5 Year Air Monitoring Network Assessment

Tennessee Department of Environment and Conservation
Division of Air Pollution Control
Final June 30, 2015

Overview of the 5 Year Assessment

EPA requires each air monitoring agency to perform an assessment of the air monitoring networks within each monitoring agency to determine if the network meets the monitoring needs for both the monitoring agency and EPA. The actual requirements that specify what must be considered in perform the assessment are found in 40CFR58.10 (d) which states as follows:

> *"The State, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and where new technologies are appropriate for incorporation in the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For $PM_{2.5}$, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan to the Regional Administrator. The first assessment is due July 1, 2010."*

The objective of this review will be to address the required elements of the 5 year assessment and provide the rationale and supporting data to satisfy the requirements of 40CFR58.10 (d) and to guide the future changes and development of the air monitoring networks in Tennessee over the next 5 years. This document is not designed to replace the annual network review that is normally prepared and submitted for public review each year by the end of June. This document serves as the long range planning guide to help in the decisions required to plan for and anticipate changes that are likely to affect the operation of the air monitoring networks in Tennessee. Normally EPA is not constrained by economics in going about the process of enacting or revising the National Ambient Air Quality Standards (NAAQS). However, the implementation of the standards does require economic considerations especially as it relates to the funding provided by EPA to implement the monitoring networks required to monitor for compliance with the new/existing standards. EPA provides direct and indirect funding support to

the state and local air monitoring agencies through the 103 and 105 federal grants awarded to the agencies. Each state or local agency may also support the monitoring networks to varying degrees based on matching fund requirements associated with the federal grants, state sponsored monitoring studies and investigations including complaint monitoring and specialized monitoring studies as a part of the PSD pre/post monitoring requirements. States may also work with the regulated industries in their state placing air monitoring network requirements upon the industry as a method to meet the needs of the overall network density and source oriented requirements where the state or local monitoring agency may have limited resources to perform this type of monitoring.

EPA periodically revises the NAAQS, adding new standards or lowering the existing standards to address health related concerns that specific air pollutants may aggravate or enhance symptoms in sensitive or compromised individuals. The NAAQS currently in effect are as follows. Use the link provided to go to EPA's NAAQS web page for more information.

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3 month average	0.15 µg/m3	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	Annual	53 ppb	Annual Mean
Ozone [73 FR 16436, Mar 27, 2008]		primary and secondary	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution 12/14/2012	$PM_{2.5}$	primary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
		secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
		primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010]		primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
[38 FR 25678, Sept 14, 1973]		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

National Ambient Air Quality Standards (NAAQS) | Air and Radiation | US EPA

As shown in the table above and in recent proposals currently under consideration by EPA, the NAAQS are constantly changing. Lead, $PM_{2.5}$, Ozone, SO_2 and NO_2 have all recently undergone changes that in some cases drastically lowered the previous NAAQS standards. EPA recently enacted new monitoring requirements for "Near Road" monitoring and for "NCore" monitoring which has also changed the network monitoring requirements and in some cases added additional types of specially sited monitors to address the needs of the new standards. Policy changes have also led to adoption of a combination of both monitoring and modeling to satisfy regulatory requirements with modeling NAAQS standard exceedances now being considered as equivalent to a monitored exceedance for certain pollutants.

Historically, air quality has improved from previous years and continues to improve. This is due in part to stricter standards and emission regulations, improved emissions controls with new technology to control source emissions and significant improvements to automotive technology with increased fuel economy, improved emissions controls and alternative fuel vehicles all adding to the overall air quality improvements over time and into the near future. Other changes have emerged over time that have changed the emphasis in particulate pollution from larger particle sizes to fine particulate matter and the technology necessary to effectively monitor for them. The reduction in all pollutant emissions over time has also occurred while our state and national population has continually grown including growth in the number of automobiles on the roads and an accompanying growth in VMT's (vehicle miles traveled). This growth has also included significant improvement in the economy as well with continued economic development and increases in employment and economic output.

The components of the assessment will include specific sections dealing with each of the following questions that must be addressed in the assessment: These questions are designed to

address both the needs of the monitoring agency and the needs of Region 4 as they also evaluate the recommendations made for the network.

1) If the network meets the monitoring objectives defined in Appendix D

2) Whether new monitoring sites are needed

3) Whether existing sites are no longer needed and can be terminated

4) Whether new technologies are appropriate for incorporation into the air monitoring network.

5) Whether the network sufficiently supports characterization of air quality in areas with large populations of susceptible individuals

6) Whether discontinuance of a monitoring site would have an adverse impact on other data users or health studies.

7) For PM2.5 the assessment must identify needed changes to population oriented sites

8) If monitoring is required near any additional Pb sources according to the most recent National Emissions Inventory. (Monitoring is required near sources with Pb emissions greater than 0.5 tons per year.)

9) Any waiver of 40 CFR Parts 50 and/or 58 regulatory requirements must be renewed during each 5-Year Assessment unless otherwise specified to be renewed annually during the network plan process.

a. Pb source monitoring waivers
b. Continuous PM2.5 FEM Comparability (NAAQS Exclusion).
c. Siting criteria
d. Any additional waiver of Part 50 and/or 58 regulatory requirements.

The specific recommendations that are developed from the assessment will also be provided as a discussion and table with the pollutant network and proposed modifications

indicated along with a tentative timeline. The timelines for implementation may be separate from the timelines associated with the annual network review as these recommendations essentially deal with a longer term network vision and may also attempt to address the eventual requirements imposed by changes in the existing NAAQS where lowered standards may require additional support for potentially new or modified nonattainment areas and potential changes to monitoring strategy if areas are identified as meeting the NAAQS over 3 or more years and therefore may no longer be subject to certain monitoring requirements either as an attaining area or as an area below the percentage thresholds that may trigger the need for more population based monitoring sites.

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Summary of Recommendations and Anticipated Changes

The following NAAQS pollutants are evaluated and recommendations made for network modifications or revisions. The recommendations are based on previous changes made to each of the networks and based in part on the recently completed or proposed changes to the networks. The additional analysis preformed to aid in this process is presented beginning on page 23 with the correlation analysis, lead emissions analysis, NEI emissions summary and projections, health data analysis and finally poverty and emissions density. One additional area of consideration is how the industrial monitoring network sites should be evaluated with regard to the required or mandatory network monitors operated in the state. The industrial monitors are operated typically to meet state imposed permit required monitoring. The monitors may not meet the requirements of a SLAMs network monitor and therefore may not be acceptable for comparisons to the NAAQS. They are also not required to be counted towards meeting the MSA minimum monitoring requirements and are not used for meeting the needs of population based monitoring. The industrial monitors do not include ozone or PM2.5 monitors and may be operated in areas where an existing Tennessee monitor is also operated. In that case the Tennessee monitor would be used for any NAAQS comparisons or attainment/nonattainment designation purposes. For these reasons, the industrial monitoring sites are not included in the 5 yeas assessment, but may be included for information purposes in the annual network review.

Ozone

Tennessee does anticipate the potential needs for additional ozone monitoring sites given that the ozone standards are under consideration for revisions. Tennessee does not anticipate additional shutdown of existing ozone monitoring sites in the near future except as where the site may need to be relocated to meet site requirements under a revised ozone standard. In the

previous 5 years, Tennessee has discontinued monitoring for ozone at 3 sites and has not yet completed the relocation of the Loudon ozone site back to the Loudon Middle School site where it was temporarily relocated from. The Meigs County ozone monitoring site was discontinued after the end of the 2013 ozone monitoring season and will not be restarted. This site shut down was approved by EPA.

Fine Particulate Matter 2.5 Microns or Less (PM2.5)

Tennessee does not anticipate the need for additional new PM2.5 sites. One PM2.5 site located in the Chattanooga has been requested to be shut down by the local program. The written request for this was made to EPA in recent correspondence. Tennessee also has two regional background sites (one in Blount County and one in Lawrence County) and three regional transport sites.(two in Chattanooga and one in Blount County) in operation.

PM2.5 Speciation

EPA recently evaluated the value of all of the speciation sites in this network and determined that low value sites should be discontinued. As a result of this analysis, three speciation sites in Tennessee (one operated by Tennessee and two operated by local programs in Nashville and Chattanooga were defunded beginning October 2014. This shutdown has left only the speciation sites in Memphis and Knoxville funded and operational for the coming years. No additions to this network are planned for the future.

Particulate Matter 10 Microns or Less (PM10)

The majority of the remaining PM10 monitoring sites have been shut down over the past 5 years. Tennessee operates one continuous site at the present time. Several are operated by the local programs and have also been shut down. Recently Chattanooga proposed shutting down the single PM10 collocated site operating in the MSA on Broad Street. This request was

approved by EPA. A similar request was approved by EPA to shut down a single PM10 monitoring site located at Fite Road in Memphis. Two other sites remain operating in this MSA area. No additions to this network are planned for the future.

Lead

Tennessee operates a single lead monitoring site in Sullivan County, Tennessee. This area is currently attaining the lead standard and will likely continue to operate for the future. The Knox county local program also operates lead monitoring site in the Knoxville area. Two of the sites were requested to be relocated and approval to move the sites was given by EPA. No additions to this network are planned for the future.

Nitrogen Dioxide (NO2)

Tennessee does not operate any NO2 sites, however area wide NO2 monitors are operated in the Nashville and Memphis MSA areas by the Nashville local program and the State of Arkansas. No additions to this network are planned for the future.

Near Road NO2

Tennessee does not operate any Near Road NO2 sites. Two sites are operated by the local programs, one in the Nashville area and the other in the Memphis area. Both sites are approved by EPA. Two additional Near Road NO2 sites may be required to operate, one in the Chattanooga area and another in the Knoxville area. It is uncertain at this time if either of these sites will be required to be operating by Jan. 1, 2017.

Sulfur Dioxide (SO2)

Tennessee currently operates one SO2 site in Anderson County at the Freels Bend location. Tennessee is currently working with EPA on selection of another SO2 site to be located in Sullivan County in proximity to the Eastman facility within the boundary of the

existing SO2 nonattainment area. Tennessee has conducted a modeling exercise to help determine the best site location to select in the area and has proposed several locations for consideration. At the time of this documents creation, the final recommendations and site to be selected were not yet available. See the section at the end of the plan for the analysis.

Carbon Monoxide (CO)

Tennessee does not operate any CO monitoring sites. The Nashville Local program requested to discontinue monitoring for CO at the Braodway site in 2013. This request was approved by EPA. No additions to this network are planned for the future.

NCore

Tennessee does not operate any NCore sites. Tennessee currently has two designated NCore sites approved by EPA. One site is located in Memphis, TN and the other site is located at Look Rock in the GSMNP. The Memphis local program is responsible for operating the site in Shelby County. The Look Rock site was previously operated and in part funded by TVA and the NPS. In Oct. 2014, TVA decided to completely shut down and defund all air monitoring activities at the Look Rock site. EPA and the NPS have reached an agreement to continue the operation of this NCore site. No additions to this network are planned for the future.

1) If the network meets the monitoring objectives defined in Appendix D

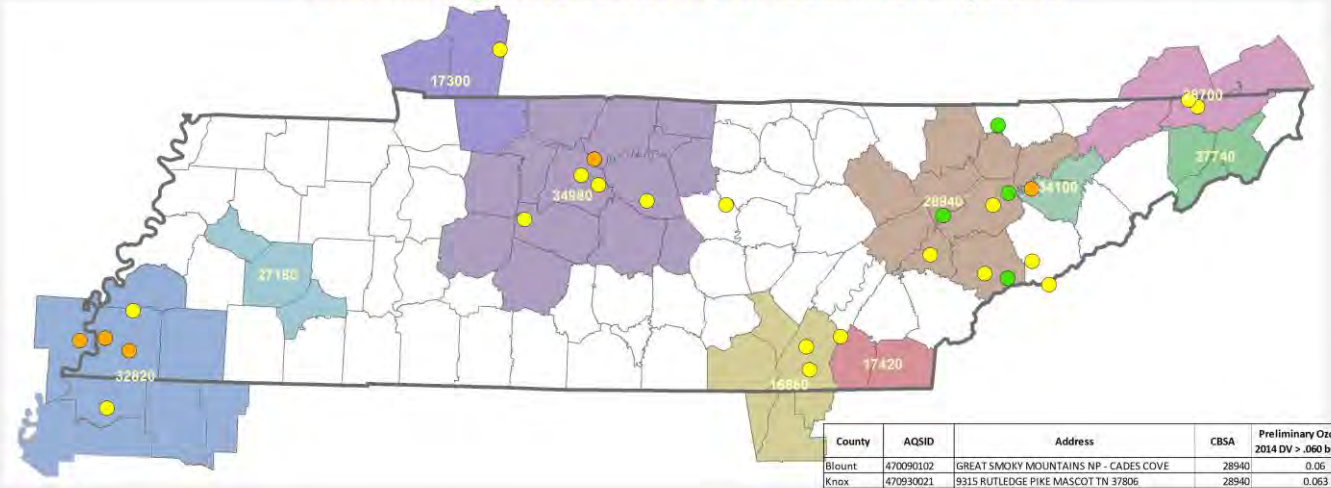
Tennessee has prepared a draft annual network monitoring plan for the 2015/2016 calendar year and has also evaluated all of the existing monitoring sites each year previously and concludes that the current network monitors and respective monitoring networks meet the requirements of Appendix D. Please reference the copy the draft annual network monitoring plan for calendar year 2015 as a supporting document and the previous annual plan that was also found by EPA to meet these requirements. There are currently adequate sites in place to address the network requirements with the exception of the need for an additional SO2 monitoring site in the Sullivan County area to address the need for a monitor in the named nonattainment area to be used to demonstrate monitored attainment over time as certain emission reduction programs are implemented at the nearby point sources of SO2 emissions.

2) Whether new monitoring sites are needed

Tennessee is currently reviewing a major modification to the PM2.5 monitoring network and is proposing to begin phasing out a large portion of the existing PM2.5 filter based manual samplers for new continuous PM2.5 FEM/FRM particulate samplers. This includes additional colocation of the continuous FEM/FRM samplers as needed to meet the necessary siting and network requirements. A colocation study is also proposed at most of the existing FRM filter based sites to allow for generation of a correlation dataset to study the differences and similarities between both sampling technologies. This study is not anticipated to run longer than a single calendar year. With the proposals for revisions to the ozone standard currently under consideration by EPA, there are potential changes that may be required in the ozone network sites. The following graphic depict the possible nonattainment area outcomes for the new ozone standards

based on the proposed levels EPA has stated are currently under consideration given the current monitoring networks most recent reported data and ozone levels. If the lowest levels under consideration are selected by EPA for the new ozone standards, a number of Tennessee counties may face the possibility of not immediately meeting the new standards. The lowering of the ozone standards to levels that are approaching at or near background levels is a significant concern expressed in comments submitted to EPA regarding the proposed standard changes. As the standard drops closer to what is called the "normally prevailing ozone background", it becomes more difficult to develop and implement control strategies to return the nonattainment area to attainment. In this instance, it is also highly likely that any new or additional ozone monitoring sites that are established would potentially show nonattainment because of the prevalence of the normally occurring background. This may also reduce incentives to add to existing networks or expand monitoring for additional voluntary precursor emission reduction program associated with ozone forecasting and public health outreach activities.

Preliminary 2012 to 2014 8 Hr Ozone DV Options



Legend

2013 CBSA selection Tenn Only

NAME

- Chattanooga, TN-GA 16860
- Clarksville, TN-KY 17300
- Cleveland, TN 17420
- Jackson, TN 27180
- Johnson City, TN 27740
- Kingsport-Bristol-Bristol, TN-VA 28700
- Knoxville, TN 28940
- Memphis, TN-MS-AR 22820
- Morristown, TN 34100
- Nashville-Davidson--Murfreesboro--Franklin, TN 34980

Legend

Preliminary Ozone Data

DV2012_14

- 0.060 - 0.065
- 0.066 - 0.070
- 0.071 - 0.075

County	AQSID	Address	CBSA	Preliminary Ozone 2012 2014 DV > .060 but <= .065
Blount	470090102	GREAT SMOKY MOUNTAINS NP - CADES COVE	28940	0.06
Knox	470930021	9315 RUTLEDGE PIKE MASCOT TN 37806	28940	0.063
Claiborne	470259991	718 Russell Hill Rd, Speedwell, TN 37870		0.063
Anderson	470010101	FREELS BEND_STUDY AREA MELTON LAKE Oak R	28940	0.064

County	AQSID	Address	CBSA	Preliminary Ozone 2012 2014 DV > .065 but <= .070
Sullivan	471632003	3301 BLOOMINGDALE RD. Kingsport TN 3762	28700	0.066
Davidson	470370011	1015 TRINITY LANE	34980	0.066
Williamson	471870106	FAIRVIEW MIDDLE SCHOOL CROW CUT ROAD F	34980	0.066
Hamilton	470651011	SODDY DAISY H.S. 00618 SEQUOYAH RD	16860	0.067
Fayette	210470006	WILLIAMSON RESIDENCE, 10800 PILOT ROCK R	17300	0.067
Blount	470090101	GREAT SMOKY MOUNTAINS NP LOOK ROCK	28940	0.067
Knox	470931020	4625 MILDRED DRIVE	28940	0.067
Loudon	471050108_010	130 WEBB DR. 1703 Roberts Rd. Loudon TN	28940	0.067
Wilson	471890103	CEDARS OF LEBANON STATE PARK	34980	0.067
DeKalb	470419991	Edgar Evans State Park, Smithville, TN 3		0.067
Meigs	471210104	8401 Highway 60		0.067
Sevier	471550102	CLINGSMANS DOME, GREAT SMOKY MTNS. NP		0.067
Sullivan	471632002	Indian Springs School Shawnee Ave Bloun	28700	0.068
Sevier	471550101	GREAT SMOKY MOUNTAIN NP COVE MOUNTAIN		0.068
Hamilton	470654003	6200 BONNY OAKS DRIVE EASTSIDE UTILITY F	16860	0.069
Crockett	280330002	5 EAST SOUTH ST. (HERNANDO)	32820	0.069
Shelby	471571004	6855 MUDVILLE RD.	32820	0.07
Davidson	470370026	3711 BELL ROAD	34980	0.07

County	AQSID	Address	CBSA	Preliminary Ozone 2012 2014 DV > .070 but <= .075
Cumberland	050350005	LH POLK AND COLONIAL DRIVE	32820	0.071
Jefferson	470890002	2393 Forrester Road, New Market TN 37820	34100	0.071
Sumner	471650007	ROCKLAND RECREATION AREA-OLD HICKORY DAM	34980	0.072
Shelby	471570021	1330 FRAYSER BLVD	32820	0.073
Shelby	471570075	6388 Haley Rd. (Shelby Farms NCORE site)	32820	0.073

County	AQSID	Address	CBSA	Preliminary Ozone 2012 2014 DV > = .075

The following table is also provided in the graphic above and for clarity is included below to help identify areas likely to be impacted by the proposed ozone standard changes.

County	AQSID	Address	CBSA	Preliminary Ozone 2012 2014 DV > .060 but <= .065
Blount	470090102	GREAT SMOKY MOUNTAINS NP - CADES COVE	28940	0.06
Knox	470930021	9315 RUTLEDGE PIKE MASCOT TN 37806	28940	0.063
Claiborne	470259991	718 Russell Hill Rd, Speedwell, TN 37870		0.063
Anderson	470010101	FREELS BEND_STUDY AREA MELTON LAKE Oak R	28940	0.064

County	AQSID	Address	CBSA	Preliminary Ozone 2012 2014 DV > .065 but <= .070
Sullivan	471632003	3301 BLOOMINGDALE RD. Kingsport TN 3762	28700	0.066
Davidson	470370011	1015 TRINITY LANE	34980	0.066
Williamson	471870106	FAIRVIEW MIDDLE SCHOOL CROW CUT ROAD F	34980	0.066
Hamilton	470651011	SODDY DAISY H.S. 00618 SEQUOYAH RD	16860	0.067
Fayette	210470006	WILLIAMSON RESIDENCE, 10800 PILOT ROCK R	17300	0.067
Blount	470090101	GREAT SMOKY MOUNTAINS NP LOOK ROCK	28940	0.067
Knox	470931020	4625 MILDRED DRIVE	28940	0.067
Loudon	471050108_0109	130 WEBB DR. 1703 Roberts Rd. Loudon TN	28940	0.067
Wilson	471890103	CEDARS OF LEBANON STATE PARK	34980	0.067
DeKalb	470419991	Edgar Evans State Park, Smithville, TN 3		0.067
Meigs	471210104	8401 Highway 60		0.067
Sevier	471550102	CLINGSMANS DOME, GREAT SMOKY MTNS. NP		0.067
Sullivan	471632002	Indian Springs School Shawnee Ave Bloun	28700	0.068
Sevier	471550101	GREAT SMOKY MOUNTAIN NP COVE MOUNTAIN		0.068
Hamilton	470654003	6200 BONNY OAKS DRIVE EASTSIDE UTILITY F	16860	0.069
Crockett	280330002	5 EAST SOUTH ST. (HERNANDO)	32820	0.069
Shelby	471571004	6855 MUDVILLE RD.	32820	0.07
Davidson	470370026	3711 BELL ROAD	34980	0.07

County	AQSID	Address	CBSA	Preliminary Ozone 2012 2014 DV > .070 but <= .075
Crittenden	050350005	LH POLK AND COLONIAL DRIVE	32820	0.071
Jefferson	470890002	2393 Forrester Road, New Market TN 37820	34100	0.071
Sumner	471650007	ROCKLAND RECREATION AREA-OLD HICKORY DAM	34980	0.072
Shelby	471570021	1330 FRAYSER BLVD	32820	0.073
Shelby	471570075	6388 Haley Rd. (Shelby Farms NCORE site)	32820	0.073

County	AQSID	Address	CBSA	Preliminary Ozone 2012 2014 DV > = .075
None				

EPA has also requested consideration of an additional new standard for ozone which would be a possible secondary standard protective of vegetation and based on an exposure weighted calculation described as the W126 standard. The following table evaluated impacts to the state based on some of the various levels under consideration to be possibly adopted by EPA. These evaluations are based on the 2011 to 2013 datasets and are a possible projection of what the impacts the adoption of a similar ozone standard might have in Tennessee.

W126 <= 7.0 PPM Hours

County	AQSID	Year	Address	Corr_3_Yr_Avg	CBSA
Blount	470090102	2011_13	GREAT SMOKY MOUNTAINS NP - CADES COVE	5.99	28940
Claiborne	470259991	2011_13	718 Russell Hill Rd, Speedwell, TN 37870	6.14	

W126 > 7.0 but <= 13.0 PPM Hours

County	AQSID	Year	Address	Corr_3_Yr_Avg	CBSA
DeKalb	470419991	2011_13	Edgar Evans State Park, Smithville, TN 3	7.54	
Davidson	470370011	2011_13	1015 TRINITY LANE	7.92	34980
Anderson	470010101	2011_13	FREELS BEND_STUDY AREA MELTON LAKE Oak R	8.96	28940
Sullivan	471632003	2011_13	3301 BLOOMINGDALE RD. Kingsport TN 3762	9.24	28700
Knox	470930021	2011_13	9315 RUTLEDGE PIKE MASCOT TN 37806	9.37	28940
Sevier	471550102	2011_13	CLINGSMANS DOME, GREAT SMOKY MTNS. NP	9.51	42940
Sevier	471550101	2011_13	GREAT SMOKY MOUNTAIN NP COVE MOUNTAIN	9.66	42940
Williamson	471870106	2011_13	FAIRVIEW MIDDLE SCHOOL CROW CUT ROAD F	9.73	34980
Meigs	471210104	2011_13	8401 Highway 60	10.31	
Hamilton	470651011	2011_13	SODDY DAISY H.S. 00618 SEQUOYAH RD	10.57	16860
Sullivan	471632002	2011_13	Indian Springs School Shawnee Ave Bloun	10.57	28700
Davidson	470370026	2011_13	3711 BELL ROAD	10.76	34980
Rutherford	471490101	2011_12	Eagleville (Shut down)	11.22	
Knox	470931020	2011_13	4625 MILDRED DRIVE	11.32	28940
Hamilton	470654003	2011_13	6200 BONNY OAKS DRIVE EASTSIDE UTILITY F	11.46	16860
Loudon	471050108_0109	2011_13	130 WEBB DR. /1703 Roberts Rd. Loudon TN	11.65	28940
Jefferson	470890002	2011_13	2393 Forrester Road, New Market TN 37820	12.31	34100
Wilson	471890103	2011_13	CEDARS OF LEBANON STATE PARK	12.42	34980

W126 > 13.0 but <= 17 PPM Hours

County	AQSID	Year	Address	Corr_3_Yr_Avg	CBSA
Shelby	471571004	2011_13	6855 MUDVILLE RD.	13.11	32820
Sumner	471650101	2011_12	Cottontown (Shutdown)	13.12	
Shelby	471570021	2011_13	1330 FRAYSER BLVD	13.27	32820
Blount	470090101	2011_13	GREAT SMOKY MOUNTAINS NP LOOK ROCK	13.87	28940
Shelby	471570075	2011_13	6388 Haley Rd. (Shelby Farms NCORE site)	15.29	32820
Sumner	471650007	2011_13	ROCKLAND RECREATION AREA-OLD HICKORY DAM	15.91	34980

W126 > 17.0 PPM Hours

County	AQSID	Year	Address	Corr_3_Yr_Avg	CBSA
None					

3) Whether existing sites are no longer needed and can be terminated

The majority of the existing ozone sites that are present in the state are used not only to help demonstrate attainment with the current ozone NAAQS, but to also support the AIRNOW air quality forecasting program for ozone. In the past two years, several ozone monitoring sites have been identified as redundant are were shutdown. The sites included were the Cottontown site, the Eagleville site and the Meigs county ozone sites. These sites were located in the Nashville MSA and near the Chattanooga MSA. There is an ongoing concern with shutting down additional ozone sites that may be beneficial in configuring the monitoring network after the final promulgation of the new proposed ozone standard and the decision on whether to implement a secondary vegetation standard. These regulatory developments may require additional monitoring in areas that were previously determine to be attaining the old standards and could pose challenges if the standard is set at the lowest possible levels EPA is considering (60 to 65 PPB 8 hour average). The current PM2.5 FRM network is supplemented by a non-FEM/FRM continuous network of TEOM monitors that will be allowed to operate to provide support for the AIRNOW air quality forecasting activities for fine particulate matter. These are anticipated to operate until the new BAM FEM/FRM continuous samplers are installed and properly operating. After the BAM's have been demonstrated to be acceptably generating continuous PM fine data, the TEOM's will be discontinued and shut down and removed from the sites. The BAM's will then be used for support of the air quality forecasting program during the FRM filter based comparison study. They will continue to also support this need after the collocated FRM filter based samplers are shut down and removed from the sites.

4) Whether new technologies are appropriate for incorporation into the air monitoring network.

The previous discussion of the upcoming changes in the PM2.5 monitoring program illustrates a good example of new technologies being incorporated into the monitoring networks. At this time the changeover to wireless cellular communications in the general monitoring network is being investigated and is expected to be implemented at the same time the new continuous BAM monitors are being field installed.

5) Whether the network sufficiently supports characterization of air quality in areas with large populations of susceptible individuals

In an effort to address the question of how the states air monitoring networks characterize air quality in Tennessee with respect to susceptible individuals (or populations of susceptible groups), an analysis of the air monitoring site coverage for the state's populations of asthma (pediatric and adult), COPD and lung cancer was prepared with a graphic analysis provided showing the locations of the monitoring sites and the county by county incidence of each of these illnesses and a numeric count by county of the reported cases. This is included at the end of this report. Additionally poverty was selected as another potential factor that might identify susceptible populations of individuals in the state. A graphic is also included that compares the total amount of reported NEI criteria air pollutants for 2011 against the county poverty percentages most recently available for Tennessee. This identifies the areas served by the existing monitoring networks and areas that may not be.

6) Whether discontinuance of a monitoring site would have an adverse impact on other data users or health studies.

TDEC APCD is aware of a number of other agencies or organizations that either use or periodically require updates on air quality data and monitoring activities in Tennessee. Several Federal agencies besides EPA use and have significant interest in the states air monitoring networks and the data they generate. The following list is not inclusive of all of the interested groups or organizations: Shutting down or significantly reducing the size of the air monitoring networks in Tennessee would likely impact the direct support provided to these organizations and also could likely impact other studies that these agencies support or are partners in research studies at the state and federal levels. A number of inquiries are received from public schools and university students requesting specific air monitoring data and/or access to air quality data reports. Another area of interest has developed around the small low cost air sensors that are now publically available. It is anticipated that public requests for comparison studies will be received by state and local monitoring agencies from the public that are using the network monitoring sites to "truth" the data generated by the low cost portable monitors and essentially verify or roughly calibrate their sensors to the fixed monitoring network site monitors.

Federal Agencies:

Environmental Protection Agency

CDC (Center for Disease Control)

AIRNOW and EnviroFlash Programs

National Weather Service

State Monitoring Agencies

Adjacent Region 4 States that share a common MSA area or may be operating a monitoring network with sites also on the Tennessee border.

Tennessee Departments or Agencies

Tennessee and County Emergency Management Agencies (Primarily for fire related smoke reports and particulate data comparisons.)

Tennessee Department of Health

Tennessee Department of Transportation

Tennessee Municipal Planning Organizations

Local Pollution Control Agencies in Tennessee Located in the Following Counties:

Davidson - Nashville

Knox - Knoxville

Hamilton - Chattanooga

Shelby – Memphis

Local Air Action Partner Organizations

Clean Air Partnerships in Nashville and Tri-Cities

Private Organizations

ALA (American Lung Association)

SIERRA Club

Private Citizens

Relocating to Tennessee

Requesting complaint monitoring

Requesting general air quality information or data

7) For PM2.5 the assessment must identify needed changes to population oriented sites

Currently Tennessee meets the requirements for the minimum needed population required network monitoring sites. The following table describes the current PM2.5 monitoring network population monitoring requirements including the most recently available S Census estimates.

MSA Monitor Requirements

Monitoring Program	Census Area Identification and Population			88101 PM2.5			
State / PQAO	CBSA Code	Census 2010 / 2014	CBSA Title (MS Areas)	Operating	2012 2014* Annual DV ug/m3	2012 2014* 24 Hr DV ug/m3	Required
GA 0437	16860	528143 / 544559	Chattanooga, TN-GA	1	9.6	19	2
TN 0170				3			
TN 0025							
KY 0584	17300	260625 / 278353	Clarksville, TN-KY		9.2	21	0
TN 0953							
TN 0025				1			
TN 0112	17420	115788 / 119705	Cleveland, TN	0			0
TN 0025							
TN 0025	27180	130011 / 130225	Jackson, TN	1	8.6	18	0
TN 0025	27740	198716 / 201091	Johnson City, TN	0			0
TN 0375	28700	309544 / 308079	Kingsport-Bristol-Bristol, TN-VA		8.6	15	0
TN 0025				1			
TN 0026							
VA 1127							
TN 0581	28940	837571 / 857585	Knoxville, TN	4	10.2	19	2
TN 0921							
NPS 0745							
TN 0025				3			
TN 0027							
AR 0055	32820	1324829 / 1343230	Memphis, TN-MS-AR		9.5	21	2
MS 073							
TN 0673				2			
TN 0025							
TN 0025	34100	113951 / 115713	Morristown, TN	0			0
TN 0682	34980	1670890 / 1792649	Nashville-Davidson--Murfreesboro, TN	2	10.3	20	3
TN 0025				1			

*The PM2.5 statistic presented represents the 2013 to 2014 DV except for the Chattanooga MSA.

Micropolitan Monitor Requirements

Monitoring Program	Census Area Identification and Population			88101 PM2.5			
State / PQAO	CBSA Code	Census 2010 / 2014	CBSA Title (MicroS Areas)	Operating	2012 2014* Annual DV ug/m3	2012 2014* 24 Hr DV ug/m3	Required
TN 0112	11940	52266 / 52626	Athens, TN				0
TN 0025				1	8.9	17	

*The PM2.5 statistic presented represents the 2013 to 2014 DV except for the Chattanooga MSA.

8) If monitoring is required near any additional Pb sources according to the most recent National Emissions Inventory. (Monitoring is required near sources with Pb emissions greater than 0.5 tons per year.)

Tennessee has evaluated the sources identified in the 2011 NEI with emissions in excess of 0.5 TPY of lead. Five sources were initially identified with emissions in excess of the levels that would require ambient monitoring and the sources were all contacted to verify the accuracy of the reported emission inventories for lead as reported to NEI. Two of the sources are currently either required to monitor for lead and are doing so and/or have either a state or local program lead monitoring network in operation. These networks are already established and are known to EPA.

The other three sources have confirmed that the initially reported NEI lead emissions are incorrect and in error and have submitted documentation to both the state and EPA for updating to the NEI inventory that conforms they are well below the 0.5 TPY lead emissions threshold are not subject to a lead monitoring requirement. One of the existing lead sources that currently have a lead monitoring network in place is also located in a lead nonattainment area. The source has recently gone out of business and is no longer operating. The area monitoring network has generated enough data over the past 3 years to receive a clean data determination from EPA and a reclassification to attainment request was recently submitted to EPA for the nonattainment area.

9) Any waiver of 40 CFR Parts 50 and/or 58 regulatory requirements must be renewed during each 5-Year Assessment unless otherwise specified to be renewed annually during the network plan process.

a. Pb source monitoring waivers

b. Continuous PM2.5 FEM Comparability (NAAQS Exclusion).

c. Siting criteria

d. Any additional waiver of Part 50 and/or 58 regulatory requirements.

Tennessee does not currently have any waivers for lead monitoring, continuous PM2.5 monitoring, siting criteria or waivers for additional parts of the 40 CFR 50 or 58 requirements, therefore none will need to be reviewed or renewed.

Tennessee Ozone Sites Correlation Analysis

Hourly data for the ozone monitors were downloaded from EPA's AQS database and processed to derive the running 8 hour statistics for all sites. The number of hours used to calculate the 8 hour averages were evaluated to identify any averages that may have included less than 6 hourly values. These averages were excluded so that only 8 hour averages containing 6 or more hourly values were retained. The periods of data collection were also evaluated and any site that operated outside of the recognized ozone season (March through October), were excluded. Any 8 hour averages that may have contained hourly data from the months of Jan. to Feb. and Nov. to Dec. were also identified and excluded from the 8 hour datasets. All sites including the TDEC, local program, NPS and CASTNET (EPA) operated sites were included and processed. Some of the NPS sites in east Tennessee routinely do not collect data from March through October due to the extreme winter conditions at higher elevations and may not report data until April or May each year. One site underwent relocation because of site renovation activity and a second site was established in the same general area to resume data collection. The data from the two sites were combined into a single dataset for the purpose of this evaluation.

Ozone Sites Correlation Analysis Discussion

The following table (Table 1), depicts the correlation analysis performed on the ozone data sets for the Tennessee operated monitoring sites reporting data between 2010 and 2014. Sites that were shut-down during this period were not included in the analysis. Sites that operated for 4 of the 5 years were also included if they operated in 2014 and are operating in 2015. Correlation values that were in excess of 0.90 are shown in red text. All of the cells are color coded with the

lowest correlation value shown in dark blue shading up to light blue (the highest correlation). (See example) 

The individual sites were evaluated for the relative distance to each other and were grouped by MSA/CBSA area so that the sites within a given MSA/CBSA area were able to be clustered near a site in the same MSA/CBSA area. This allowed for a simpler grouping analysis of the sites that are expected to be more highly correlated in comparison to sites some distance away.

For the purpose of this study, any sites that have a correlation in excess of 0.90, are considered to be highly correlated with another site and are considered to be a site that could be evaluated for either shutdown or relocation. Sites that have lower or low correlations are considered to be sites that should be considered to remain operating as long as they perform a needed function for the overall network. In some cases, because of the population requirements found in 40CFR 58 Subpart G, Appendix D, the actual number of monitors required in a given ozone network must be maintained so that at least the minimum monitoring requirements are met. The following example may explain this more clearly. Table D-2 from Appendix D provides the number of monitoring sites requires. Table 2 evaluates the number of sites in the network and the minimum requirements for the network. Table 3 depicts additional needs that the sites are used for and if any new sites are needed or site relocations are needed to meet those requirements.

Table 1 Ozone Correlation Analysis

2010 to 2014 8 Hour Ozone Correlation Analysis Statistics

	MSA Name / County	Knoxville						Chattanooga		Morristown	Sevierville		Memphis			Kingsport		Nashville					Claiborne Co.	DeKalb Co.
	CBSA	28940						16860		34100	42940		32820			28700		34980					None	None
MSA Name / County	AQS ID (Note: All sites may not have 2010 data reported)*	470010101-1	470090101-1	470090102-1	470930021-1	470931020-1	471050109*	470651011-1	470654003-1	470890002-1	471550101-1	471550102-1	471570021-1	471570075-1	471571004-1	471632002-1	471632003-1	470370011-1	470370026-1	471650007-1	471870106-1	471890103-1	470259991-1*	470419991-1*
Knoxville	470010101-1	1																						
	470090101-1	0.362	1																					
	470090102-1	0.803	0.462	1																				
	470930021-1	0.908	0.397	0.761	1																			
	470931020-1	0.903	0.418	0.741	0.94	1																		
	471050109*	0.924	0.365	0.798	0.901	0.901	1																	
Chattanooga	470651011-1	0.782	0.599	0.699	0.785	0.795	0.772	1																
	470654003-1	0.787	0.583	0.713	0.808	0.826	0.801	0.947	1															
Morristown	470890002-1	0.834	0.578	0.719	0.894	0.898	0.836	0.823	0.849	1														
Sevierville	471550101-1	0.257	0.932	0.374	0.277	0.298	0.251	0.486	0.468	0.471	1													
	471550102-1	0.147	0.786	0.247	0.174	0.192	0.148	0.384	0.358	0.293	0.867	1												
Memphis	471570021-1	0.682	0.292	0.601	0.67	0.648	0.685	0.579	0.598	0.603	0.213	0.154	1											
	471570075-1	0.677	0.381	0.594	0.695	0.68	0.688	0.631	0.648	0.652	0.292	0.224	0.941	1										
	471571004-1	0.679	0.429	0.582	0.671	0.663	0.66	0.673	0.674	0.674	0.339	0.247	0.868	0.91	1									
Kingsport	471632002-1	0.857	0.448	0.792	0.881	0.856	0.846	0.771	0.779	0.865	0.359	0.229	0.64	0.656	0.652	1								
	471632003-1	0.866	0.402	0.772	0.888	0.86	0.85	0.758	0.768	0.85	0.308	0.191	0.64	0.649	0.643	0.97	1							
Nashville	470370011-1	0.779	0.292	0.685	0.767	0.754	0.8	0.667	0.689	0.678	0.212	0.138	0.777	0.765	0.705	0.734	0.734	1						
	470370026-1	0.764	0.353	0.695	0.756	0.734	0.786	0.666	0.694	0.704	0.278	0.177	0.785	0.789	0.717	0.731	0.72	0.932	1					
	471650007-1	0.808	0.307	0.715	0.794	0.769	0.82	0.677	0.698	0.697	0.218	0.148	0.791	0.784	0.728	0.759	0.76	0.946	0.933	1				
	471870106-1	0.611	0.654	0.585	0.592	0.589	0.594	0.7	0.672	0.67	0.579	0.454	0.621	0.69	0.742	0.611	0.581	0.646	0.711	0.654	1			
	471890103-1	0.797	0.437	0.754	0.755	0.721	0.765	0.724	0.709	0.706	0.349	0.25	0.753	0.769	0.745	0.74	0.726	0.838	0.883	0.861	0.775	1		
Claiborne Co.	470259991-1*	0.911	0.37	0.769	0.903	0.891	0.869	0.766	0.768	0.83	0.261	0.143	0.634	0.633	0.643	0.856	0.864	0.74	0.719	0.763	0.571	0.734	1	
DeKalb Co.	470419991-1*	0.784	0.559	0.749	0.767	0.775	0.763	0.804	0.808	0.786	0.472	0.353	0.655	0.678	0.716	0.756	0.726	0.773	0.804	0.783	0.773	0.85	0.785	1

TABLE D–2 OF APPENDIX D TO PART 58 SLAMS MINIMUM O_3 MONITORING REQUIREMENTS

MSA population[1, 2]	Most recent 3-year design value concentrations ≥85% of any O_3 NAAQS[3]	Most recent 3-year design value concentrations <85% of any O_3 NAAQS[3,4]
>10 million	4	2
4–10 million	3	1
350,000–<4 million	2	1
50,000–<350,000 [5]	1	0

1. Minimum monitoring requirements apply to the Metropolitan statistical area (MSA).
2. Population based on latest available census figures.
3. The ozone (O_3) National Ambient Air Quality Standards (NAAQS) levels and forms are defined in 40 CFR part 50.
4. These minimum monitoring requirements apply in the absence of a design value.

Table 2 Example of site evaluation

Number of sites in area with DV ≥85% of O3 NAAQS	Minimum number of sites required for area with population of >350,000 <4 million	Number of sites above minimum required.	Number of sites with high degree of correlation (.0.90) and subject to consideration for (shutdown or relocation)	Number of low correlation sites
5	2	3	3 (2)	2

Table 3 Example of recommendation based on evaluation

Required number of sites that must remain operating	Number of high correlation sites and number that might be (redundant)	Number of sites that might be shut down and still meet the minimum requirements	Number of sites used (needed) for AQI forecasting	Number of sites that have low correlation results and support forecasting	Number of sites proposed to remain operating	New site locations needed for: (1 forecasting) (2 new stds) (3 PSD) (4 SIP Maint.)	Existing sites to continue to be operated
2	3 (2)	3	5 (3)	2	3	0	3

The final determination of the remaining sites to be left operating needs to be based on the potential value of the sites in relation to the network needs. In this example two of the high correlation sites might be shut down leaving 1 of the three highly correlated sites and 2 other sites. In this case no new sites are proposed to be installed and 3 existing sites will be used to meet the network requirements. The following tables (Table 4 through Table 9) depict the correlations in each of the major metropolitan areas that have more than one ozone monitoring site. Table 9 also evaluates and compares the Knoxville MSA to the Sevierville micropolitan area and the Claiborne

Co. ozone monitoring site. These sites exhibited high correlations in the Knoxville region and also a high correlation to the Claiborne Co. site which is located north of the Knoxville MSA area.

Site Removal Bias

The removal bias estimation uses the nearest neighbors to each site to estimate the concentration at the location of the site if the site had never existed. This is done using the Voronoi Neighborhood Averaging algorithm with inverse distance squared weighting. The squared distance allows for higher weighting on concentrations at sites located closer to the site being examined. The bias was calculated for each day at each site by taking the difference between the predicted value from the interpolation and the measured concentration. A positive average bias would mean that if the site being examined was removed, the neighboring sites would indicate that the estimated concentration would be larger than the measured concentration. Likewise, a negative average bias would suggest that the estimated concentration at the location of the site is smaller than the actual measured concentration.

Specific Network Assessments by MSA/CBSA

Table 4

Nashville 34980

2010 to 2014 8 Hour Ozone Correlation Analysis

Statistics

		MSA Name / County	Nashville				
		CBSA	34980				
MSA Name / County	CBSA	*AQS ID (Note: All sites may not have 2010 data reported)**	470370011-1	470370026-1	471650007-1	471870106-1	471890103-1
Nashville	34980	470370011-1	1				
		470370026-1	0.932	1			
		471650007-1	0.946	0.933	1		
		471870106-1	0.646	0.711	0.654	1	
		471890103-1	0.838	0.883	0.861	0.775	1

Required number of sites that must remain operating	Number of high correlation sites and number that might be (redundant)	Number of sites that might be shut down and still meet the minimum requirements	Number of sites used (needed) for AQI forecasting	Number of sites that have low correlation results and support forecasting	Number of sites proposed to remain operating	New site locations needed for: (1 forecasting) (2 new stds) (3 PSD) (4 SIP Maint.)	Existing sites to continue to be operated
2	3 (2)	3	5 (3)	2	3	0	3

Site ID	Mean Removal Bias	Min Removal Bias	Max Removal Bias	Removal Bias Standard Deviation	Neighbors Included	Mean Relative Removal Bias (%)	Min Relative Removal Bias (%)	Max Relative Removal Bias (%)
47-037-0023	-0.7498	-6.5	10.9	1.452768991	4	-3	-54	1848
47-037-0036	0.5771	-10.9	6.15	1.443316347	4	8	-46	111
47-165-0007	0.6616	-3.41	10.1	1.246366393	6	52	-37	10094

Table 5

Memphis 32820

2010 to 2014 8 Hour Ozone
Correlation Analysis Statistics

		MSA Name / County	Memphis		
		CBSA	32820		
MSA Name / County	CBSA	*AQS ID (Note: All sites may not have 2010 data reported)**	471570021-1	471570075-1	471571004-1
Memphis	32820	471570021-1	1		
		471570075-1	0.941	1	
		471571004-1	0.868	0.91	1

See recommendations provided by the Memphis local program.

Site ID	Mean Removal Bias	Min Removal Bias	Max Removal Bias	Removal Bias Standard Deviation	Neighbors Included	Mean Relative Removal Bias (%)	Min Relative Removal Bias (%)	Max Relative Removal Bias (%)
05-035-0005	-0.8913	-17.2	11.5	3.100623	5	-2	-60	141
28-033-0002	0.5779	-12.1	11.6	2.6185114	6	9	-50	183
47-157-0047	-0.3062	-7.69	7.28	1.7143075	4	-1	-40	55
47-157-0075	0.5324	-9.89	4.14	1.386988	4	8	-53	59

Table 6

Knoxville 28940

2010 to 2014 8 Hour Ozone Correlation Analysis Statistics

MSA Name / County	CBSA	MSA Name / County	Knoxville					
		CBSA	28940					
MSA Name / County	CBSA	*AQS ID (Note: All sites may not have 2010 data reported)**	470010101-1	470090101-1	470090102-1	470930021-1	470931020-1	471050109*
Knoxville	28940	470010101-1	1					
		470090101-1	0.362	1				
		470090102-1	0.803	0.462	1			
		470930021-1	0.908	0.397	0.761	1		
		470931020-1	0.903	0.418	0.741	0.94	1	
		471050109*	0.924	0.365	0.798	0.901	0.901	1

See recommendations provided by the Knoxville local program.

Required number of sites that must remain operating	Number of high correlation sites and number that might be (redundant)	Number of sites that might be shut down and still meet the minimum requirements	Number of sites used (needed) for AQI forecasting	Number of sites that have low correlation results and support forecasting	Number of sites proposed to remain operating	New site locations needed for: (1 forecasting) (2 new stds) (3 PSD) (4 SIP Maint.)	Existing sites to continue to be operated
2	3 (2)	3	5 (3)	2	5	0	5

Site ID	Mean Removal Bias	Min Removal Bias	Max Removal Bias	Removal Bias Standard Deviation	Neighbors Included	Mean Relative Removal Bias (%)	Min Relative Removal Bias (%)	Max Relative Removal Bias (%)
47-001-0101	0.0027	-0.0171	0.0166	0.004006	6	7	-26	62
47-009-0101	-0.0081	-0.0299	0.00525	0.005027	5	-15	-56	15
47-009-0102	0.0093	-	0.0326	0.005699	5	26	-5	138
47-089-0002	-0.002	-0.0191	0.026	0.004266	6	-4	-48	62
47-093-0021	0.0019	-0.0064	0.0252	0.002777	4	5	-19	194
47-093-1020	-3.00E-	-0.0183	0.0141	0.003751	6	1	-43	129
47-105-0109	0.0011	-0.0171	0.027	0.004759	5	4	-27	123
47-155-0101	-0.0046	-0.0353	0.0143	0.004537	7	-9	-60	40
47-155-0102	-0.0101	-0.0359	0.00151	0.005424	6	-19	-62	3

Table 7

Chattanooga 16860

2010 to 2014 8 Hour Ozone Correlation Analysis Statistics

MSA Name / County	CBSA	MSA Name / County	Chattanooga	
		CBSA	16860	
MSA Name / County	CBSA	*AQS ID (Note: All sites may not have 2010 data reported)**	470651011-1	470654003-1
Chattanooga	16860	470651011-1	1	
		470654003-1	0.947	1

See recommendations provided by the Chattanooga local program.

Site ID	Mean Removal Bias	Min Removal Bias	Max Removal Bias	Removal Bias Standard Deviation	Neighbors Included	Mean Relative Removal Bias (%)	Min Relative Removal Bias (%)	Max Relative Removal Bias (%)
47-065-1011	7.00E-04	-0.00769	0.0123	0.0029624	5	2	-21	41
47-065-4003	-0.001	-0.0145	0.0074	0.003104	5	-2	-30	26

Table 8

Kingsport 28700

2010 to 2014 8 Hour Ozone
Correlation Analysis Statistics

		MSA Name / County	Kingsport	
		CBSA	28700	
MSA Name / County	CBSA	*AQS ID (Note: All sites may not have 2010 data reported)**	471632002-1	471632003-1
Kingsport	28700	471632002-1	1	
		471632003-1	0.97	1

Required number of sites that must remain operating	Number of high correlation sites and number that are (redundant)	Number of sites that could be shut down and still meet the minimum requirements	Number of sites used (needed) for AQI forecasting	Number of sites that have low correlation results and support forecasting	Number of sites proposed to remain operating	New site locations needed for: (1 forecasting) (2 new stds) (3 PSD) (4 SIP Maint.)	Existing sites to continue to be operated
1	2(1)	1	2 (2)	0	2	0	2

Table 9

Sevierville 42940

2010 to 2014 8 Hour Ozone Correlation Analysis Statistics

		MSA Name / County	Knoxville						Sevierville		Claiborne Co.
		CBSA	28940						42940		None
MSA Name / County	CBSA	*AQS ID (Note: All sites may not have 2010 data reported)**	470010101-1	470090101-1	470090102-1	470930021-1	470931020-1	471050109*	471550101-1	471550102-1	470259991-1*
Sevierville	42940	471550101-1	0.257	0.932	0.374	0.277	0.298	0.251	1		
		471550102-1	0.147	0.786	0.247	0.174	0.192	0.148	0.867	1	
Claiborne Co.	None	470259991-1*	0.911	0.37	0.769	0.903	0.891	0.869	0.261	0.143	1

The monitoring sites in this evaluation are operated by the NPS and the EPA.

The analysis indicates that a high degree of correlation exists with one of the Anderson Co. site (470010101) and the Claiborne Co. site (470259991). A high correlation was also noted between the Claiborne Co. site and the Knox Co. site (470930021). A high correlation was also noted between the Sevier Co. site (471550101) and the Blount Co. site (470090101). The distances between the sites in question are of further interest in that they are a significant distance apart.

The current analysis of ozone monitoring sites operated in 2014 and currently operating in 2015 see table 10 below, indicate the following areas have existing ozone monitoring networks currently in operation. The PQAO's for each monitoring agency are identified by network and the state (if outside of Tennessee) is also identified. The required number of sites and the actual number of operating sites are also identified. In more than one MSA, the number

of operating sites exceeds the number required to be operated based on the requirements found in Table D2 above. These sites may be potentially redundant sites and should be evaluated for correlation to other sites in the MSA.

Table 10

MSA Monitor Requirements

Monitoring Program	Census Area Identification and Population			44201 Ozone		
State / PQAO	CBSA Code	Census 2010 / 2014	CBSA Title (MS Areas)	Operating	2012 2014 8 Hr DV	Required
GA 0437	16860	528143 / 544559	Chattanooga, TN-GA		0.069	
TN 0170				2		2
TN 1025						
KY 0584	17300	260625 / 278353	Clarksville, TN-KY	1	0.067	1
TN 0953						
TN 1025						
TN 0375	28700	309544 / 308079	Kingsport-Bristol-Bristol, TN-VA		0.068	1
TN 1025				2		
TN 1026						
VA 1127						
TN 0581	28940	837571 / 857585	Knoxville, TN	2	.069	2
NPS 0745				2		
TN 1025				2		
TN 1027						
AR 0055	32820	1324829 / 1343230	Memphis, TN-MS-AR	1	0.073	2
MS 073				1		
TN 0673				3		
TN 1025						
TN 1025	34100	113951 / 115713	Morristown, TN	1	0.071	1
TN 0682	34980	1670890 / 1792649	Nashville-Davidson--Murfreesboro, TN	2	0.072	2
TN 1025				3		

Tennessee PM2.5 Sites Correlation Analysis

24 hour sample data for the PM2.5 FRM samplers were downloaded from EPA's AQS. All sites, including the TDEC and local program operated sites were included and processed. These datasets were then processed using the Excel Correlation analysis data analysis tool.

PM2.5 Sites Correlation Analysis Discussion

The following table (Table 1), depicts the correlation analysis performed on the PM2.5 data sets for the Tennessee operated monitoring sites reporting data between 2013 and 2014. Sites that operated in 2014 are also operating in 2015. Correlation values that were in excess of 0.90 are shown in black bold text. All of the cells are color coded with the lowest correlation value shown in light red shading up to dark red (the highest correlation). (See example)

0.526	0.769	**0.902**

The individual sites were evaluated for the relative distance to each other and were grouped by MSA/CBSA area so that the sites within a given MSA/CBSA area were able to be clustered near a site in the same MSA/CBSA area. This allowed for a simpler grouping analysis of the sites that are expected to be more highly correlated in comparison to sites some distance away.

For the purpose of this study, any sites that have a correlation in excess of 0.90, are considered to be highly correlated with another site and are considered to be a site that could be evaluated for either shutdown or relocation. Sites that have lower or low correlations are considered to be sites that should be considered to remain operating as long as they perform a needed function for the overall network.

In some cases, because of the population requirements found in 40CFR 58 Subpart G, Appendix D, the actual number of monitors required in a given PM2.5 network must be maintained so that at least the minimum monitoring requirements are met. The following example may explain this more clearly. Table D-5 from Appendix D provides the number of monitoring sites requires. Table 2 evaluates the number of sites in the network and the minimum requirements for the network. Table 3 depicts additional needs that the sites are used for and if any new sites are needed or site relocations are needed to meet those requirements.

Table 1 Tennessee PM2.5 Site Correlation Analysis

2013 - 2014 PM2.5 FRM Correlation Analysis Statistics

	MSA Name	Athens	Chattanooga			Clarksville	Cookeville	Dyersburg	Jackson	Kingsport	Knoxville							Lawrenceburg	Memphis		Nashville			
	CBSA	11940	16860			17300	18260	20540	27180	28700	28940							29980	32820		34980			
MSA Name	CBSA	AQSID	471071002-1	470650031-1	470651011-1	470654002-1	471251009-1	471410005-1	470450004-1	471130006-1	471631007-1	470090011-1	470930028-1	470931013-1	470931017-1	470931020-1	471050108-1	471450004-1	470990002-1	471570047-1	471570075-1	470370023-1	470370036-1	471192007-1	471650007-1
Athens	11940	*471071002-1*	1																					
Chattanooga	16860	*470650031-1*	0.847	1																				
		470651011-1	0.871	0.87	1																			
		470654002-1	0.867	**0.93**	**0.94**	1																		
Clarksville	17300	*471251009-1*	0.529	0.5	0.42	0.46	1																	
Cookeville	18260	*471410005-1*	0.741	0.69	0.71	0.68	0.711	1																
Dyersburg	20540	*470450004-1*	0.535	0.51	0.45	0.52	0.819	0.721	1															
Jackson	27180	*471130006-1*	0.577	0.56	0.48	0.54	0.817	0.754	**0.931**	1														
Kingsport	28700	*471631007-1*	0.729	0.72	0.72	0.73	0.527	0.636	0.508	0.528	1													
Knoxville	28940	*470090011-1*	0.839	0.81	0.83	0.8	0.491	0.756	0.496	0.518	0.76	1												
		470930028-1	0.847	0.84	0.84	0.85	0.421	0.702	0.48	0.512	0.788	**0.93**	1											
		470931013-1	0.825	0.85	0.83	0.84	0.403	0.692	0.39	0.451	0.76	**0.9**	**0.94**	1										
		470931017-1	0.813	0.8	0.78	0.81	0.441	0.693	0.471	0.526	0.769	**0.9**	**0.95**	**0.92**	1									
		470931020-1	0.841	0.82	0.88	0.85	0.429	0.721	0.496	0.533	0.836	**0.91**	**0.94**	**0.95**	**0.94**	1								
		471050108-1	0.839	0.83	0.79	0.82	0.524	0.736	0.52	0.562	0.783	0.88	0.89	0.87	0.88	0.87	1							
		471450004-1	0.85	0.79	0.85	0.83	0.52	0.762	0.52	0.545	0.782	0.87	0.88	0.85	0.84	0.89	0.87	1						
Lawrenceburg	29980	*470990002-1*	0.719	0.69	0.68	0.69	0.706	0.794	0.735	0.813	0.583	0.62	0.65	0.59	0.61	0.66	0.67	0.63	1					
Memphis	32820	*471570047-1*	0.49	0.49	0.37	0.43	0.713	0.664	0.817	0.817	0.394	0.47	0.38	0.39	0.38	0.37	0.49	0.45	0.625	1				
		471570075-1	0.523	0.5	0.4	0.49	0.745	0.689	0.885	0.899	0.461	0.52	0.5	0.33	0.47	0.47	0.54	0.51	0.676	0.89	1			
Nashville	34980	*470370023-1*	0.614	0.63	0.49	0.57	0.872	0.819	0.792	0.845	0.579	0.64	0.56	0.51	0.59	0.54	0.66	0.62	0.786	0.71	0.76	1		
		470370036-1	0.602	0.61	0.47	0.55	0.882	0.822	0.806	0.839	0.593	0.62	0.57	0.5	0.58	0.54	0.63	0.61	0.784	0.7	0.75	**0.94**	1	
		471192007-1	0.699	0.66	0.61	0.66	0.8	0.833	0.784	0.828	0.59	0.63	0.63	0.53	0.62	0.64	0.65	0.64	0.899	0.66	0.73	0.84	0.85	1
		471650007-1	0.663	0.66	0.55	0.61	0.871	0.833	0.8	0.845	0.658	0.65	0.64	0.54	0.66	0.64	0.68	0.66	0.81	0.68	0.74	**0.95**	**0.94**	0.87

TABLE D–5 OF APPENDIX D TO PART 58 $PM_{2.5}$ MINIMUM MONITORING REQUIREMENTS

MSA population[1, 2]	Most recent 3-year design value concentrations ≥85% of any $PM_{2.5}$ NAAQS[3]	Most recent 3-year design value concentrations <85% of any $PM_{2.5}$ NAAQS[3,4]
>1,000,000	3	2
500,000–1,000,000	2	1
50,000–<500,000 [5]	1	0

1 Minimum monitoring requirements apply to the Metropolitan statistical area (MSA).

2 Population based on latest available census figures.

3 The $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) levels and forms are defined in 40 CFR part 50.

4 These minimum monitoring requirements apply in the absence of a design value.

Table 2 Example of site evaluation

Number of sites in area with DV ≥85% of PM2.5 NAAQS	Minimum number of sites required for area with population of >50,000 and <1 million	Number of sites above minimum required.	Number of sites with high degree of correlation (.0.90) and subject to consideration for (shutdown or relocation)	Number of low correlation sites
7	2	5	4 (3)	3

Table 3 Example of recommendation based on evaluation

Required number of sites that must remain operating	Number of high correlation sites and number that are (redundant)	Number of sites that could be shut down and still meet the minimum requirements	Number of sites that have low correlation results	Number of sites proposed to remain operating	New site locations needed for: (1 new stds) (2 PSD) (3 SIP Maint.)	Existing sites to continue to be operated
2	4 (3)	5	2	2	0	2

The final determination of the remaining sites to be left operating needs to be based on the potential value of the sites in relation to the network needs. In this example up to 4 of the high correlation sites might be shut down leaving 1 of the five highly correlated sites and 1 other site. In this case no new sites are proposed to be installed and 2 existing sites will be used to

meet the network requirements. The following tables (Table 4 through Table 9) depict the correlations in each of the major metropolitan areas that have more than one PM2.5 monitoring site.

Site Removal Bias

The removal bias estimation uses the nearest neighbors to each site to estimate the concentration at the location of the site if the site had never existed. This is done using the Voronoi Neighborhood Averaging algorithm with inverse distance squared weighting. The squared distance allows for higher weighting on concentrations at sites located closer to the site being examined. The bias was calculated for each day at each site by taking the difference between the predicted value from the interpolation and the measured concentration. A positive average bias would mean that if the site being examined was removed, the neighboring sites would indicate that the estimated concentration would be larger than the measured concentration. Likewise, a negative average bias would suggest that the estimated concentration at the location of the site is smaller than the actual measured concentration.

Specific Network Assessments by MSA/CBSA

Table 4

Chattanooga 16860

2013 - 2014 PM2.5 FRM
Correlation Analysis Statistics

		MSA Name	Chattanooga		
		CBSA	16860		
MSA Name	CBSA	AQSID	470650031-1	470651011-1	470654002-1
Chattanooga	16860	*470650031-1*	1		
		470651011-1	0.87	1	
		470654002-1	0.93	0.94	1

Required number of sites that must remain operating	Number of high correlation sites and number that might be (redundant)	Number of sites that might be shut down and still meet the minimum requirements	Number of sites used (needed) for AQI forecasting	Number of sites that have low correlation results	Number of sites proposed to remain operating	New site locations needed for: (1 forecasting) (2 new stds) (3 PSD) (4 SIP Maint.)	Existing sites to continue to be operated
1	2(1)	2	0 (0)	1	3	0	3(2)

Site ID	Mean Removal Bias	Min Removal Bias	Max Removal Bias	Removal Bias Standard Deviation	Neighbors Included	Mean Relative Removal Bias (%)	Min Relative Removal Bias (%)	Max Relative Removal Bias (%)
47-065-1011	7.00E-04	-0.00769	0.0123	0.0029624	5	2	-21	41
47-065-4003	-0.001	-0.0145	0.0074	0.003104	5	-2	-30	26

Table 5

Jackson 27180/Dyersburg 20540

2013 - 2014 PM2.5 FRM Correlation Analysis Statistics

		MSA Name	Dyersburg	Jackson
		CBSA	20540	27180
MSA Name	CBSA	AQSID	470450004-1	471130006-1
Dyersburg	20540	*470450004-1*	1	
Jackson	27180	*471130006-1*	0.931	1

Required number of sites that must remain operating	Number of high correlation sites and number that might be (redundant)	Number of sites that might be shut down and still meet the minimum requirements	Number of sites used (needed) for AQI forecasting	Number of sites that have low correlation results	Number of sites proposed to remain operating	New site locations needed for: (1 forecasting) (2 new stds) (3 PSD) (4 SIP Maint.)	Existing sites to continue to be operated
0	0	0	0 (0)	0	1	0	1

Table 6

Knoxville 28940

2013 - 2014 PM2.5 FRM Correlation Analysis

Statistics

		MSA Name	Knoxville						
		CBSA	28940						
MSA Name	CBSA	AQSID	470090011-1	470930028-1	470931013-1	470931017-1	470931020-1	471050108-1	471450004-1
Knoxville	28940	470090011-1	1						
		470930028-1	0.93	1					
		470931013-1	0.9	0.94	1				
		470931017-1	0.9	0.95	0.92	1			
		470931020-1	0.91	0.94	0.95	0.94	1		
		471050108-1	0.88	0.89	0.87	0.88	0.87	1	
		471450004-1	0.87	0.88	0.85	0.84	0.89	0.87	1

Required number of sites that must remain operating	Number of high correlation sites and number that might be (redundant)	Number of sites that might be shut down and still meet the minimum requirements	Number of sites used (needed) for AQI forecasting	Number of sites that have low correlation results	Number of sites proposed to remain operating	New site locations needed for: (1 forecasting) (2 new stds) (3 PSD) (4 SIP Maint.)	Existing sites to continue to be operated
2	4(2)	5	0 (0)	2	7	0	7

Site ID	Mean Removal Bias	Min Removal Bias	Max Removal Bias	Removal Bias Standard Deviation	Neighbors Included	Mean Relative Removal Bias (%)	Min Relative Removal Bias (%)	Max Relative Removal Bias (%)
47-009-0011	0.444	-5.5	2.71	1.308701891	7	7	-48	70
47-093-0028	0.529	-10.1	5.91	1.408125951	8	10	-77	258
47-093-1013	-0.1456	-8.41	2.63	1.51011657	3	-1	-93	48
47-093-1017	-0.5066	-5.79	8.86	1.240100958	5	23	-42	8855
47-093-1020	0.2958	-9.4	7.03	1.824007346	7	4	-224	131
47-105-0108	0.7498	-3.71	6	1.741673635	5	16	-31	207

Table 7

Nashville 34980

2013 - 2014 PM2.5 FRM Correlation Analysis Statistics

MSA Name	CBSA	Nashville			
		34980			
		470370023-1	470370036-1	471192007-1	471650007-1
Nashville	34980	1			
		0.94	1		
		0.84	0.85	1	
		0.95	0.94	0.87	1

Required number of sites that must remain operating	Number of high correlation sites and number that might be (redundant)	Number of sites that might be shut down and still meet the minimum requirements	Number of sites used (needed) for AQI forecasting	Number of sites that have low correlation results	Number of sites proposed to remain operating	New site locations needed for: (1 forecasting) (2 new stds) (3 PSD) (4 SIP Maint.)	Existing sites to continue to be operated
3	3(3)	1	0 (0)	1	4	0	4

Site ID	Mean Removal Bias	Min Removal Bias	Max Removal Bias	Removal Bias Standard Deviation	Neighbors Included	Mean Relative Removal Bias (%)	Min Relative Removal Bias (%)	Max Relative Removal Bias (%)
47-037-0023	-0.7498	-6.5	10.9	1.452768991	4	-3	-54	1848
47-037-0036	0.5771	-10.9	6.15	1.443316347	4	8	-46	111
47-165-0007	0.6616	-3.41	10.1	1.246366393	6	52	-37	10094

The current analysis of PM2.5 FRM monitoring sites operated in 2014 and currently operating in 2015 (see table 8 below), indicate the following areas have existing PM2.5 monitoring networks currently in operation. The PQAO's for each monitoring agency are identified by network and the state (if outside of Tennessee) is also identified. The required number of sites and the actual number of operating sites are also identified. In more than one MSA, the number of operating sites exceeds the number required to be operated based on the requirements found in Table D - 5 above. These sites may be potentially redundant sites and should be evaluated for correlation to other sites in the MSA.

Table 8

MSA Monitor Requirements

Monitoring Program	Census Area Identification and Population			88101 PM2.5			
State / PQAO	CBSA Code	Census 2010 / 2014	CBSA Title (MS Areas)	Operating	2012 2014* Annual DV ug/m3	2012 2014* 24 Hr DV ug/m3	Required
GA 0437	16860	528143 / 544559	Chattanooga, TN-GA	1	9.6	19	2
TN 0170				3			
TN 1025							
KY 0584	17300	260625 / 278353	Clarksville, TN-KY		9.2	21	0
TN 0953							
TN 1025				1			
TN 0112	17420	115788 / 119705	Cleveland, TN	0			0
TN 1025							
TN 1025	27180	130011 / 130225	Jackson, TN	1	8.6	18	0
TN 1025	27740	198716 / 201091	Johnson City, TN	0			0
TN 0375	28700	309544 / 308079	Kingsport-Bristol-Bristol, TN-VA		8.6	15	0
TN 1025				1			
TN 1026							
VA 1127							
TN 0581	28940	837571 / 857585	Knoxville, TN	4	10.2	19	2
TN 0921							
NPS 0745							
TN 1025				3			
TN 1027							
AR 0055	32820	1324829 / 1343230	Memphis, TN-MS-AR		9.5	21	2
MS 073							
TN 0673				2			
TN 1025							
TN 1025	34100	113951 / 115713	Morristown, TN	0			0
TN 0682	34980	1670890 / 1792649	Nashville-Davidson--Murfreesboro, TN	2	10.3	20	3
TN 1025				1			

*The PM2.5 statistic presented represents the 2013 to 2014 DV except for the Chattanooga MSA.

Micropolitan Monitor Requirements

Monitoring Program	Census Area Identification and Population			88101 PM2.5			
State / PQAO	CBSA Code	Census 2010 / 2014	CBSA Title (MicroS Areas)	Operating	2012 2014* Annual DV ug/m3	2012 2014* 24 Hr DV ug/m3	Required
TN 0112	11940	52266 / 52626	Athens. TN				0
TN 1025				1	8.9	17	

*The PM2.5 statistic presented represents the 2013 to 2014 DV except for the Chattanooga MSA.

Source Compliance with the Lead Emissions Threshold for Monitoring in Tennessee

After receiving an inquiry from EPA requesting a status update for lead sources that are showing NEI emissions of greater than or equal to 0.5 ton lead per year (monitoring emissions threshold), TAPCD evaluated and then contacted all of the identified lead sources to confirm their emissions data calculations and verify that they were in fact in excess of the 0.5 ton threshold.

The following information was requested by EPA to address the need for source oriented lead air monitoring sites:

1. Identify any new or proposed Pb monitoring sites near new sources with emissions over 0.5 tpy in the 2011 NEI.

Tennessee does not have any new or proposed air monitoring sites that are the result of a lead source having emissions in excess of the 0.5 TPY thresholds. There are two facilities in Tennessee with current lead air monitoring networks in place and operating. The first is the Exide facility in Sullivan County. This facility has formally shut down and surrendered its permits and is no longer in operation. The facility is also located in a lead non-attainment area that recently received a CDD from EPA and in now undergoing re-designation to attainment. The facility operates an industrial lead air monitoring network and the state operates a second air monitoring network in the immediate area near the plant site within the nonattainment area boundary. The second facility is located in Knox County and is the Gerdau Ameristeel facility that currently operates in the Knoxville area. This facility has an lead air monitoring network operated by the Knoxville Local Program.

2. Provide a copy of any waiver requests for source-oriented monitoring.

Tennessee does not have any previous, current or future proposed waiver requests for source oriented lead monitoring. Tennessee believes the state has correctly evaluated the NEI emissions data provided by EPA and independently obtained by the state staff and conclude that no waivers are required at this time.

3. Provide the revised emissions calculations for any applicable sources that now show the source is below the 0.5 TPY thresholds.

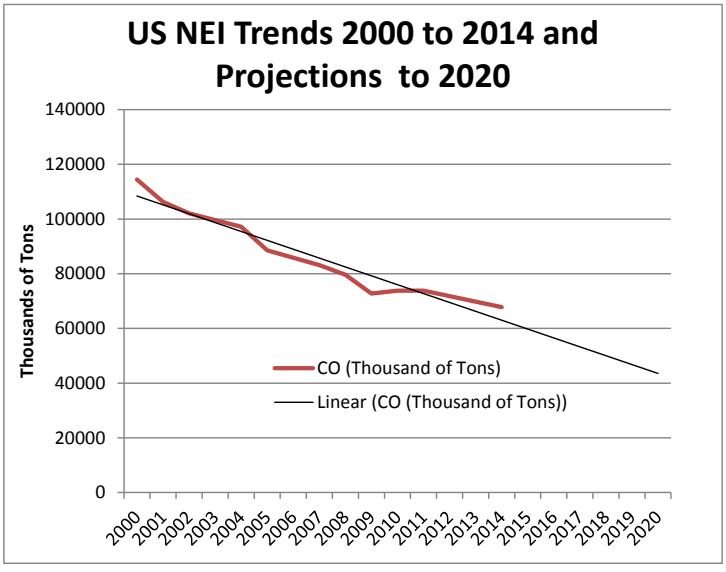
Tennessee has evaluated the list of 5 sources and calculated emissions as found in the 2011 NEI and has determine that errors were reported in the NEI for the NYRSTAR (Montgomery County), Gerdau (Madison County) and DENSO Manufacturing (Blount County). The corrected emissions data has been requested from each of the facilities and they have in turn provided the data. The revised lead emissions were then updated to the NEI system. Permit modifications have been completed for the DENSO facility with additional permit modifications currently underway for the other two identified sources. The Exide facility (Sullivan County) is no longer operating and has surrendered its permits as a lead source. The Gerdau Ameristeel (Knox County) emissions remain unchanged. Both of these two remaining facilities have an existing air monitoring network in place.

The following table confirms the findings from that evaluation and the subsequent evaluation and revisions made to the NEI to correct the emission levels in excess of 0.5 TPY.

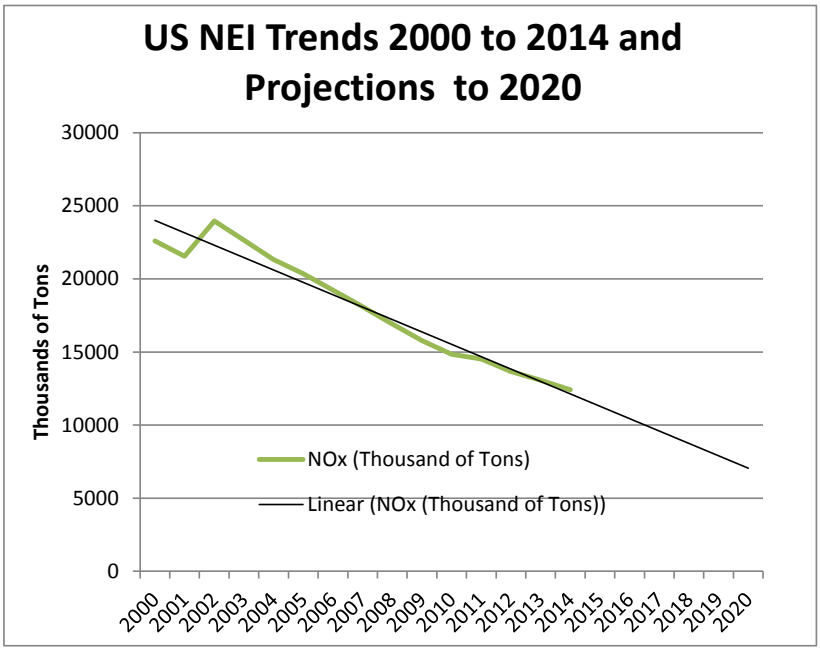
State	County	Site Name	October 2014 NEI Lead (tons) Reported	May 2015 NEI Lead (tons) Reported	Facility Type	City	Zip Code	NAICS Code	NAICS Description	FIPS	Street Address	EIS_Identifier
TN	Montgomery	NYRSTAR CLARKSVILLE, INC.	3.42	0.178	Mines/Quarries	CLARKSVILLE	37040	212231	Lead Ore and Zinc Ore Mining	47125	1800 ZINC PLANT RD.	4964211
Comment:	NYRSTAR has identified errors in the emissions data reported to NEI and has submitted corrections for 2011 showing the facility emissions to be 0.178 TPY. These data are now reflected in the NEI report for 2011.											
TN	Madison	GERDAU AMERISTEEL	2.39	0.168	Steel Mill	JACKSON	38305	331110		47113	801 GERDAU AMERISTEEL RD	4014511
Comment:	GERDAU AMERISTEEL appears to have reported emissions based on the 2011 stack test in excess of the 0.5 TPY threshold, however, a followup stack test performed in 2013 indicates that the actual emission levels are below the 0.5 TPY threshold. The facility emissions have been updated to the NEI accordingly with 0.168 TPY in 2014, 0.151 TPY in 2013, 0.173 TPY in 2012 and 0.21 TPY in 2011.											
TN	Blount	DENSO MANUFACTURING TENNESSEE, INC.	1.2	0.25	Automobile/Truck or Parts Plant	MARYVILLE	37801	336320		47009	1720 ROBERT C. JACKSON DRIVE	7126911
Comment:	Denso has sent in a letter dated Oct. 28, 2014 clarifying their emissions are 0.25 TPY and requesting that their combined permit allowables be set at 0.2 TPY of lead. Their current actual lead emissions are 7.32 pounds per year. This has already been updated to the NEI by Ron Ryan with EPA changing the 2011 data from 1.2 to 0.25 TPY lead. Need to resolve the three identified emission points all shown as DENSO.											
TN	Sullivan	Exide Techs	0.74	Shut down.	Battery Plant	Bristol	37620	335911	Storage Battery Manufacturing	47163	364 Exide Dr.	3812811
Comment:	Air monitoring for Lead already underway and being conducted by TDEC and the company. Facility is in a mothballed status but has retained TV permits.											
TN	Knox	Gerdau Ameristeel	0.72		Steel Mill	Knoxville	37921	331110		47093	1919 Tennessee Avenue	2898511
Comment:	Air monitoring for Lead already underway and being conducted by the Knoxville Local Program.											

Emissions Summary and Future Years Projections

The criteria pollutant levels measured by air monitoring networks are a general indicator of the emission inventories of those pollutants for a given area. Evaluation of the historic trends of those emission inventories may serve as a general indicator of the future air quality trends and a predictor for area compliance and attainment of the NAAQS criteria pollutants. The following charts provide national emission inventory trend data for the entire US. The NEI trends are displayed from 2000 to 2014 and these data are used to project the levels of the pollutants out to the year 2020. These national trends are based on all source categories and not just point source emissions. All of the future case projections are made using a linear trend model and assume the observed reductions over time will continue into the future. It should also be noted that in addition to the overall trends observed nationally, there are similar trends noted at the state level in Tennessee. Additional discussion of the impacts these future reductions may have is presented later, but it is important to note in Tennessee, specific changes to the number and types of sources contributing significantly to the states emissions inventory is expected to have lasting and quantifiable impacts to the states over –all air quality.



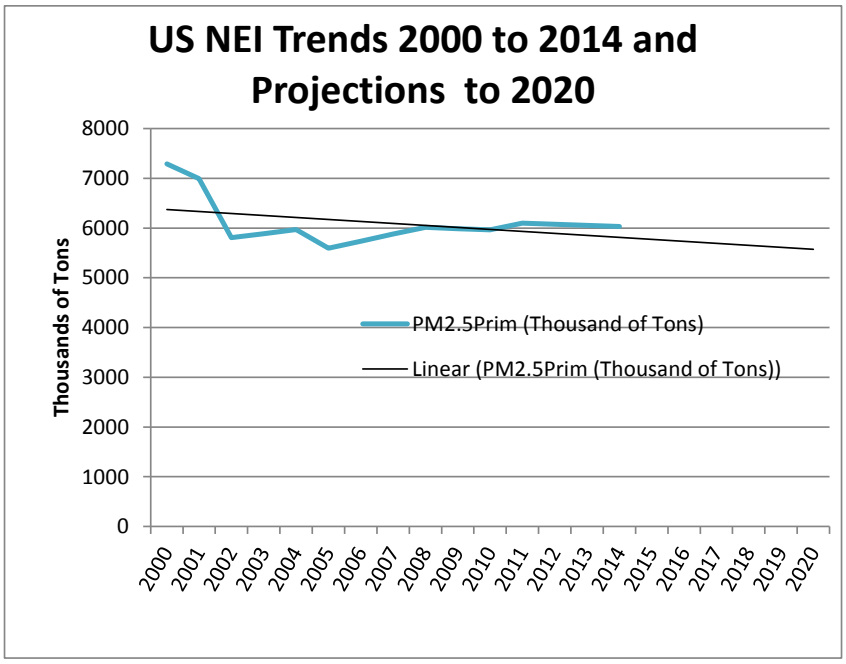
The CO inventory data shows a continued decline in emissions beginning before the year 2000 and is expected to continue to decline into the future. These reductions are in part due to the improvements in automobile and mobile source fuel efficiency and lowered emission requirements over time. The same holds true for the next chart for NOx.

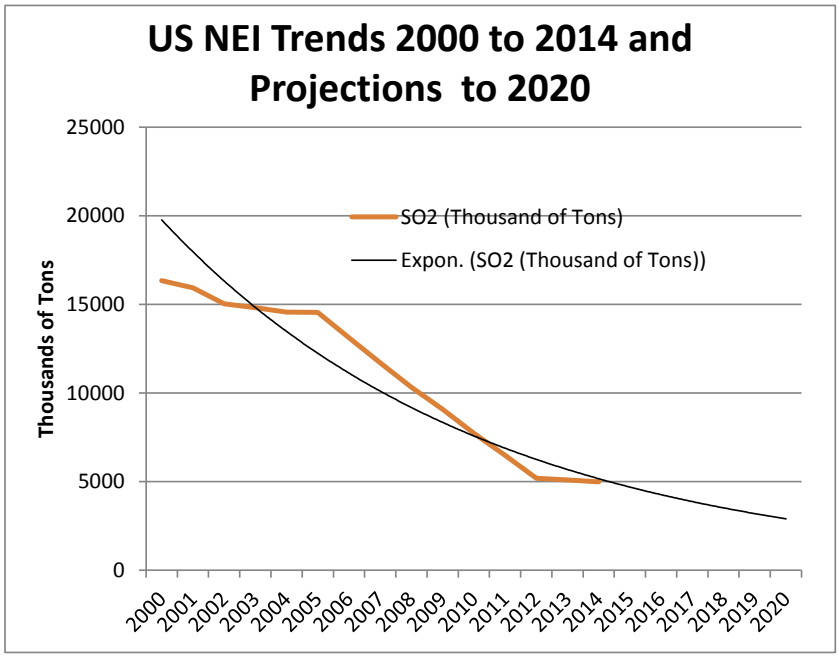


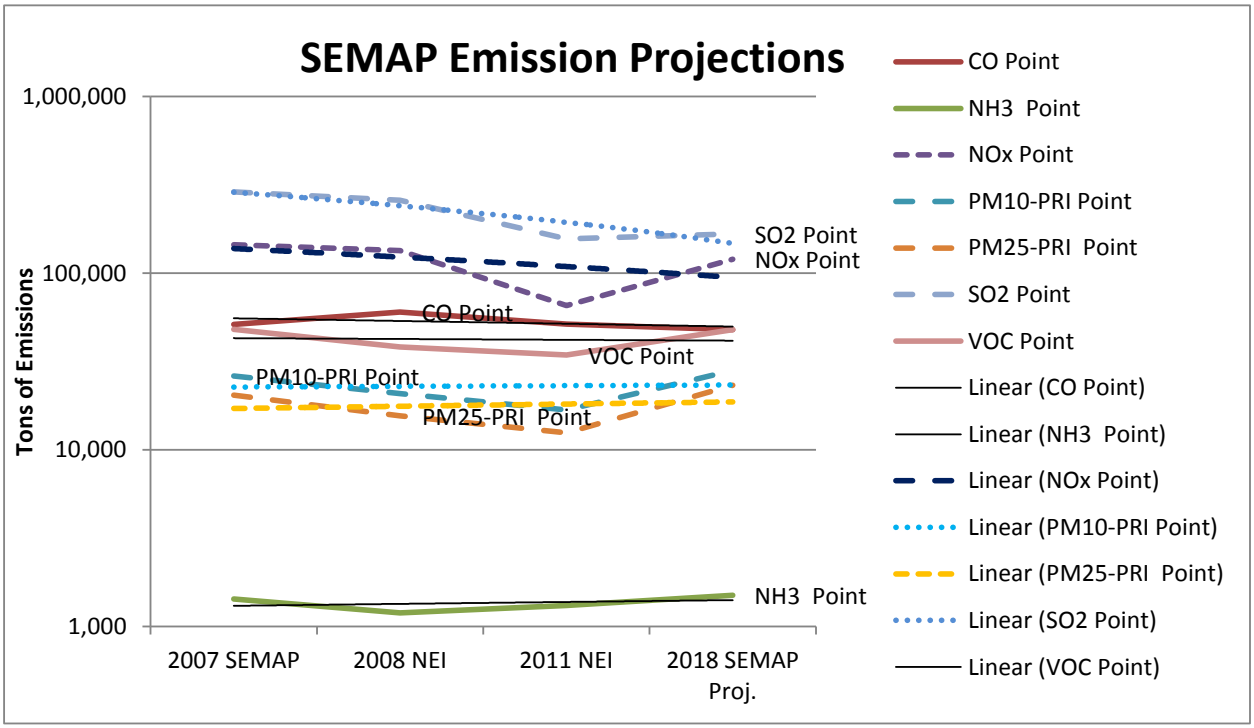
NOx emissions are also showing a reduction over time. The larger fuel burning sources have been required to address excess NOx emissions and implement source specific emission reductions specifically addressing some of the largest coal fired EGU's and other fuel burning sources. Recent changes in the actual and projected needs for electrical power, has produced a reduction in the number of needed operational coal fired power plants and the opportunity to idle some of the capacity of other plants throughout the US. Other plants are being completely shut down and still others are being converted to burn natural gas, a much cleaner fuel that may also show promise for further NOx reductions over time. Some existing plants are installing more

efficient NOx emission controls as a part of the mandated reductions required in the NOx SIP call. Other plants are being required to make additional emission reductions as required by BART and the Regional Haze rules. These reductions are also impacting other emission categories.

The next chart shows the PM2.5 primary emission reductions and the promise of additional future reductions out to 2020 as the precursor emissions of sulfates and nitrates, direct (SO2 and NOx) and the directly emitted black carbon particulates are gradually being reduced over time. The benefits of shifting away from coal and greater utilization of natural gas will also benefit the PM2.5 and SO2 emission inventory. The SO2 inventory chart shows a rapid future decline to little or no SO2 emissions, where in reality the SO2 inventory is likely to remain elevated but at a much lower level than is depicted from the 2014 data point. The SO2 SEMAP point source emission inventory future case chart for Tennessee show a likely leveling off of this trend.

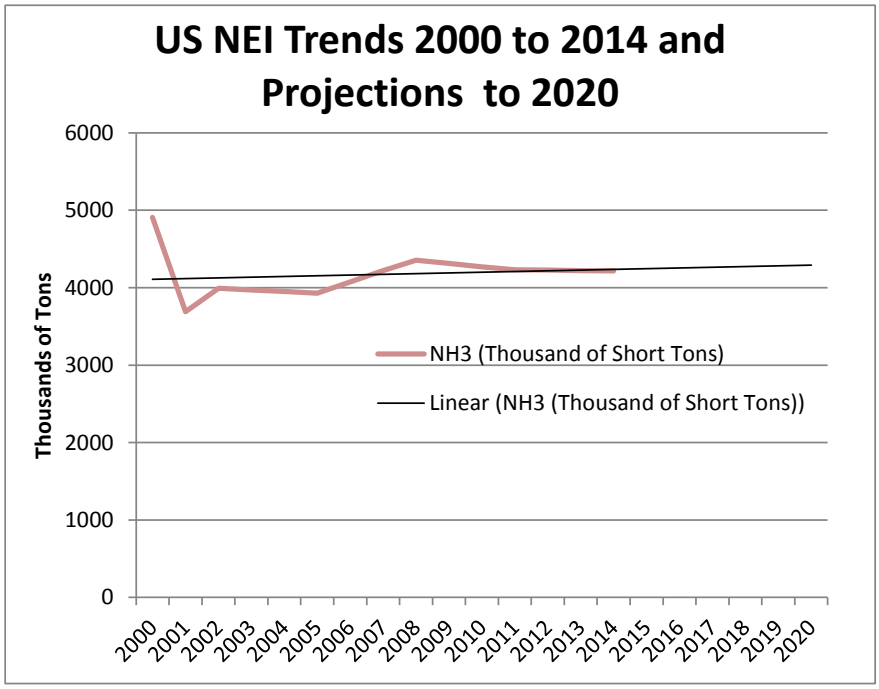



US NEI Trends 2000 to 2014 and Projections to 2020
Thousands of Tons
25000
20000
15000
10000
5000
0
SO2 (Thousand of Tons)
Expon. (SO2 (Thousand of Tons))
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020


SEMAP Emission Projections
Tons of Emissions
1,000,000
100,000
10,000
1,000
SO2 Point
NOx Point
CO Point
VOC Point
PM10-PRI Point
PM25-PRI Point
NH3 Point
2007 SEMAP
2008 NEI
2011 NEI
2018 SEMAP Proj.
CO Point
NH3 Point
NOx Point
PM10-PRI Point
PM25-PRI Point
SO2 Point
VOC Point
Linear (CO Point)
Linear (NH3 Point)
Linear (NOx Point)
Linear (PM10-PRI Point)
Linear (PM25-PRI Point)
Linear (SO2 Point)
Linear (VOC Point)

The historic and future case trends for VOC's indicate a more gradual decline over time and in the case of Tennessee actually show a projected rise over time with the reductions gained in 2008 and 2011 slowly reversing to levels near the 2007 SEMAP base. The minor increase this may indicate is more than offset by the NOx reductions projected in the NOx limited ozone region Tennessee is a part of.

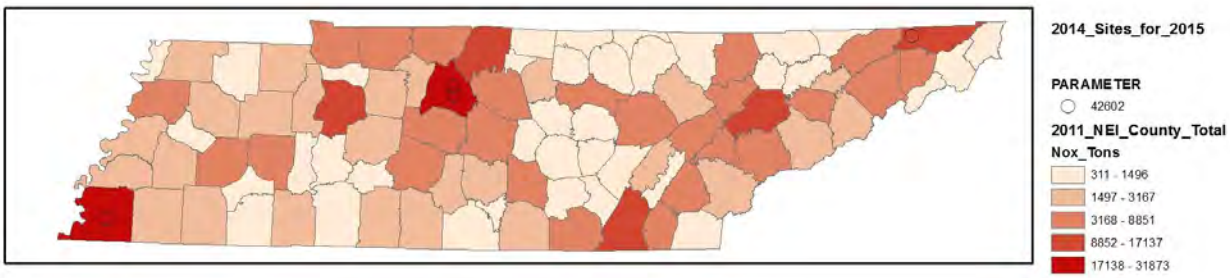
The final chart provides an indication of the national trends anticipated in ammonia (NH3) emissions. This is relatively similar to the projections anticipated in the SEMAP point source chart with regard to the anticipated gradual increase in reported emissions over time.

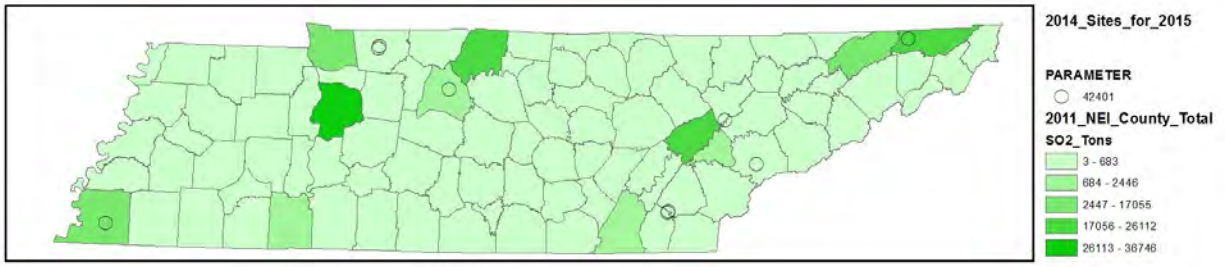


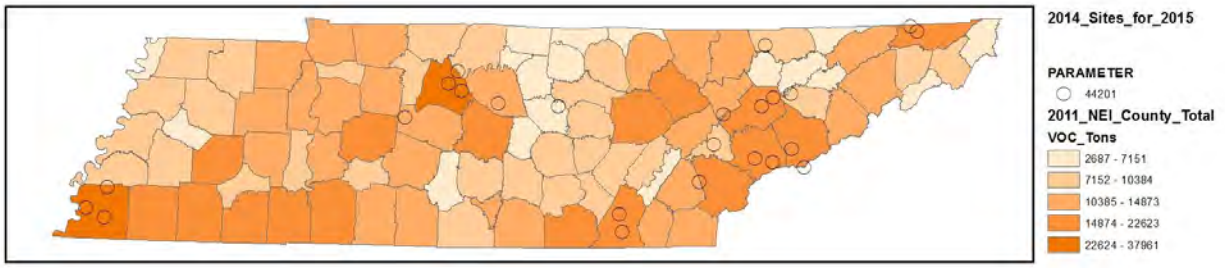
The relative distribution of the most recent NEI emissions data for Tennessee is depicted in the following graphic which also includes the locations of the air monitoring sites that either monitor for that pollutant or are used in part as a surrogate to represent that pollutant (VOC and NOx for ozone and NOx and SO2 along with NH3 to represent PM2.5). There are also primary PM2.5 emissions from black carbon and also directly emitted fine particulates. This map and the

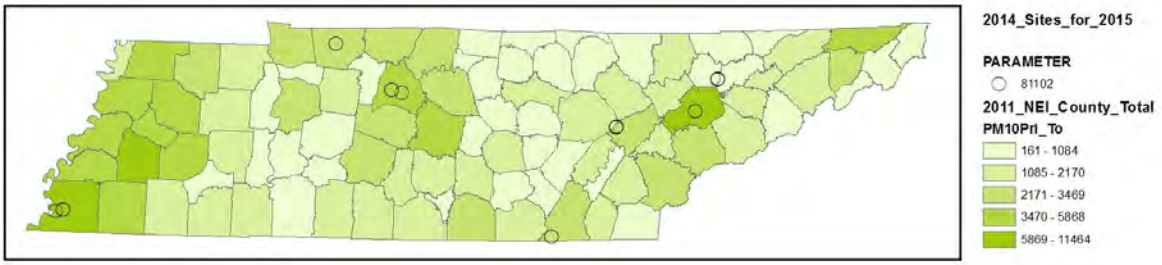
relative locations of the monitoring sites help to inform strategy of monitoring for both the emitted pollutants and the secondary formation of other pollutants. In this instance, most of the counties with the largest contributions of the various pollutants identified in the inventory, have existing monitoring sites; in some case with multiple sites in the same county. There are no plans to adjust the current monitoring network sites based on the current or projected future emission densities observed in Tennessee.

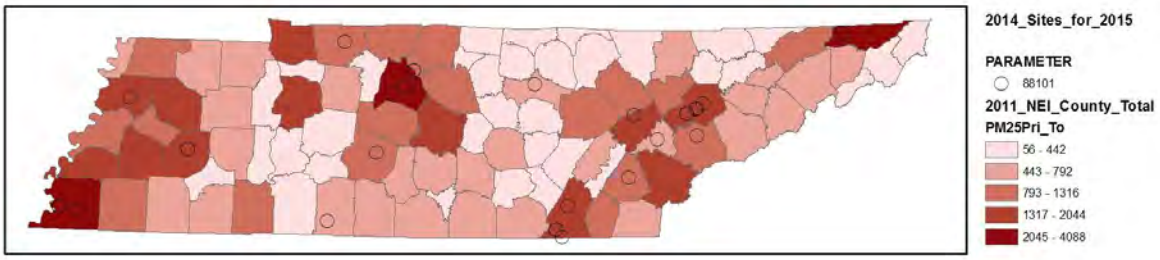

2014_Sites_for_2015
PARAMETER
42101
2011_NEI_County_Total
CO_Tons
1916 - 9208
9209 - 18053
18054 - 37716
37717 - 81027
81028 - 134716

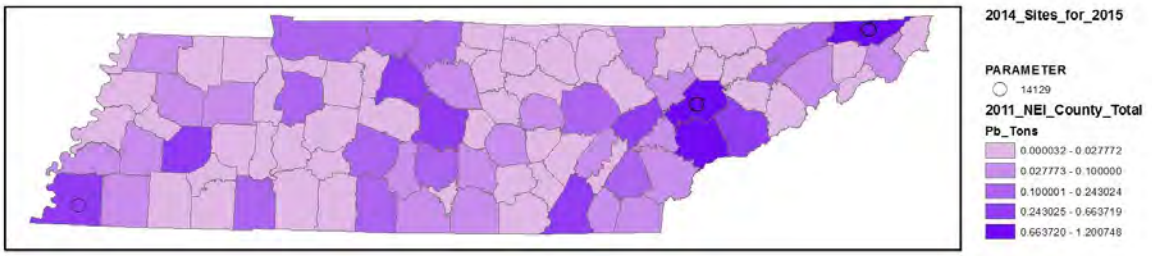

2014_Sites_for_2015
PARAMETER
42602
2011_NEI_County_Total
Nox_Tons
311 - 1496
1497 - 3167
3168 - 8851
8852 - 17137
17138 - 31873

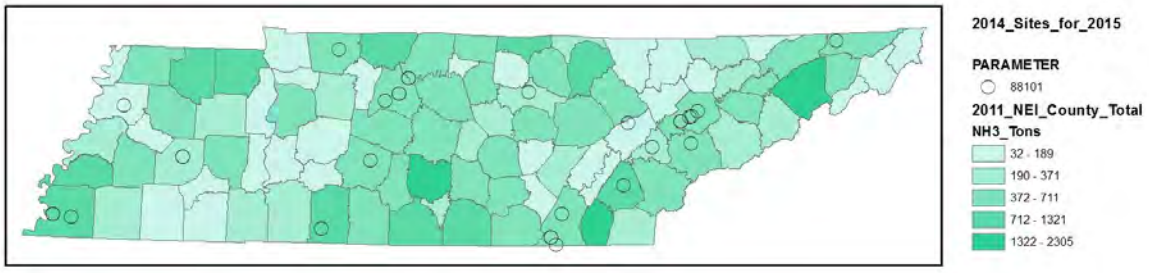

2014_Sites_for_2015
PARAMETER
42401
2011_NEI_County_Total
SO2_Tons
3 - 683
684 - 2446
2447 - 17055
17056 - 26112
26113 - 36746


2014_Sites_for_2015
PARAMETER
44201
2011_NEI_County_Total
VOC_Tons
2687 - 7151
7152 - 10384
10385 - 14873
14874 - 22623
22624 - 37961

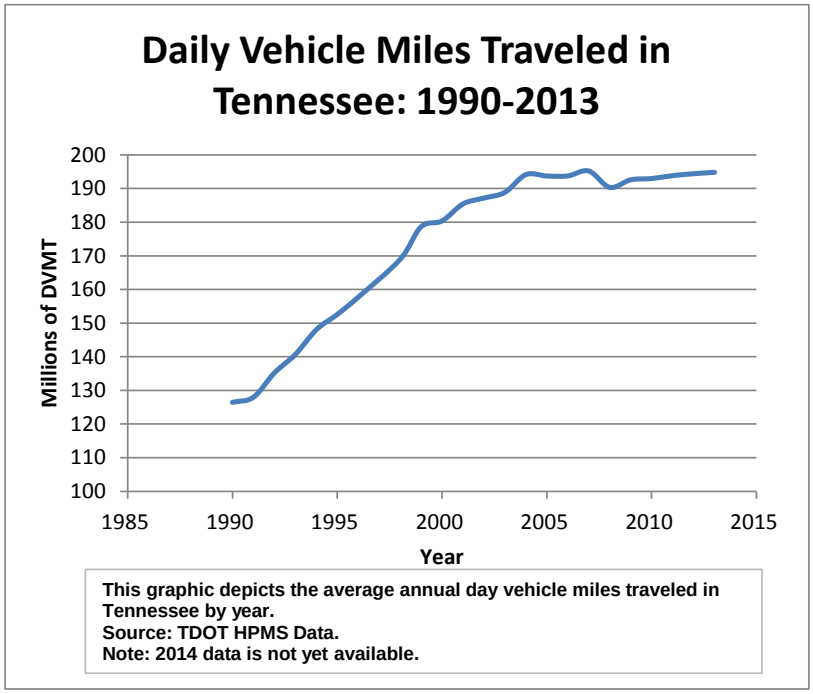

2014_Sites_for_2015
PARAMETER
81102
2011_NEI_County_Total
PM10Pri_To
161 - 1084
1085 - 2170
2171 - 3469
3470 - 5868
5869 - 11464


2014_Sites_for_2015
PARAMETER
88101
2011_NEI_County_Total
PM25Pri_To
56 - 442
443 - 792
793 - 1316
1317 - 2044
2045 - 4088


2014_Sites_for_2015
PARAMETER
14129
2011_NEI_County_Total
Pb_Tons
0.000032 - 0.027772
0.027773 - 0.100000
0.100001 - 0.243024
0.243025 - 0.663719
0.663720 - 1.200748


2014_Sites_for_2015
PARAMETER
88101
2011_NEI_County_Total
NH3_Tons
32 - 189
190 - 371
372 - 711
712 - 1321
1322 - 2305

VMT for Tennessee 1990 to 2013



Year	DVMT	Millions of DVMT
1990	126,454,405	126
1991	127,964,086	128
1992	135,198,717	135
1993	140,684,784	141
1994	148,026,952	148
1995	152,574,933	153
1996	157,695,748	158
1998	168,944,410	169
1999	178,635,992	179
2000	180,365,915	180
2001	185,422,446	185
2002	187,167,199	187
2003	188,866,032	189
2004	194,138,251	194
2005	193,710,533	194
2006	193,731,356	194
2007	195,209,253	195
2008	190,333,487	190
2009	192,581,983	193
2010	192,956,296	193
2011	193,828,108	194
2012	194,386,582	194
2013	194,816,305	195

Proposed and Existing Changes to the Major Sources in Tennessee

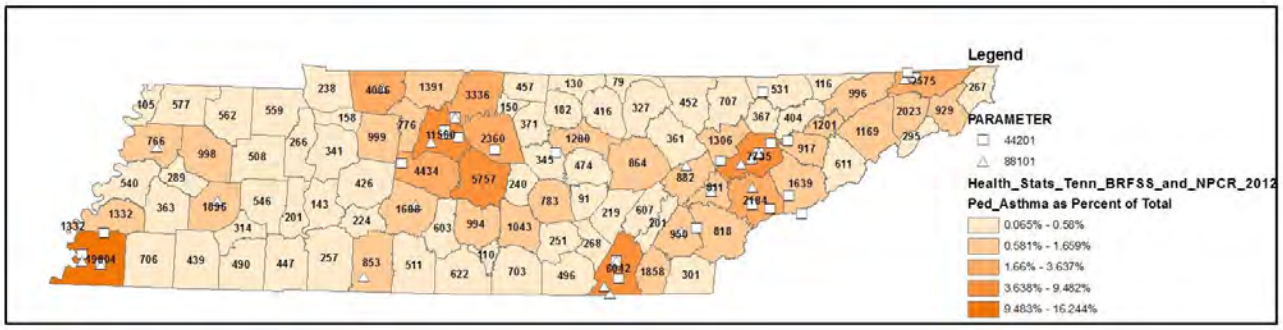
The following major sources have either shut down or are proposed to shut down or are repowering to operate on natural gas. The facilities include both TVA and other non-EGU sources. Several sources are converting to natural gas which is much cleaner than coal and is anticipated to produce beneficial emission reductions in NOx, SO2 and to some extent PM Fine particulates.

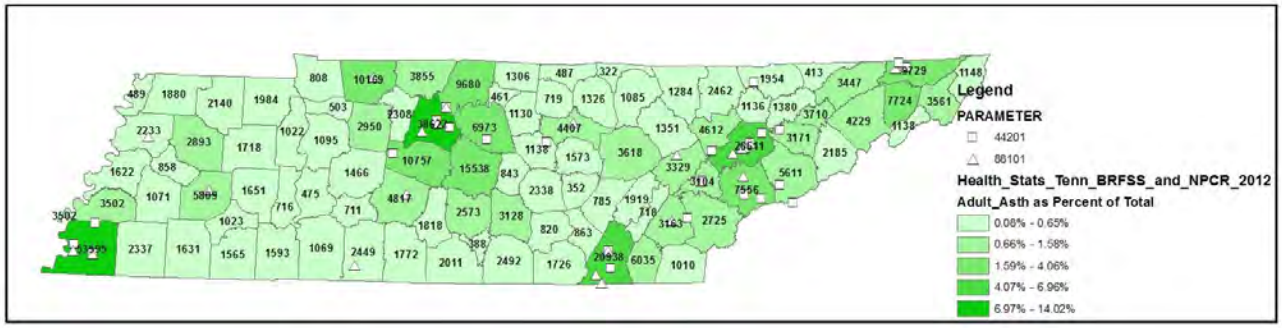
Source Name	Description of Actions	Actual or Proposed Date
TVA John Sevier	All coal units retired	12/31/2012
TVA Gallatin	Scrubbers on-line	4/16/2016
	SCRs on-line by	12/31/2017
TVA Johnsonville	Six units retired by	12/31/2015
	Remaining four units retired by	12/31/2017
TVA Allen	All coal units retired by	12/31/2018
Cargill, Memphis	Coal-fired boiler retired	2015
Eastman Chemical	Re-powering B-253 Coal Fired Boilers	7/31/2018
Viskase	Repowering from coal to Natural Gas	
Tate & Lyle	Repowering from coal to Natural Gas	
UT Knoxville	Repowering from coal to Natural Gas	

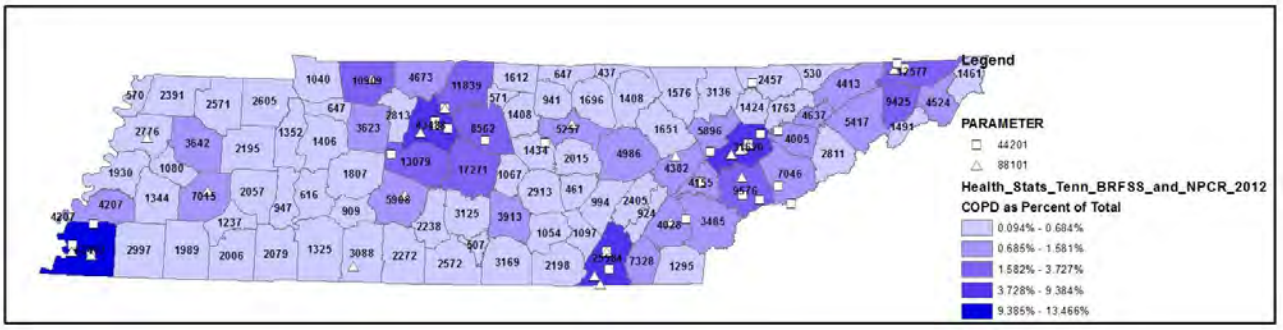
There are other emissions sources that have shut down or repowered and they may not yet appear on this list.

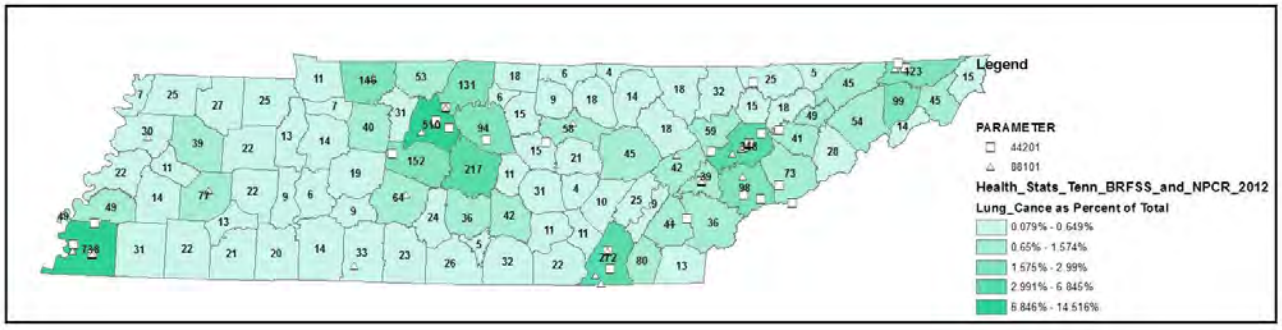
Tennessee Health Data and Monitoring Network Sites (Ozone and PM2.5)

Monitoring Network and Respiratory Health Data (2012 BRFSS)

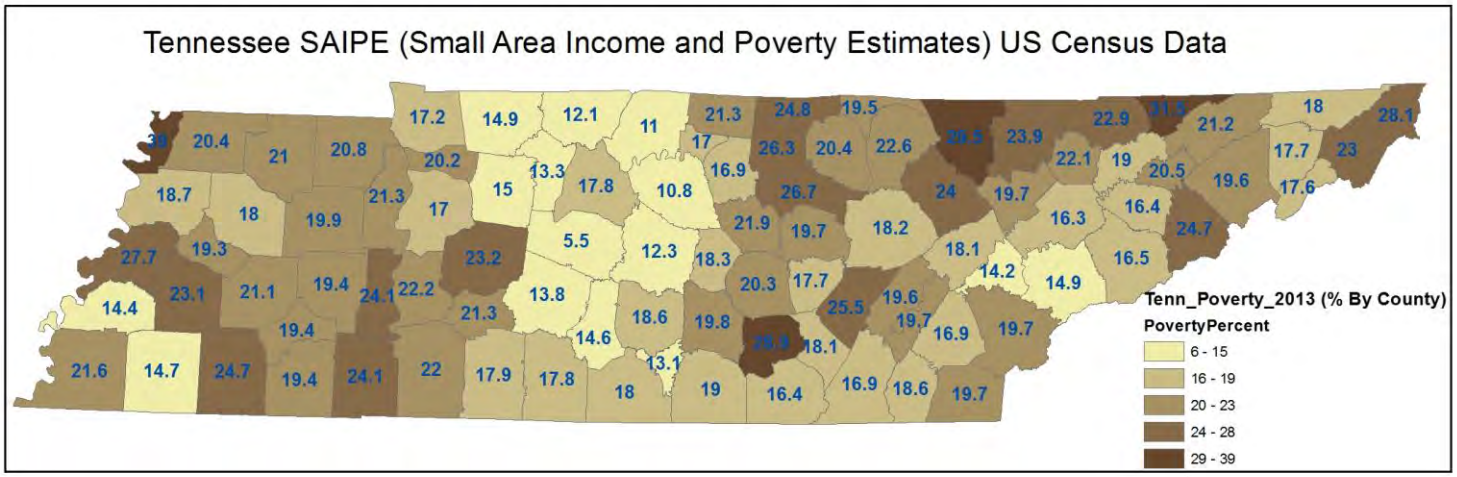


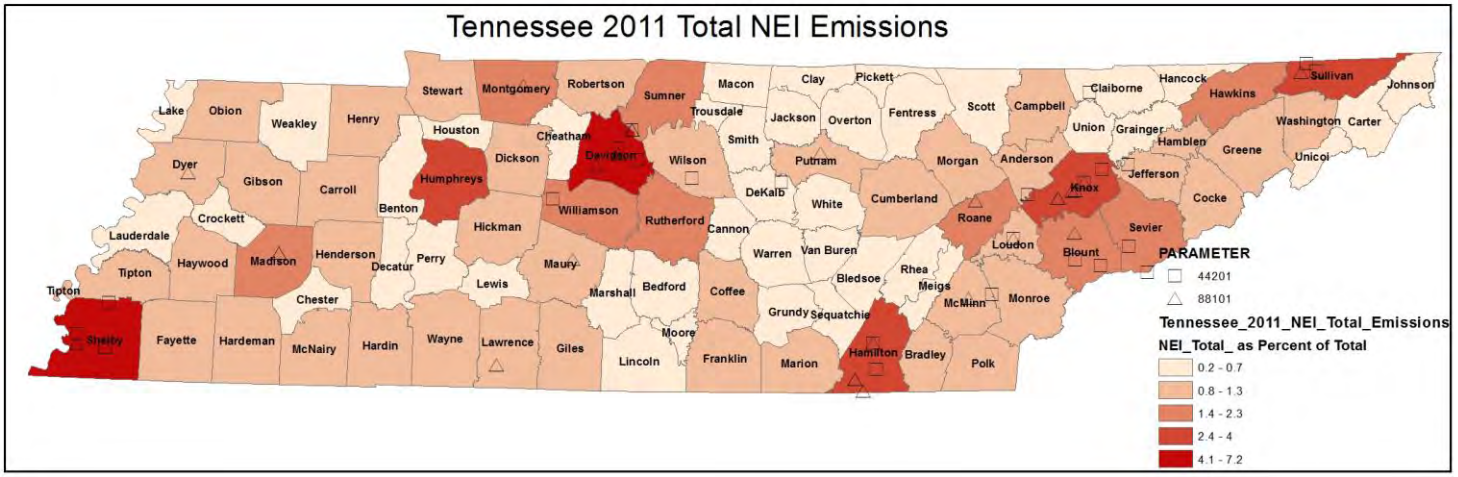






Tennessee Poverty and Emissions Density State Wide





Population Estimates for Metropolitan Areas

CBSA	ST COU	NAME	LSAD	CENSUS 2010 POP	POP ESTIMATE 2014
16860		**Chattanooga, TN-GA**	**Metropolitan Statistical Area**	**528143**	**544559**
16860	13047	Catoosa County, GA	County or equivalent	63942	65621
16860	13083	Dade County, GA	County or equivalent	16633	16389
16860	13295	Walker County, GA	County or equivalent	68756	68218
16860	47065	Hamilton County, TN	County or equivalent	336463	351220
16860	47115	Marion County, TN	County or equivalent	28237	28407
16860	47153	Sequatchie County, TN	County or equivalent	14112	14704
17300		**Clarksville, TN-KY**	**Metropolitan Statistical Area**	**260625**	**278353**
17300	21047	Christian County, KY	County or equivalent	73955	74250
17300	21221	Trigg County, KY	County or equivalent	14339	14142
17300	47125	Montgomery County, TN	County or equivalent	172331	189961
17420		**Cleveland, TN**	**Metropolitan Statistical Area**	**115788**	**119705**
17420	47011	Bradley County, TN	County or equivalent	98963	102975
17420	47139	Polk County, TN	County or equivalent	16825	16730
27180		**Jackson, TN**	**Metropolitan Statistical Area**	**130011**	**130225**
27180	47023	Chester County, TN	County or equivalent	17131	17379
27180	47033	Crockett County, TN	County or equivalent	14586	14668
27180	47113	Madison County, TN	County or equivalent	98294	98178
27740		**Johnson City, TN**	**Metropolitan Statistical Area**	**198716**	**201091**
27740	47019	Carter County, TN	County or equivalent	57424	56886
27740	47171	Unicoi County, TN	County or equivalent	18313	17963
27740	47179	Washington County, TN	County or equivalent	122979	126242
28700		**Kingsport-Bristol-Bristol, TN-VA**	**Metropolitan Statistical Area**	**309544**	**308079**
28700	47073	Hawkins County, TN	County or equivalent	56833	56735
28700	47163	Sullivan County, TN	County or equivalent	156823	157047
28700	51169	Scott County, VA	County or equivalent	23177	22384
28700	51191	Washington County, VA	County or equivalent	54876	54729
28700	51520	Bristol city, VA	County or equivalent	17835	17184
28940		**Knoxville, TN**	**Metropolitan Statistical Area**	**837571**	**857585**
28940	47001	Anderson County, TN	County or equivalent	75129	75528
28940	47009	Blount County, TN	County or equivalent	123010	126339
28940	47013	Campbell County, TN	County or equivalent	40716	39918
28940	47057	Grainger County, TN	County or equivalent	22657	22864
28940	47093	Knox County, TN	County or equivalent	432226	448644
28940	47105	Loudon County, TN	County or equivalent	48556	50771
28940	47129	Morgan County, TN	County or equivalent	21987	21660
28940	47145	Roane County, TN	County or equivalent	54181	52748
28940	47173	Union County, TN	County or equivalent	19109	19113
32820		**Memphis, TN-MS-AR**	**Metropolitan Statistical Area**	**1324829**	**1343230**
32820	5035	Crittenden County, AR	County or equivalent	50902	49548
32820	28009	Benton County, MS	County or equivalent	8729	8296
32820	28033	DeSoto County, MS	County or equivalent	161252	170913
32820	28093	Marshall County, MS	County or equivalent	37144	36234
32820	28137	Tate County, MS	County or equivalent	28886	28204
32820	28143	Tunica County, MS	County or equivalent	10778	10598
32820	47047	Fayette County, TN	County or equivalent	38413	39011
32820	47157	Shelby County, TN	County or equivalent	927644	938803
32820	47167	Tipton County, TN	County or equivalent	61081	61623
34100		**Morristown, TN**	**Metropolitan Statistical Area**	**113951**	**115713**
34100	47063	Hamblen County, TN	County or equivalent	62544	63036
34100	47089	Jefferson County, TN	County or equivalent	51407	52677
34980		**Nashville-Davidson--Murfreesboro--Franklin, TN**	**Metropolitan Statistical Area**	**1670890**	**1792649**
34980	47015	Cannon County, TN	County or equivalent	13801	13757
34980	47021	Cheatham County, TN	County or equivalent	39105	39764
34980	47037	Davidson County, TN	County or equivalent	626681	668347
34980	47043	Dickson County, TN	County or equivalent	49666	50575
34980	47081	Hickman County, TN	County or equivalent	24690	24384
34980	47111	Macon County, TN	County or equivalent	22248	23003
34980	47119	Maury County, TN	County or equivalent	80956	85515
34980	47147	Robertson County, TN	County or equivalent	66283	68079
34980	47149	Rutherford County, TN	County or equivalent	262604	288906
34980	47159	Smith County, TN	County or equivalent	19166	19009
34980	47165	Sumner County, TN	County or equivalent	160645	172706
34980	47169	Trousdale County, TN	County or equivalent	7870	8002
34980	47187	Williamson County, TN	County or equivalent	183182	205226
34980	47189	Wilson County, TN	County or equivalent	113993	125376

Population Estimates for Micropolitan Areas

CBSA	STCOU	NAME	LSAD	CENSUS 2010 POP	POP ESTIMATE 2014
11940		**Athens, TN**	**Micropolitan Statistical Area**	**52266**	**52626**
11940	47107	McMinn County, TN	County or equivalent	52266	52626
18260		**Cookeville, TN**	**Micropolitan Statistical Area**	**106042**	**107761**
18260	47087	Jackson County, TN	County or equivalent	11638	11568
18260	47133	Overton County, TN	County or equivalent	22083	22028
18260	47141	Putnam County, TN	County or equivalent	72321	74165
18900		**Crossville, TN**	**Micropolitan Statistical Area**	**56053**	**57985**
18900	47035	Cumberland County, TN	County or equivalent	56053	57985
19420		**Dayton, TN**	**Micropolitan Statistical Area**	**31809**	**32641**
19420	47143	Rhea County, TN	County or equivalent	31809	32641
20540		**Dyersburg, TN**	**Micropolitan Statistical Area**	**38335**	**37935**
20540	47045	Dyer County, TN	County or equivalent	38335	37935
24620		**Greeneville, TN**	**Micropolitan Statistical Area**	**68831**	**68335**
24620	47059	Greene County, TN	County or equivalent	68831	68335
29980		**Lawrenceburg, TN**	**Micropolitan Statistical Area**	**41869**	**42274**
29980	47099	Lawrence County, TN	County or equivalent	41869	42274
30280		**Lewisburg, TN**	**Micropolitan Statistical Area**	**30617**	**31269**
30280	47117	Marshall County, TN	County or equivalent	30617	31269
32280		**Martin, TN**	**Micropolitan Statistical Area**	**35021**	**34373**
32280	47183	Weakley County, TN	County or equivalent	35021	34373
32660		**McMinnville, TN**	**Micropolitan Statistical Area**	**39839**	**39969**
32660	47177	Warren County, TN	County or equivalent	39839	39969
35460		**Newport, TN**	**Micropolitan Statistical Area**	**35662**	**35374**
35460	47029	Cocke County, TN	County or equivalent	35662	35374
37540		**Paris, TN**	**Micropolitan Statistical Area**	**32330**	**32204**
37540	47079	Henry County, TN	County or equivalent	32330	32204
42940		**Sevierville, TN**	**Micropolitan Statistical Area**	**89889**	**95110**
42940	47155	Sevier County, TN	County or equivalent	89889	95110
43180		**Shelbyville, TN**	**Micropolitan Statistical Area**	**45058**	**46627**
43180	47003	Bedford County, TN	County or equivalent	45058	46627
46100		**Tullahoma-Manchester, TN**	**Micropolitan Statistical Area**	**100210**	**101344**
46100	47031	Coffee County, TN	County or equivalent	52796	53623
46100	47051	Franklin County, TN	County or equivalent	41052	41402
46100	47127	Moore County, TN	County or equivalent	6362	6319
46460		**Union City, TN-KY**	**Micropolitan Statistical Area**	**38620**	**37206**
46460	47131	Obion County, TN	County or equivalent	31807	30941

Proposed SO2 Air Monitoring Site in the Sullivan Co. Nonattainment Area

The following is taken from the Draft TAD (Technical Assistance Document), provided by EPA for using modeling to assist in location of potential monitoring sites for SO2.

"Modeling is a powerful tool that should be strongly considered to inform the identification of potential monitoring sites intended to satisfy the expected data requirements rule. Generally, this modeling can follow the recommendations of the SO_2 NAAQS Designations Modeling Technical Assistance Document (Modeling TAD)[4], which offers recommendations for modeling sources for designations. In general, the modeling TAD identifies the following suggested actions:

- Emissions data preparation, including sources to model, formatting of hourly emissions when available, and calculating temporally varying emissions
- Selection and processing of input meteorological data
- Source characterization including urban vs. rural treatment of sources in the modeling
- Design value calculations from model output

However, the difference between modeling to inform monitor placement and that conducted to model to determine attainment in order to satisfy the anticipated data requirements rule is that modeling to inform monitor placement can use normalized emissions. The modeling approach presented in the Modeling TAD uses the actual emissions from modeled sources. The use of normalized emissions can be used when modeling to inform monitor siting decisions because the goal of the modeling is not to determine the attainment status of an area, but to identify the location or locations of ambient SO_2 concentration maxima. The normalization of the emissions preserves the relative magnitude of emissions forecast at each receptor by the model and the spatial distribution of modeled normalized design values."

A modeling exercise was conducted to develop a list of potential locations for consideration and final selection to use as an SO2 air monitoring site within the existing 3 Km radius SO2 nonattainment area located in Kingsport, Tennessee, Sullivan County. The modeling was performed using the AERMOD model, emission inventory data obtained from NEI and the source, meteorology from an onsite met tower that operated for 1 year, building dimension data from the source along with emission point coordinates and emission characteristics also provided by the source. As stated in the TAD excerpt above, the model is not being used to perform an attainment modeling

demonstration, but to only help in selection of the best most suitable location for an air monitoring site to be installed and operated.

EASTMAN SO2 REVISED MONITOR MODELING

Adjustments to AERMOD/AERMET based on EPA Region 4 Alternative Model Approval

June 23, 2015

Introduction

TDEC had previously conducted modeling for the determination of SO_2 monitor siting, following select adjustments to AERMOD made by Eastman and their consultant, AECOM. Initially, the default beta LOWWIND2 option was used, as described in TDEC's modeling document: SO_2 Monitor Site Proposal for Eastman Chemical Company (5/18/2015). The previous modeling described will be referred to as "old modeling" in this document.

EPA Region 4 has recently approved certain alternative configurations utilized by Eastman. Some of these adjustments are relevant to this monitor siting analysis and are discussed in this update.

Adjustments

AERLIFT

EPA has approved the use of AERLIFT for the B-253 powerhouse only, based on the close spacing of those stacks. For this analysis, TDEC is simulating future emissions after conversion to natural gas. EPA has stated the insignificance of AERLIFT in this future scenario, thus TDEC has opted to not use AERLIFT.

LOW WIND OPTIONS

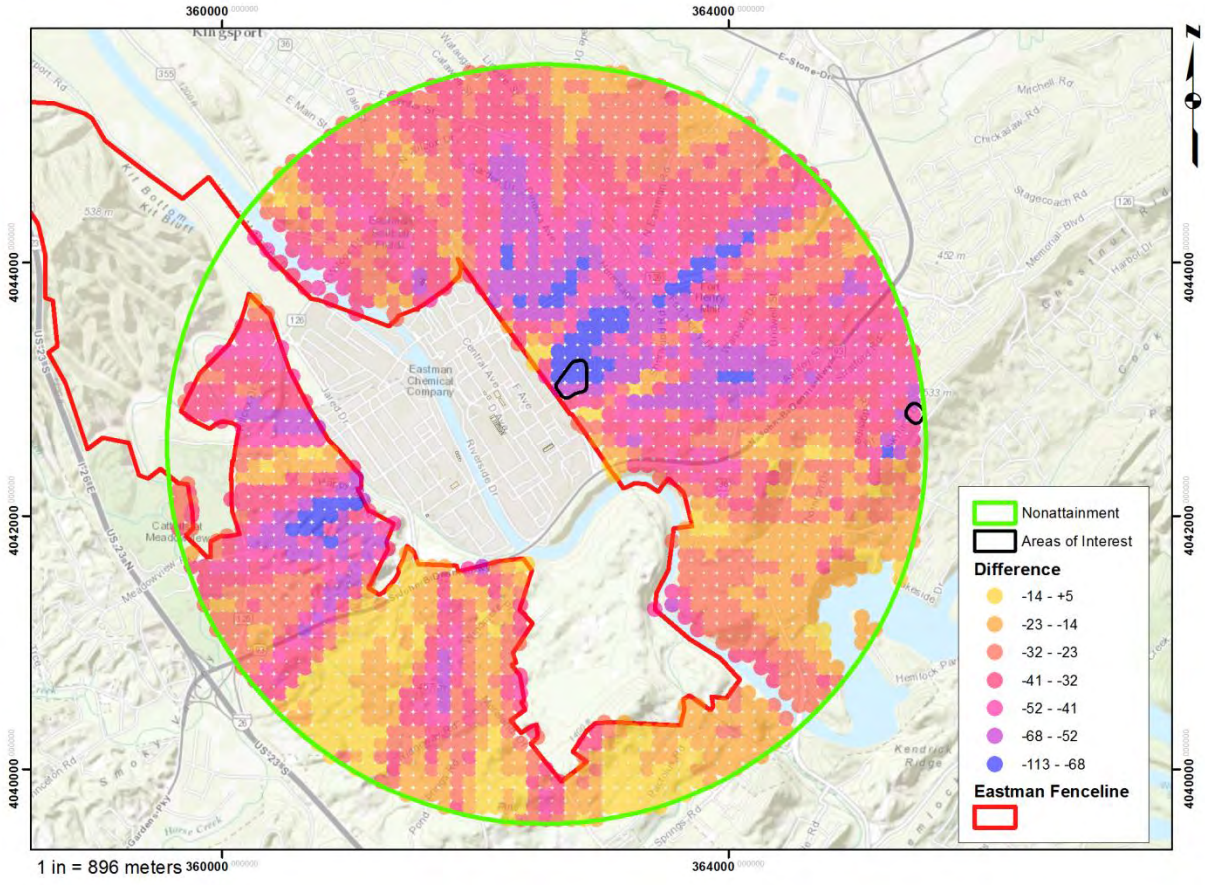
EPA has approved the use of a non-default sigma-v minimum of 0.4 m/s, versus the default 0.3 m/s under the LOWWIND2 beta option. TDEC has decided to use this recommended adjustment for this updated modeling. The default meander fraction was left at 0.95.

The AERMET ADJ_U* beta option was also used for this analysis, as it was approved by EPA. The expectation was that design value (DV) concentrations near the fenceline would be most affected by these low wind options. Specifically, the area previously identified as being a candidate for monitoring on Brookwood Rd. near the facility's northeast-facing fenceline.

Summary of Differences

The adjustments to the model resulted in lowered concentrations for all but five receptors. The biggest change was observed to the northeast and southwest of the plant, shown as dark purple in figure 1. EPA Region 4 and TDEC have identified two parcels as target areas for SO_2 monitoring. One is on Skyland Dr., near the eastern boundary of the nonattainment radius; the other is located on Brookwood Rd., near the northeast-facing fenceline, and both parcels are circled in black in figure 1.

FIGURE 1: NEW MODELING DV WITH ADJUSTMENTS MINUS OLD MODELING DV (µG/M^3)



The overall ranks of the top 20 receptors are reevaluated in table 1. Receptors at higher elevations generally saw a bump in rank while lower receptors saw a drop. The outlier is the receptor with the old rank of five. That receptor had a significant drop in concentration (76 $\mu g/m^3$) and dropped rank by 32 places. This receptor is on the Skyland Dr. ridge and is downstream from a hill of similar elevation, about 800 meters to the southwest. The upstream hill saw a significant increase in rank under the new model configuration, going from an old rank of 53 to a new rank of three.

TABLE 1: RANKS FROM THE TOP 20 RECEPTORS COMPARED TO THE OLD MODELING

New Combined Rank	Old Combined Rank	Receptor Elevation (m)
1	1	495
1	*3	514
3	53	467
4	6	513
5	72	389
6	19	402
7	13	484
8	65	391
9	11	489
10	**2	381
11	9	387
11	10	387
13	13	391
14	40	390
15		397
16	8	363
17	18	387
18		403
19	21	388
20	4	383
21	7	384
22	16	388
37	5	501
40	16	393
47	12	387
78	20	385

*Skyland Dr. receptor

**Brookwood Rd. receptor

New Rankings

New combined ranks were computed (DV concentration + number of days rank). The top ranked receptors and their respective parcels can be seen in figures 2 and 3.

FIGURE 2: DESIGN VALUE RANK (TOP) AND FREQUENCY OF DAYS RECEPTOR WAS THE MAX (BOTTOM)

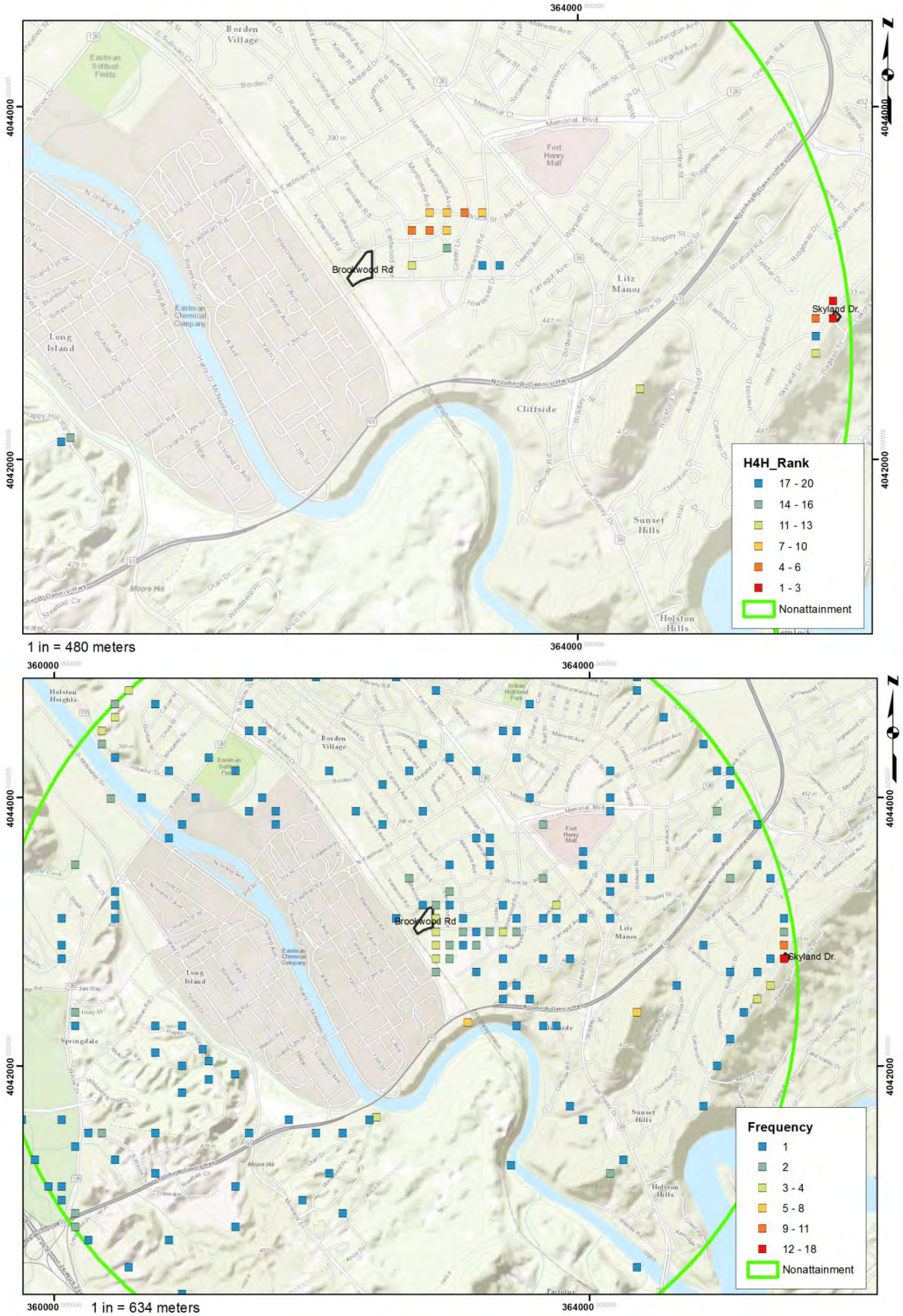
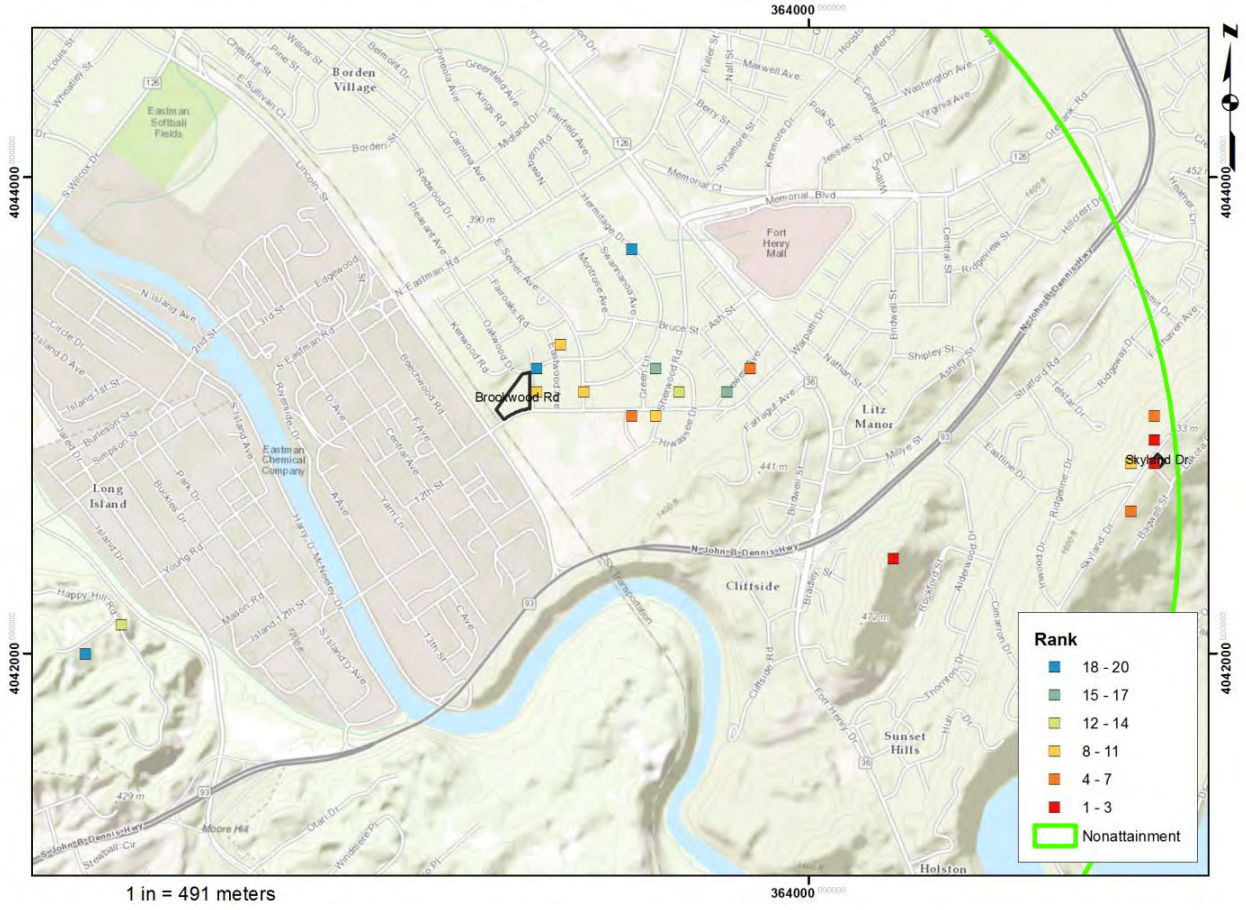


FIGURE 3: COMBINED RANK, TOP 20 RECEPTORS

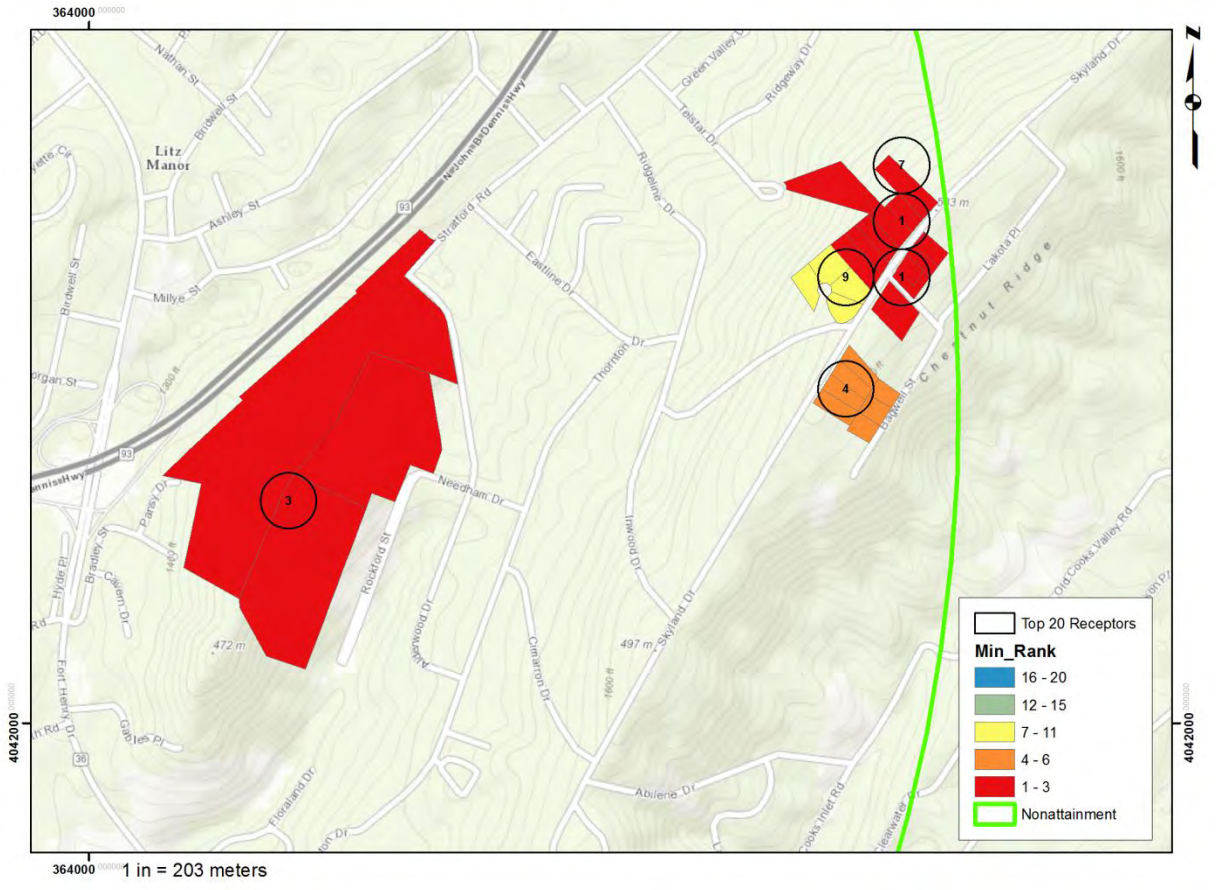


The Skyland Dr. area did not see any significant changes. The parcel that was prevouisly identified as being the best suitable location, moved from the third ranked parcel to tying with the first (see table 1).

TABLE 2: DETAILS OF THE TOP 10 RECEPTOR RANKINGS UNDER THE NEW CONFIGURATION

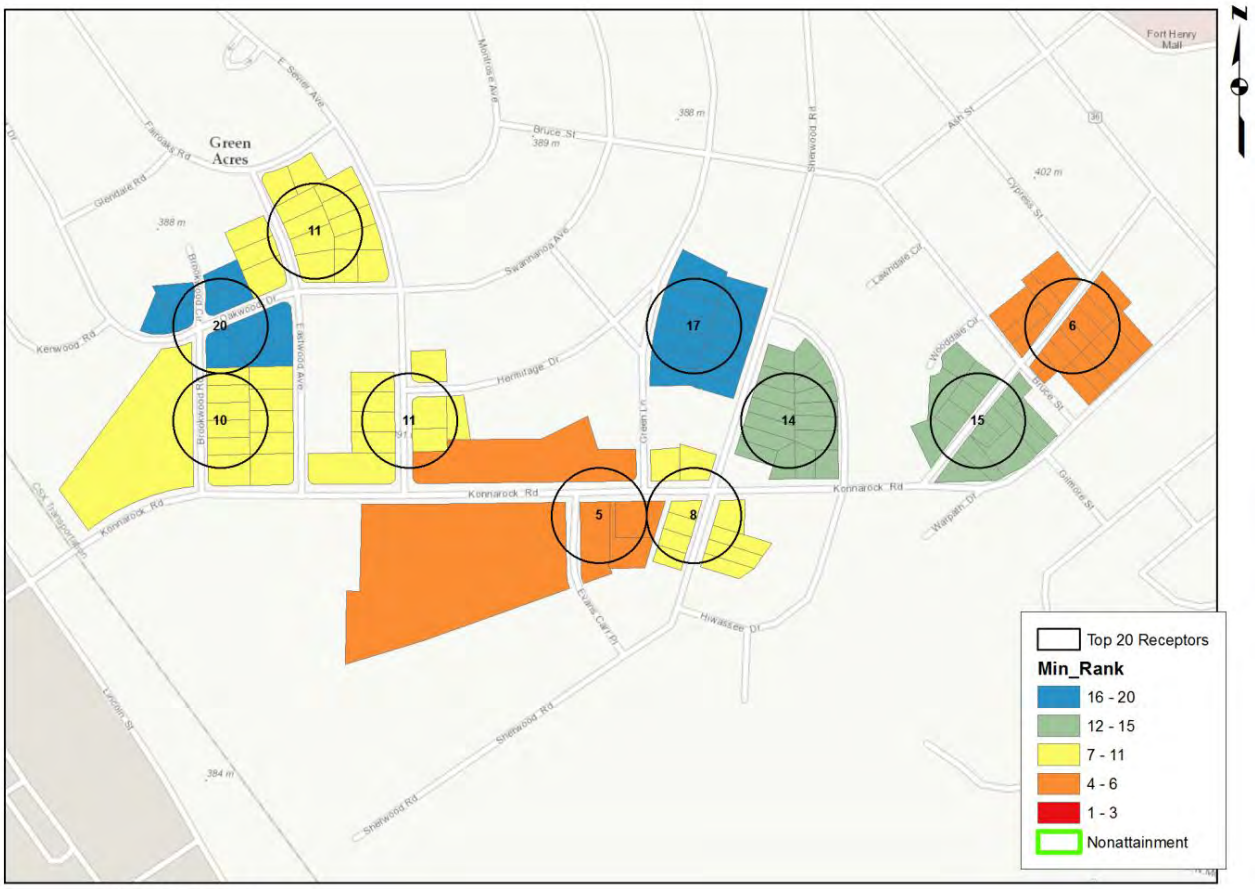
Receptor	Design Value Rank		Days Receptor was the Max		Combined Rank	
XY	H4H Concentration	H4H Rank	Frequency	Freq Rank	Score	Rank
365458.00000 4042798.50000	204.982	2	18	1	3	1
365458.00000 4042898.50000	231.748	1	11	2	3	1
364358.00000 4042398.50000	184.99	13	8	3	16	3
365358.00000 4042598.50000	185.094	12	3	13	25	4
363258.00000 4042998.50000	178.164	24	2	25	49	5
363758.00000 4043198.50000	175.086	39	3	13	52	6
365458.00000 4042998.50000	176.421	32	2	25	57	7
363358.00000 4042998.50000	174.254	45	3	13	58	8
365358.00000 4042798.50000	194.12	5	1	55	60	9
362858.00000 4043098.50000	172.113	58	4	7	65	10

FIGURE 4: SKYLAND DR. AREA AND THE TOP THREE COMBINED RANKED PARCELS



Over by the Kingsport Power Company, the higher ranked parcels were pushed out further from the fence. The Brookwood Rd. parcel was ranked second in the previous modeling. EPA had discussed this parcel, owned by Eastman, as a potential site. With the new adjustments, this parcel is now ranked 10th.

FIGURE 5: COMBINED RANK- RECEPTORS AND PARCELS IN THE KINGSPORT POWER COMPANY AREA



1 in = 127 meters

TABLE 3: PARCEL DATA FOR TOP 10 RANKED PARCELS

Address	Class	Mailing Address	Rank	Area (ft^2)
SKYLAND DR 4005	00 RESIDENTIAL	4005 SKYLAND DR	1	49,381.10
SKYLAND DR 4016	00 RESIDENTIAL	4016 SKYLAND DR	1	27,365.53
SKYLAND DR 4023	00 RESIDENTIAL	4023 SKYLAND DR	1	19,198.99
SKYLAND DR 4019	00 RESIDENTIAL	4019 SKYLAND DRIVE	1	13,863.42
SKYLAND DR 4008	00 RESIDENTIAL	4008 SKYLAND DR	1	37,394.38
SKYLAND DR	00 RESIDENTIAL	4008 SKYLAND DR	1	24,491.31
TELSTAR DR	00 RESIDENTIAL	3845 TELSTAR DR	1	87,014.38
SKYLAND DR 4015	02 CITY	CITY HALL	1	14,105.37
SKYLAND DR	00 RESIDENTIAL	221 ALABAMA AVE #3	1	20,985.55
SKYLAND DR 4020	00 RESIDENTIAL	4020 SKYLAND DR	1	30,352.96
SKYLAND DR 4028	00 RESIDENTIAL	4028 SKYLAND DR	1	49,822.38
BAGWELL ST	08 COMMERCIAL	P O BOX 511	1	15,351.77
STRATFORD RD	10 FARM	P O BOX 144	3	1,125,053.24
ROCKFORD ST	08 COMMERCIAL	4017 WASHINGTON RD PMB 353	3	460,688.79
ROCKFORD ST OFF	00 RESIDENTIAL	3849 RIDGELINE DR	3	489,661.50
BAGWELL ST 3944	00 RESIDENTIAL	3944 BAGWELL ST	4	16,163.73
SKYLAND DR 3963	00 RESIDENTIAL	3963 SKYLAND DR	4	25,118.26
SKYLAND DR 3975	00 RESIDENTIAL	4179 TRIANGLE CIR	4	22,225.95
BAGWELL ST 3948	00 RESIDENTIAL	3948 BAGWELL ST	4	18,285.55
BAGWELL ST 3952	00 RESIDENTIAL	3952 BAGWELL ST	4	18,528.43
SKYLAND DR 3971	00 RESIDENTIAL	3971 SKYLAND DR	4	22,345.38
SKYLAND DR 3967	00 RESIDENTIAL	3967 SKYLAND DR	4	22,159.78
KONNAROCK RD OFF	08 COMMERCIAL	1031 LEE ST	5	16,645.02
KONNAROCK RD 1241	08 COMMERCIAL	5800 VIOLET ST	5	19,530.66
KONNAROCK RD	00 RESIDENTIAL	1268 KONNAROCK RD	5	113,210.13
KONNAROCK RD 1233	08 COMMERCIAL	1031 LEE ST	5	27,231.92
KONNAROCK RD 1213	02 CITY	CITY HALL	5	315,438.36
WARPATH DR 1376	05 RELIGIOUS	1383 DEWEY AVE	6	7,762.12
DEWEY AVE	05 RELIGIOUS	1383 DEWEY AVE	6	6,305.12
DEWEY AVE 1370	00 RESIDENTIAL	1370 DEWEY AVE	6	8,338.08
DEWEY AVE 1373	00 RESIDENTIAL	1373 DEWEY AVE	6	6,813.36
WARPATH DR 1370	00 RESIDENTIAL	ATTN: TRUST REAL ESTATE	6	7,664.85
DEWEY AVE 1369	00 RESIDENTIAL	1001 N EASTMAN RD STE B	6	5,373.15
BRUCE ST 2253	00 RESIDENTIAL	2253 BRUCE ST	6	8,274.75
BRUCE ST 2249	00 RESIDENTIAL	2617 E LIBERTY ST	6	12,390.48
WARPATH DR 1374	05 RELIGIOUS	1383 DEWEY AVE	6	7,697.26
WARPATH DR 1368	00 RESIDENTIAL	130 ANCO DR APT 1	6	7,308.00
DEWEY AVE 1377	05 RELIGIOUS	1383 DEWEY AVE	6	7,050.14
CYPRESS ST 2248	00 RESIDENTIAL	2248 CYPRESS ST	6	15,747.85
DEWEY AVE 1364	00 RESIDENTIAL	913 CATLETT RD	6	6,436.18
BRUCE ST 2305	00 RESIDENTIAL	2305 BRUCE ST	6	2,473.54
WARPATH DR 1366	00 RESIDENTIAL	288 SOUTHRIDGE DR	6	8,229.53
BRUCE ST 2301	00 RESIDENTIAL	704 HAMMOND AVE	6	2,836.39
DEWEY AVE 1375	00 RESIDENTIAL	1375 DEWEY AVE	6	6,497.96
DEWEY AVE 1371	00 RESIDENTIAL	3281 RIDGEVIEW ST	6	5,668.66
DEWEY AVE 1367	00 RESIDENTIAL	1367 DEWEY AVE	6	5,456.10
WARPATH DR 1372	00 RESIDENTIAL	902 PADDOCK PARK	6	8,095.27
SHERWOOD RD 2313	00 RESIDENTIAL	2313 SHERWOOD RD	8	6,126.81
SHERWOOD RD 2308	08 COMMERCIAL	1809 HERMITAGE DR	8	9,456.96
SHERWOOD RD 2301	00 RESIDENTIAL	709 JIM TOWN RD	8	5,703.27
SHERWOOD RD 2305	00 RESIDENTIAL	2305 SHERWOOD RD	8	6,091.72
KONNAROCK RD 1301	00 RESIDENTIAL	1301 KONNAROCK RD	8	10,434.98
SHERWOOD RD 2241	00 RESIDENTIAL	3216 MEMORIAL BLVD	8	12,458.09
SHERWOOD RD 2309	00 RESIDENTIAL	4913 PRESTON PARK DR	8	6,109.36

Address	Class	Mailing Address	Rank	Area (ft^2)
GREEN LN 2124	00 RESIDENTIAL	2124 GREEN LN	8	11,085.46
SHERWOOD RD 2304	00 RESIDENTIAL	7755 EISENHOWER ST	8	10,299.36
SHERWOOD RD 2312	00 RESIDENTIAL	2312 SHERWOOD RD	8	8,070.08
HIDDEN OAK CIR	00 RESIDENTIAL	5305 OREBANK ROAD	9	32,086.64
SKYLAND DR 4004	00 RESIDENTIAL	4004 SKYLAND DR	9	28,288.56
RIDGELINE DR 3948	00 RESIDENTIAL	3948 RIDGELINE DR	9	23,758.16
HIDDEN OAK CIR	00 RESIDENTIAL	1440 DOBYNS DR	9	25,061.70
KONNAROCK RD	00 RESIDENTIAL	P O BOX 511	10	164,324.18
KONNAROCK RD 1018	00 RESIDENTIAL	1018 KONNAROCK RD	10	16,013.94
EASTWOOD AVE 2113	00 RESIDENTIAL	2113 EASTWOOD AVE	10	11,778.68
BROOKWOOD RD 2124	00 RESIDENTIAL	2124 BROOKWOOD RD	10	8,865.54
BROOKWOOD RD 2116	00 RESIDENTIAL	2116 BROOKWOOD RD	10	8,868.84
BROOKWOOD RD 2112	00 RESIDENTIAL	1432 DOBYNS DR	10	9,120.37
BROOKWOOD RD 2128	00 RESIDENTIAL	1567 N EASTMAN RD STE #14	10	8,853.40
EASTWOOD AVE 2117	00 RESIDENTIAL	2117 EASTWOOD AVE	10	11,365.53
EASTWOOD AVE 2125	00 RESIDENTIAL	2125 EASTWOOD AVE	10	11,299.50
KONNAROCK RD	00 RESIDENTIAL	1002 KONNAROCK RD	10	15,601.21
EASTWOOD AVE 2121	00 RESIDENTIAL	1805 FLEETWOOD DR	10	11,346.06
BROOKWOOD RD 2120	00 RESIDENTIAL	1570 CRESCENT DR	10	8,877.31

Conclusions

Adjusting the LOWWIND2 sigma-V to 0.4 m/s and using the AERMET beta option to adjust the low wind speed (u*), had the biggest effect on the Brookwood Rd. area. This area is still a good, separate area of highly ranked parcels; however, the specific parcels of interest may need to be revised.

FIGURE 6: IMAGERY OF THE HIGHEST RANKED PARCEL IN THE KINGSPORT POWER COMPANY AREA