follette, TN CSA, based on data for the 2009-2011 period (i.e., the 2011 design value), which are the most recent years with fully-certified air quality data. It should be noted that for EPA's December 9, 2011, technical analysis EPA only had certified monitoring data for the 2008-2010 period for the Knoxville-Sevierville-La Follette, TN CSA to consider. The 2009-2011 monitoring data indicated a decline in the number of violating monitors (from 3 to 1) in the Knoxville-Sevierville-La Follette, TN CSA. EPA's updated analysis in support of this final designation determination considers the reduction in the number of violating monitors for this area.

A monitor's design value is the metric or statistic that indicates whether that monitor attains a specified air quality standard. The 2008 ozone NAAQS are met at a monitor when the annual fourth-highest daily maximum 8-hour average concentration, averaged over 3 years is 75 ppb or less. A design value is only valid if minimum data completeness criteria are met. See 40 CFR part 50 Appendix P. Where several monitors are located in a county (or a designated nonattainment area or maintenance area), the design value for the county or area is determined by the monitor with the highest level.

The 2009-2011 design values for the 2008 ozone NAAQS for counties in the Knoxville-Sevierville-La Follette, TN CSA are shown in Table 3.

Table 3. Air Quality Data.

County*	State Recommended Nonattainment? [5]	2009-2011 Design Value (ppb)
Anderson, TN	No	70
Blount, TN	**Yes (Partial)**	**77**
Cocke, TN	No	N/A
Jefferson, TN	No	73
Knox, TN	No	71
Loudon, TN	No	72
Sevier, TN	No	75

*Counties with violating monitors are shown in bold.

Based on 2009-2011 monitoring data, Blount County shows a violation of the 2008 ozone NAAQS, therefore this county is included in the nonattainment area. For EPA's initial boundary determination for the Knoxville, TN area, released December 9, 2011, EPA included Knox and Sevier Counties based on violating monitors in these counties for the monitoring period of 2008-2010. As mentioned above, Tennessee has since certified its 2009-2011 data, and thus EPA consideration of inclusion of Knox and Sevier Counties is based on whether or not these areas contribute to violations at the nearby monitor in Blount County.

A county (or partial county) must also be designated nonattainment if it contributes to a violation in a nearby area. Each county without a violating monitor that is located near a county with a violating monitor has been evaluated, as discussed below, based on the five factors to determine whether it contributes to the nearby violation. EPA started with the CSA or CBSA for evaluating what areas violate and contribute to violations of the ozone NAAQS.

[5] Tennessee provided several alternatives but this reflects the State's first preference.

Factor 2: Emissions and Emissions-Related Data

EPA evaluated emissions of ozone precursors (NOx and VOC) and other emissions-related data that provide information on areas contributing to violating monitors.

Emissions Data

EPA evaluated county-level emission data for NOx and VOC derived from the 2008 National Emissions Inventory (NEI), version 1.5. This is the most recently available NEI. (See http://www.epa.gov/ttn/chief/net/2008inventory.html) Significant emissions levels in a nearby area indicate the potential for the area to contribute to observed violations. EPA also considered any additional information we received on changes to emissions levels that are not reflected in recent inventories.

As mentioned above, EPA received additional information from Tennessee following the preliminary boundary determination for the Knoxville, TN nonattainment area, and this information was considered for this final designation. Specifically, Tennessee provided additional information regarding the potential impacts of long range transport of emissions on the violations at the Blount County monitor and also provided additional information on the reduction in emissions at the Tennessee Valley Authority's (TVA's) Bull Run facility.

The precursor emission source-category percentages used below and throughout the document were derived from emissions data from the 2008 NEI version 1.5 referenced above. Table 4 shows emissions of NOx and VOC (given in tons per year (tpy)) for violating and nearby counties that EPA considered for inclusion in the Knoxville, TN area.

Table 4. Total 2008 NOx and VOC Emissions.

County*	State Recommended Nonattainment? [6]	NOx (tpy)	VOC (tpy)
Anderson, TN	**No**	**12,475**	**3,569**
Blount, TN	**Yes (Partial)**	**3,593**	**6,749**
Campbell, TN	No	2,964	1,773
Cocke, TN	No	1,761	2,273
Grainger, TN	No	687	1,216
Hamblen, TN	No	6,612	4,719
Jefferson, TN	No	3,148	3,329
Knox, TN	**No**	**15,169**	**16,182**
Loudon, TN	No	3,751	3,340
Roane, TN	No	10,711	3,006
Sevier, TN	No	2,602	5,399
Union, TN	No	432	959
	Areawide:	63,905	52,514

*Counties that EPA intends to designate as nonattainment are shown in bold.

Knox County is leading all counties with 24 percent of NOx and 31 percent VOC of the CSA's emissions. Anderson County emits 19 percent of the CSA's NOx emissions with 77 percent from point sources. It is worth noting that TVA's Bull Run Facility Electric Generating Unit (EGU) in Anderson

[6] Tennessee provided several alternatives but this reflects the State's first preference.

County generated 1,086 tpy of NOx with selective catalytic reduction (SCR) control during the 2008 ozone season. Blount County is the second highest VOC contributor at 6,749 tpy, 13 percent of the CSA total, and the fourth highest contributor of NOx emissions at 3,593 tpy.

Population density and degree of urbanization

EPA evaluated the population and vehicle use characteristics and trends of the area as indicators of the probable location and magnitude of non-point source emissions. These include ozone-creating emissions from on-road and off-road vehicles and engines, consumer products, residential fuel combustion, and consumer services. Areas of dense population or commercial development are an indicator of area source and mobile source NOx and VOC emissions that may contribute to ozone formation. Rapid population or vehicle miles travelled (VMT) growth (see below) in a county on the urban perimeter signifies increasing integration with the core urban area, and indicates that it may be appropriate to include the area associated with the area source and mobile source emissions as part of the nonattainment area. Table 5 shows the population, population density, and population growth information for each county in the Area.

Table 5. Population and Growth.

County*	State Recommended Nonattainment? [7]	2010 Population	2010 Population Density (1000 pop/sq mi)	Absolute change in population (2000-2010)	Population % change (2000-2010)
Anderson	**No**	**75,129**	**0.22**	**3,897**	**+5%**
Blount	**Yes (Partial)**	**123,010**	**0.22**	**16,793**	**+16%**
Campbell	No	40,716	0.08	853	+2%
Cocke	No	35,662	0.08	2,035	+6%
Grainger	No	22,657	0.07	1,920	+9%
Hamblen	No	62,544	0.36	4,301	+7%
Jefferson	No	51,407	0.16	6,825	+15%
Knox	**No**	**432,226**	**0.82**	**49,198**	**+13%**
Loudon	No	48,556	0.20	9,342	+24%
Roane	No	54,181	0.14	2,238	+4%
Sevier	No	89,889	0.15	18,190	+25%
Union	No	19,109	0.08	1,250	+7%
	Areawide:	1,055,086	0.23	116,842	12%

*Counties that EPA intends to designate as nonattainment are shown in bold.

Sources: U.S. Census Bureau population estimates for 2010 as of August 4, 2011 (http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_PL_GCTPL2.STO5&prodType=table)

Blount County experienced 16 percent growth in population. Blount County is home to 11 percent of the CSA's population and the second most populous after Knox County. Blount County's urban and agriculture development is in the northwestern half of the County. Knox County has the highest population density, the largest absolute change in population, and the largest population in the 12-county CSA. Anderson County has intermittent urbanization in Oak Ridge and Clifton on the southwestern part of the county, adjacent to Knoxville.

[7] Tennessee provided several alternatives but this reflects the state's first preference.

Cocke County has the lowest population of all of the counties that are being considered for inclusion in the Knoxville, TN nonattainment area at a 2010 population of 35,662 people. Further, Cocke County has an absolute change in population from 2000-2010 of 2,035 people with the lowest population density of the counties being considered for the nonattainment area. Also Cocke County's population grew by 6 percent from 2000-2010 – one of the lowest population change in the area.

Traffic VMT data and commuting patterns

EPA evaluated the total VMT for each county. In combination with the population/population density data and the location of main transportation arteries (see above), this information helps identify the probable location of non-point source emissions. A county with high VMT is generally an integral part of an urban area and indicates the presence of motor vehicle emissions that may contribute to ozone formation that contributes to nonattainment in the area. Rapid population or VMT growth in a county on the urban perimeter signifies increasing integration with the core urban area, and indicates that the associated area source and mobile source emissions may be appropriate to include in the nonattainment area. Table 5 shows the total 2008 VMT for each county and number of workers for each county in the area.

Table 5. Traffic and VMT Data.

County*	State Recommended Nonattainment? [8]	2008 VMT** (million miles)	Number of County Workers*** (2009 data)	Percent of County Workers that Work in Counties with Violating Monitors***
Anderson	**No**	**831**	**41,468**	**3.0**
Blount	**Yes (Partial)**	**1,105**	**39,083**	**51.4**
Campbell	No	656	7,867	1.1
Cocke	No	455	7,378	N/A
Grainger	No	232	2,773	N/A
Hamblen	No	656	29,481	N/A
Jefferson	No	819	11,256	1.2
Knox	**No**	**5,304**	**224,770**	**7.2**
Loudon	No	782	13,690	7.3
Roane	No	743	11,637	1.7
Sevier	No	1,164	35,826	3.9
Union	No	134	2,341	1.5
	Areawide:	12,881	427,570	

*Counties (or portions of counties) that EPA is designating as nonattainment are shown in bold.
**MOBILE model VMTs are those inputs into the NEI version 1.5.
*** Source: U.S. Census Bureau http://onthemap.ces.census.gov/

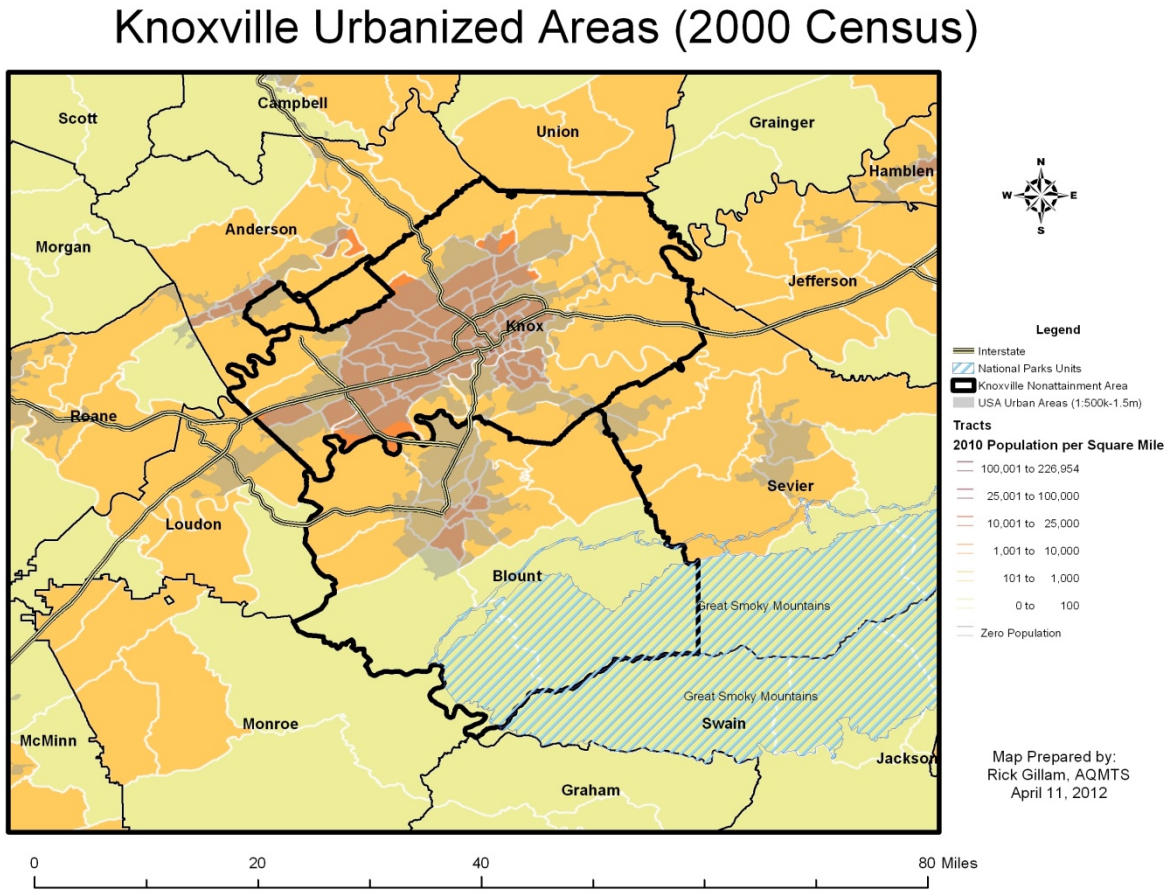
Knox County leads the CSA with the highest VMT followed by Sevier and Blount Counties.

[8] Tennessee provided several alternatives but this reflects the state's first preference

A little more than half of the workers, about 20,072 workers, live and work within Blount County. The second largest percentage of Blount County workers are from Loudon County. The third largest percentage of Blount County workers, (i.e., 16,079 workers) are from Knox County.

Since Lenoir City in Loudon County, and Seymour in Sevier County are a part of the urbanized portion of the Area and a part of the MPO (see figure 2), EPA reviewed the VMT data from these cities and determined that, based on 2009 Census Bureau data, 290 Blount County workers are from Lenior City and 120 Blount County workers are from Seymour. The two cities combined workers are less than 1 percent of Blount County's total workforce.

Figure 2. Urbanized Areas



Factor 3: Meteorology (weather/transport patterns)

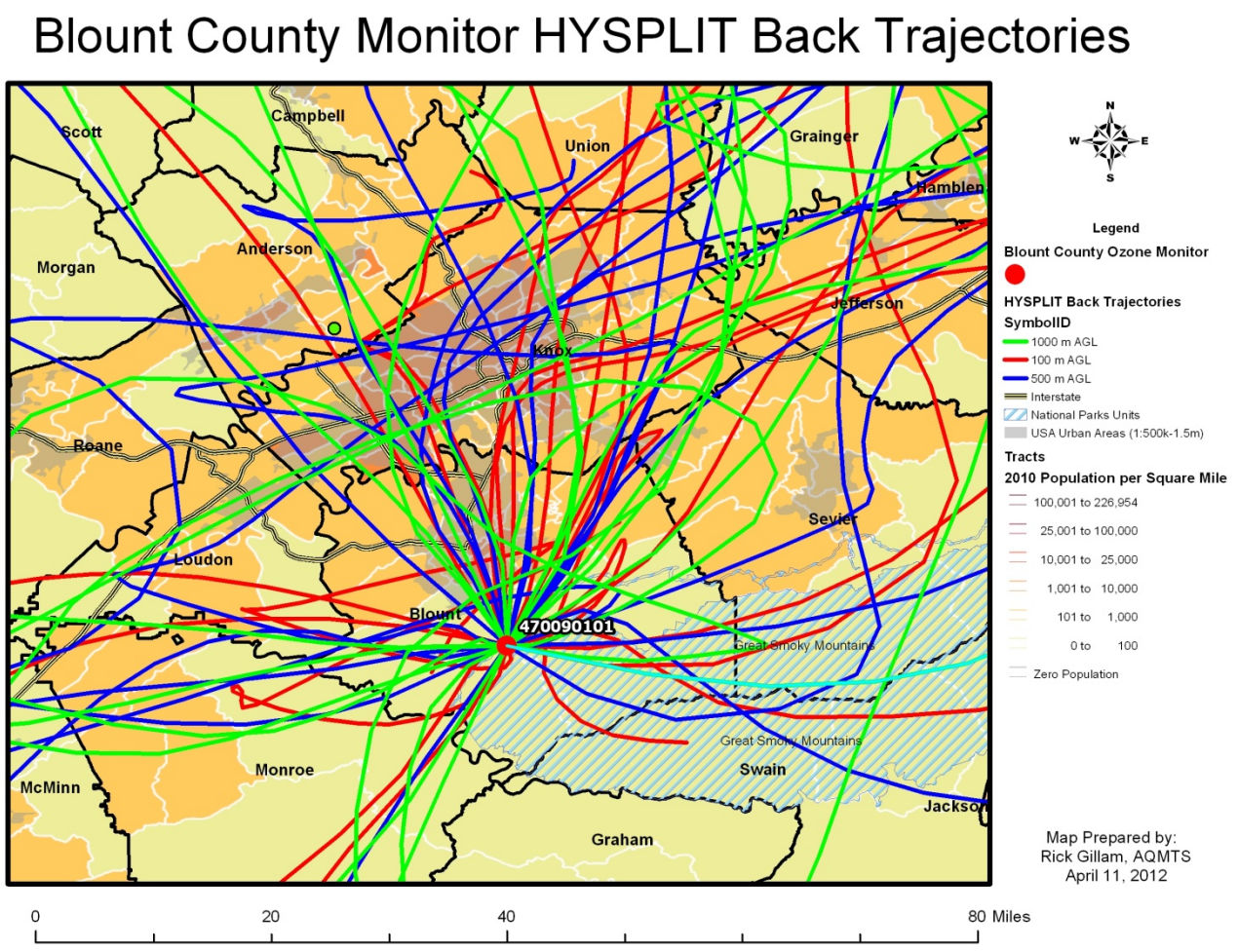
For this factor, EPA analyzed 30-years of National Weather Service (NWS) wind speed and wind direction data collected at the Knoxville/McGhee Tyson Airport (Station #13891) to help determine transport patterns and source contributions. EPA also assessed wind direction and speed for the 2009-2011 "ozone season" (March through October) in the Knoxville-Sevierville-La Follette, TN CSA. The analysis was conducted to better understand the fate and transport of precursor emissions contributing to ozone formation. EPA's analysis of the NWS data indicate predominate southwest, west-southwest and north-northeast components for the Knoxville-Sevierville-La Follette, TN CSA. Persistent winds

blowing from the north and northeast may transport ozone precursor emissions from the urbanized areas of Knoxville toward the Blount County monitor.

EPA also conducted a wind back trajectory analysis using the National Oceanic and Atmospheric Administration's (NOAA) Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT) model to evaluate potential contribution from nearby areas. The HYSPLIT analysis was done on days that exceeded the 2008 ozone NAAQS at the Blount County monitor during the 2009-2011 timeframe. The results of this analysis are presented in Figure 3. As can be seen in Figure 3, many of the back trajectories cross over areas of Knox and Blount counties and several cross over the two census tracts in Anderson county that are included in the nonattainment area. These trajectories provide evidence that ozone precursor emissions from sources in Knox, Blount and a portion of Anderson counties may contribute to violations measured at the Blount county monitor.

Tennessee submitted to EPA information prepared by Walter Landsden Dortch &Davis, LLP and EnSafe on behalf the six Tennessee Counties of Anderson, Blount, Cocke, Knox, Loudon and Sevier. This submittal contains a wind direction analysis of the same 2009-2011 Knoxville Airport NWS data as discussed above. The submittal also contains HYSPLIT back trajectory analyses that provide similar information to EPA's HYSPLIT analysis. The submittal also provides information to make the argument that the Blount County monitor is a "high elevation monitor" that is primarily impacted regional transport of ozone. However, the information shows that both downwind urban ozone formation from Knoxville, Knox County, Blount County and portions of Anderson County ozone precursor emissions and high elevation regional transport of ozone contribute to the NAAQS violations at the Blount County monitor.

Figure 3. HYSPLIT Back Trajectories for each violating day during the 2009-2011 timeframe.



Factor 4: Geography/topography (mountain ranges or other air basin boundaries)

The geography/topography analysis evaluates the physical features of the land that might affect the air shed and, therefore, the distribution of ozone over the area.

Regional topography consists of linear ridge and parallel lowland valleys. The Area has predominantly high elevations in the northern regions and lower elevations further south ranging from 700 to 1,500 feet. The Knoxville-Sevierville-La Follette, TN CSA includes the Tennessee portion of the Great Smoky Mountains National Park (GSMNP). This area consists of densely forested high peaks and valleys. The highest point in the state is at Clingman's Dome with an elevation of 6,643 feet. There are three violating monitors in the Knoxville area that are at the higher elevations and within the GSMNP. These monitors are Look Rock (AQS ID: 47-009-0101, 2009-2011 design value of 76 ppb) in Blount County, Cove Mountain (AQS ID: 47-155-0101, 2009-2011 design value of 75 ppb) in Sevier County, and Clingman's Dome (AQS ID: 47-155-0102, 2009-2011 design value of 75 ppb), also in Sevier County.

Figure 4 shows a topographical map of Knoxville and the National Park. These two monitors are located at a significantly higher elevation than the Knox County monitors. High elevation ozone sites often measure elevated ozone levels overnight due to regional transport of tropospheric ozone formed

during the daytime. The regional transport mechanisms that cause these events are related to downward transport by vertical mixing that concentrates the tropospheric ozone or by horizontal transport from surrounding areas (Eliasson et al, 2003). The long duration of these nocturnal events can also be attributed to a lack of local Nitric Oxide (NO) emissions which act to titrate the ozone and reduce the ambient ozone concentration as occurs in urban areas overnight (Eliasson et al, 2003) [9].

Figure 5 compares the hourly distribution of daily maximum hourly ozone values over 65 ppb for four sites: Look Rock, two urban Knox County Sites, and Blue Ridge Parkway, another high elevation site in North Carolina in the GSMNP that is further removed from urban areas. The Knoxville sites show a typical urban pattern of ozone events in the afternoon (approximately 12:00 pm to 6:00 pm). The Blue Ridge Parkway site is impacted primarily by regional transport and shows a typical high elevation site pattern of ozone events overnight (approximately 9:00 pm to 3:00 am). This site is not in the Knoxville Sevierville-La Follette CSA and is only included as an example of another high elevation site. The Look Rock site shows a combination of these two signals, indicating that the site is impacted by both downwind afternoon ozone formation from Knoxville and high elevation ozone transport. In some cases, these two processes could be affecting the Look Rock monitor simultaneously.

Figure 6 shows the frequency of ozone hourly values greater than 75 ppb by wind direction and time of day for the Look Rock site. This figure illustrates two distinct groups of high ozone events: afternoon ozone from the north to northwest (Knoxville) and overnight ozone from the south to southeast (regional transport). The Cove Mountain site in Sevier County shows a similar pattern as the Look Rock, although with a slightly less pronounced urban signal.

As a result of these analyses, EPA has concluded that both downwind urban ozone formation from Knoxville, Knox County, Blount County and portions of Anderson County ozone precursor emissions and high elevation regional transport of ozone contribute to the NAAQS violations at the Look Rock and Cove Mountain monitors.

[9] Ingegärd Eliasson, Sofia Thorsson, Yvonne Andersson-Sköld, Summer nocturnal ozone maxima in Göteborg, Sweden, Atmospheric Environment, Volume 37, Issue 19, June 2003, Pages 2615-2627.

Figure 4. Topographical map of Knoxville and the Great Smoky Mountains National Park

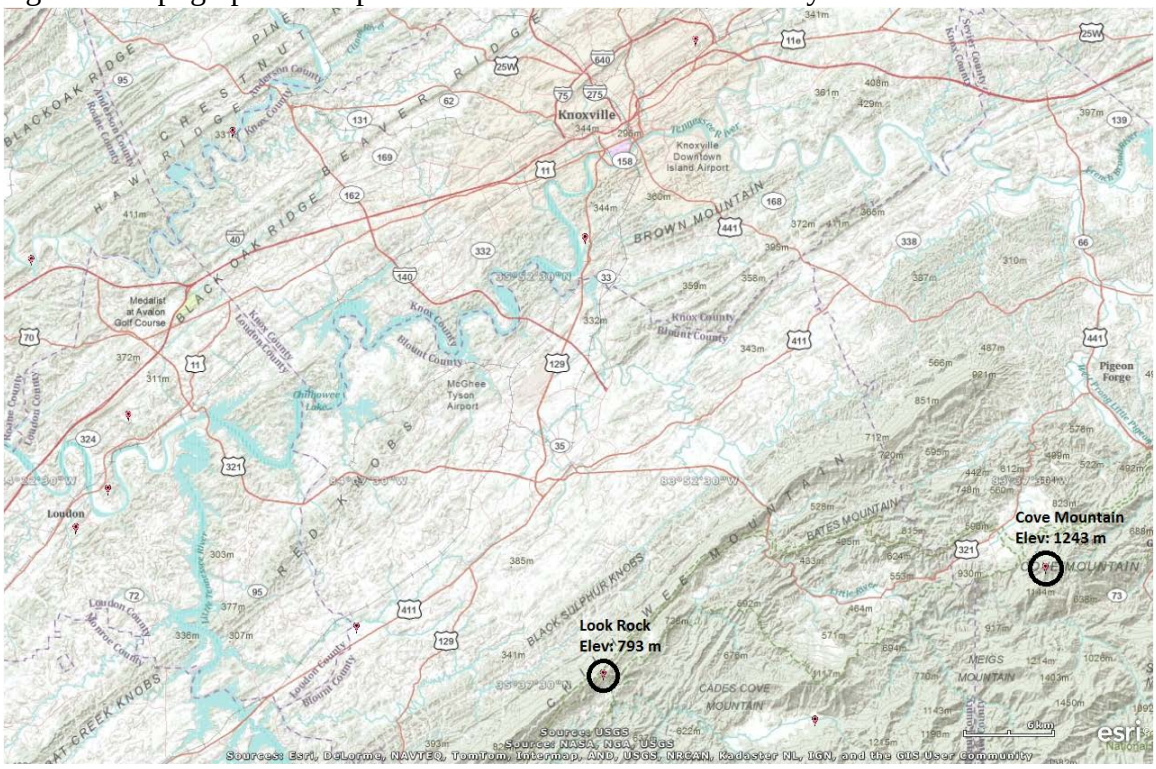


Figure 5. 2007-2010 Count of Daily Max Values > 65 ppb

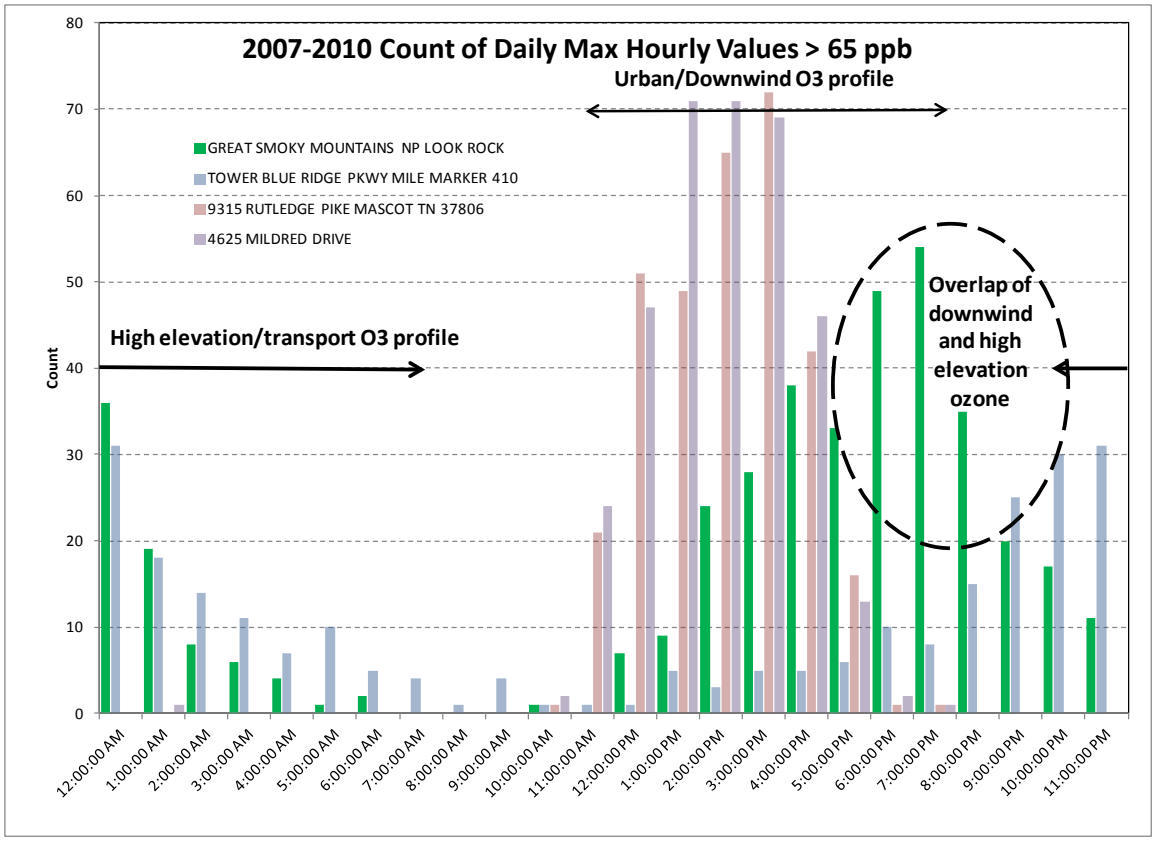
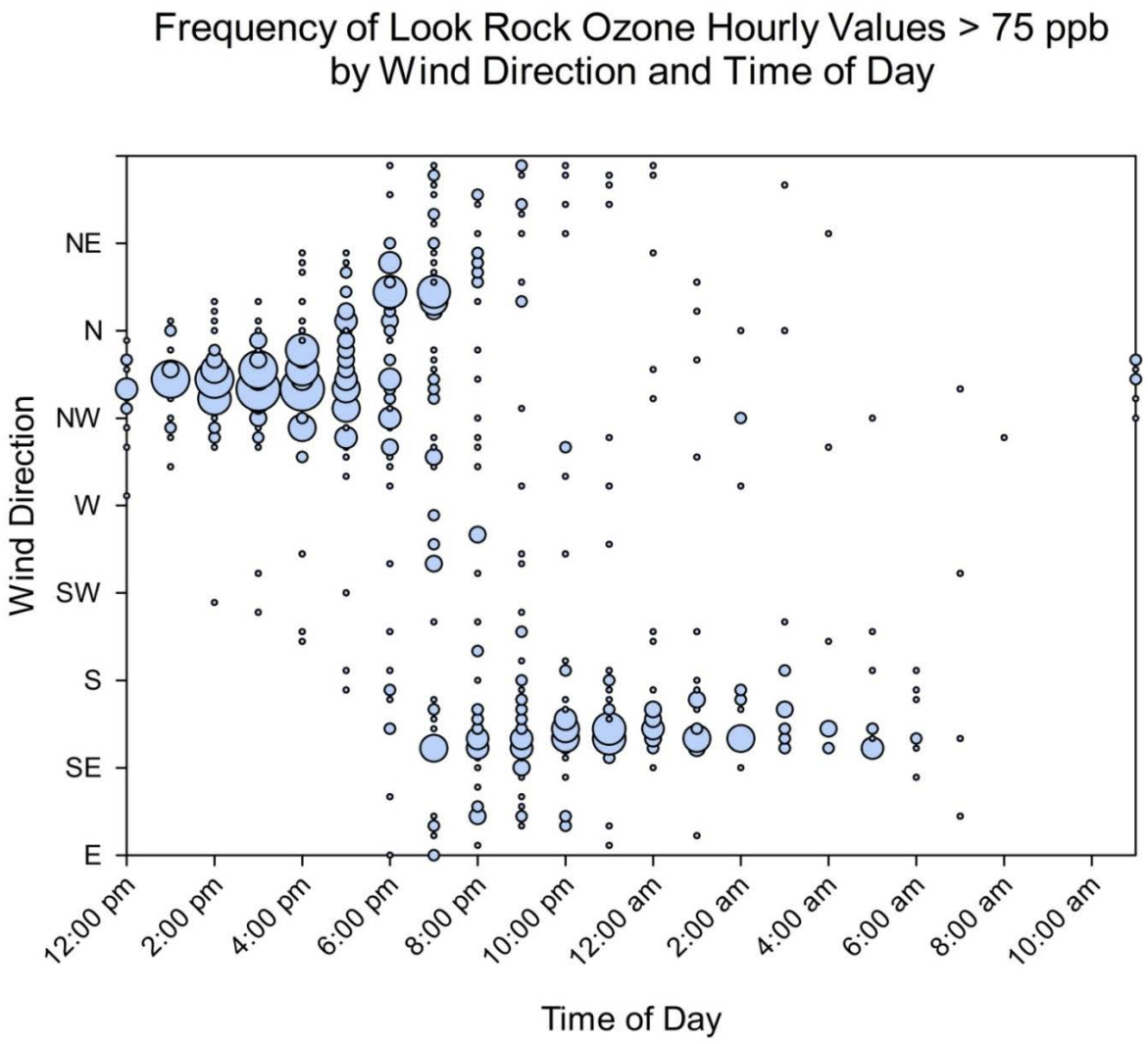


Figure 6. Frequency of Look Rock Ozone Hourly Values >75 ppb



Factor 5: Jurisdictional boundaries

Once EPA identified the general areas that the Agency anticipated would be included in the nonattainment area, EPA then considered existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary and to help identify the areas appropriate for carrying out the air quality planning and enforcement functions for nonattainment areas. Examples of jurisdictional boundaries include existing/prior nonattainment area boundaries for ozone or other urban-scale pollutants, county lines, air district boundaries, township boundaries, area covered by an MPO, state lines, Areas of Indian Country, and urban growth boundary. Where existing jurisdictional boundaries were not adequate or appropriate to describe the nonattainment area, other clearly defined and permanent landmarks or geographic coordinates were considered.

The Knoxville, TN area has previously established nonattainment boundaries associated with the both the 1-hour ozone and 1997 8-hour ozone NAAQS. The Knoxville nonattainment boundary for the 1-hour ozone NAAQS included Knox County, Tennessee in its entirety. Whereas the Knoxville

nonattainment boundary for the 1997 8-hour ozone NAAQS included Anderson, Blount, Jefferson, Knox, Loudon, and Sevier Counties in Tennessee in their entireties, and a portion of Cocke County, Tennessee.

Conclusion

Based on the assessment of factors described above, EPA has concluded that the following counties should be included as part of the Knoxville, TN nonattainment area because they are either violating the 2008 ozone NAAQS or contributing to a violation in a nearby area: Blount and Knox Counties, in their entireties and a portion of Anderson comprising the two census tracts with the TVA Bull Run Facility (Census Tract Numbers 202 and 213.02 from the 2000 Census). All of these counties (or portions thereof) are included in the Knoxville, TN nonattainment area for the 1997 ozone NAAQS.

The air quality monitor in Blount indicates a violation of the 2008 ozone NAAQS based on 2009-2011 design values, therefore the County is included in the nonattainment area. Knox County has an attaining monitor based on 2009-2011 so the county is being brought into this nonattainment area as a contributing county. Knox County has among the highest NOx and VOC emissions; it is the largest and most densely populated county; and it has the most VMT traveled in the CSA. Anderson does not have a violating monitor, but EPA has concluded that the TVA Bull Run Facility contributes to the 2008 ozone NAAQS violations in the Area due to its point source emissions. Anderson County had the second highest NOx emissions, contributing 19 percent of the CSA's total NOx. Given the prevalent wind direction (southwest, west-southwest and north-northeast), the TVA Bull Run Facility in Anderson County contributes to the violating monitor to Blount County, and therefore we are including the portion of the county in which the facility is located in the nonattainment area based on contribution. Though SCR controls were installed at the TVA facility, total NOx levels have fluctuated since 2006 going from 686 tons, to as high as 1,087 tons in 2008, down to 400 tons in 2009 and recently up to 758 tons for 2011. The Heat Input (in units of MMBtu), which indicates fuel utilization, has also fluctuated in conjunction with the NOx levels.