Proposed Revision to the Allegheny County Portion of the Pennsylvania State Implementation Plan

Attainment Demonstration for the Allegheny County, PA $PM_{2.5}$ Nonattainment Area, 2012 NAAQS

Allegheny County Health Department
Air Quality Program

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DRAFT FOR PUBLIC COMMENT

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ACRONYMS AND ABBREVIATIONS

ACHD	Allegheny County Health Department
AEO	Annual Energy Outlook
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AERR	Air Emissions Reporting Requirements
AGC	Allegheny County Airport (KAGC)
ARP	Acid Rain Program
AQS	EPA Air Quality System
BART	Best Available Retrofit Technology
BACT	Best Available Control Technology
BEIS	Biogenic Emission Inventory System
BFG	Blast Furnace Gas
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CAMx	Comprehensive Air quality Model with extensions
CEMS	Continuous Emission Monitoring System
CENSARA	Central States Air Resource Agencies Association
Cond	Condensable fraction of $PM_{2.5}$
CONUS	Continental United States
COG	Coke Oven Gas
CFR	Code of Federal Regulations
CPP	Clean Power Plan
CSAPR	Cross-State Air Pollution Rule
CSN	Chemical Speciation Network
d01	WRF/CAMx 36 km modeling domain for the continental U.S. (CONUS)
d02	WRF/CAMx 12 km modeling domain for the northeastern U.S. (NEUS)
d03	WRF/CAMx 4 km modeling domain for Pennsylvania (PA)
d04	WRF/CAMx 1.33 km modeling domain for Allegheny County
d05	WRF 0.444 km modeling domain for the Monongahela Valley
DON	Degree of Neutralization (of sulfate)
DSI	Dry Sorbent Injection
EC	Elemental Carbon
EGU	Electric Generating Unit
EIA	Energy Information Administration
EPA	United States Environmental Protection Agency
ERC	Emission Reduction Credit
ERTAC	Eastern Regional Technical Advisory Committee
ESP	Electrostatic Precipitator
EST	Eastern Standard Time
FEM	Federal Equivalent Method
FGD	Flue Gas Desulfurization
Filt	Filterable fraction of $PM_{2.5}$
FMVCP	Federal Motor Vehicle Control Program

FR	Federal Register
FRM	Federal Reference Method
H_2S	Hydrogen Sulfide
HEPA	High Efficiency Particulate Air
I/M	Inspection and Maintenance
IP	Installation Permit
IPM	Integrated Planning Model
LAA	Local Area Analysis
LADCO	Lake Michigan Air Directors Consortium
LEQT	Low-Emission Quench Tower
LNB	Low-NO_x Burner
LPM	Local Primary Material
MACT	Maximum Achievable Control Technology
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MARAMA	Mid-Atlantic Regional Air Management Association, Inc.
MATS	Modeled Attainment Test Software or Mercury Air Toxics Standards
MMIF	Mesoscale Meteorological Interface Program
MOVES	Motor Vehicle Emission Simulator model
MPO	Metropolitan Planning Organization
MSA	Metropolitan Statistical Area
MVEB	Motor Vehicle Emissions Budget
MW	Megawatt
$\mu g/m^3$	Microgram per cubic meter
µm	Micrometer, or micron
MP	Modeling Platform
NAAQS	National Ambient Air Quality Standard
NAA	Nonattainment Area
NAICS	North American Industry Classification System
NEI	National Emission Inventory
NEUS	Northeastern United States
NG	Natural Gas
NH_3	Ammonia
NH_4	Ammonium Ion
NO_3	Nitrate Ion
NO_x	Oxides of Nitrogen (generally NO or NO_2)
NNSR	Nonattainment New Source Review
NSR	New Source Review
OC	Organic Carbon
OCMmb	Organic Carbonaceous Mass by Mass Balance
OFA	Overfire Air
OH	Ohio
OP	Operating Permit
OTC	Ozone Transport Commission
OWB	Outdoor Wood-Fired Boiler
PA	Pennsylvania
PA DEP	Pennsylvania Department of Environmental Protection

PBW	Particle Bound Water
PEC	Pushing Emission Control
PennDot	Pennsylvania Department of Transportation
PGM	Photochemical Grid Model
PiG	Plume-in-Grid model
PIT	Pittsburgh International Airport (KPIT)
PM	Particulate Matter (airborne) of any size
$PM_{2.5}$	PM less than or equal to a nominal 2.5 microns in aerodynamic diameter, also referred to as fine particulates
PM_{10}	PM less than or equal to a nominal 10 microns in aerodynamic diameter
PMF	Positive Matrix Factorization model
PSAT	Particulate Source Apportionment Technology
RACM	Reasonably Available Control Measure
RACT	Reasonably Available Control Technology
RFP	Reasonable Further Progress
RPO	Regional Pennsylvania Organization
RRF	Relative Response Factor
SANDWICH	Sulfate, Adjusted Nitrate, Derived Water, Inferred Carbonaceous Material Balance Approach
SCC	Source Classification Code
SCR	Selective Catalytic Reduction
SESARM	Southeastern Air Pollution Control Agencies
SIP	State Implementation Plan
SMAT-CE	Software for the Modeled Attainment Test – Community Edition
SMOKE	Sparse Matrix Operator Kernel Emissions System
SO_2	Sulfur Dioxide
SO_4	Sulfate Ion
SPAQP	Southwest Pennsylvania Air Quality Partnership
SPC	Southwestern Planning Commission
TPY	Tons per Year (or Tons/Year) of pollutant emissions
TSD	Technical Support Document
UPMC	University of Pittsburgh Medical Center
USGS	United States Geological Survey
USS	United States Steel Corporation
VMT	Vehicle Miles Traveled
VE	Visible Emissions
VOC	Volatile Organic Compound
WOE	Weight of Evidence
WRF	Weather Research and Forecasting model
WV	West Virginia

1 Executive Summary

Particulate matter is a mixture of microscopic solids and liquid droplets suspended in air that includes: inorganic salts (such as nitrates and sulfates), organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen or mold spores). Fine particle pollution or $PM_{2.5}$ describes particulate matter that is less than or equal to 2.5 micrometer (µm, or micron) in diameter, approximately 1/30th the diameter of a human hair.

Health studies have shown a significant association between exposure to fine particles and premature death from heart or lung disease. Fine particles can aggravate heart and lung diseases and have been linked to effects such as cardiovascular symptoms, cardiac arrhythmias, heart attacks, respiratory symptoms, asthma attacks, and bronchitis. These effects can result in increased hospital admissions, emergency room visits, absences from school or work, and restricted activity days. Individuals that may be particularly sensitive to fine particle exposure include people with heart or lung disease, older adults, and children.

In 1997, the United States Environmental Protection Agency (EPA) promulgated $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) of 15.0 µg/m^3 on an annual basis and 65 µg/m^3 on a 24-hour basis. The annual standard is based on a long-term average of concentrations, while the 24-hour standard is based on 98th-percentile values of maximum daily concentrations.[1] On December 18, 2006, a revised 24-hour $PM_{2.5}$ NAAQS became effective.

Most of the Pittsburgh Metropolitan Statistical Area (MSA) was designated as a multi-county nonattainment area called the Pittsburgh-Beaver Valley area for both the 1997 and 2006 NAAQS. A portion of southeastern Allegheny County, the Liberty-Clairton area, was designated as a separate nonattainment area within the larger Pittsburgh-Beaver Valley area for both NAAQS. Liberty monitored data and other designation factors indicated that a more focused strategy for emission control was required for this particular area. Determinations of attainment suspended several State Implementation Plan (SIP) requirements for these areas for the 1997 and 2006 NAAQS.[2]

EPA set forth a revised annual $PM_{2.5}$ NAAQS on December 14, 2012. The revised standard lowered the previous 15.0 µg/m^3 annual standard to 12.0 µg/m^3. On April 15, 2015, EPA designated all of Allegheny County (named the "Allegheny County, PA" area) as a $PM_{2.5}$ moderate nonattainment area for the 2012 NAAQS, based on 2011-2013 monitored data.

This present SIP developed by the Allegheny County Health Department (ACHD) demonstrates that, by December 31, 2021, all of Allegheny County will be in attainment of the 2012 $PM_{2.5}$ NAAQS for both the annual and 24-hours standards. While the entire county was designated as nonattainment, the Liberty area continued to be the "worst case" part of the county. Based on 2011-2013 monitored data, $PM_{2.5}$ design values for Liberty were 13.4 µg/m^3 on an annual basis and 37 µg/m^3 on a 24-hour basis. Air quality modeling for this SIP shows attainment of the 12.0

[1] EPA NAAQS table: https://www.epa.gov/criteria-air-pollutants/naaqs-table

[2] Status of U.S. designated areas: https://www3.epa.gov/airquality/urbanair/sipstatus/reports/map_s.html

µg/m³ and 35 µg/m³ standards at Liberty as well as all other sites in Allegheny County for future case year 2021.

The principal control measures that enable Allegheny County to demonstrate attainment of the $PM_{2.5}$ NAAQS include upgrades/modifications and permanent shutdowns of local major industrial sources within the county. Additional regional controls such as federal and state rules were incorporated into the Mid-Atlantic Regional Air Management Association, Inc (MARAMA) emissions inventories that were used for the demonstration.

The modeled attainment demonstration was performed using the Comprehensive Air quality Model with extensions (CAMx) for regional primary and secondary impacts along with the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) for local primary $PM_{2.5}$ impacts in the Liberty area. Procedures for modeling and attainment tests were followed according to EPA guidance documents and ACHD modeling protocols. Modeled results from a base year (baseline) case 2011 to a projected (attainment) future year case 2021 were used to scale actual monitored species concentrations over a weighted 2009-2013 timeframe.

Results from the attainment demonstration showed an overall reduction of primary and secondary $PM_{2.5}$ species concentrations throughout Allegheny County. Future projected design values for the Liberty site, the location of the maximum $PM_{2.5}$ annual and 24-hour concentrations in Allegheny County, are given below:

Projected Annual Design Value by 2021 (NAAQS = 12.0 µg/m³)

Liberty = 12.0 µg/m³

Projected 24-Hour Design Value by 2021 (NAAQS = 35 µg/m³)

Liberty = 35 µg/m³

Other controls affecting Allegheny County that have not been used as part of the modeled demonstration of attainment have been included as "weight of evidence," supporting the case that the county will achieve emission reductions by the attainment date.

This SIP contains several additional elements required by the Clean Air Act (CAA) for $PM_{2.5}$ nonattainment areas.[3] In particular, CAA Title I, Part D Subpart 1 addresses nonattainment area requirements in general, while Subpart 4 contains additional provisions for $PM_{2.5}$ nonattainment areas. Conformance to these CAA requirements and the EPA $PM_{2.5}$ Implementation Rule[4] is addressed within this SIP, summarized as follows:

- Reasonably Available Control Measures (RACM) and Technology (RACT) analysis shows that no additional controls would advance the attainment date by one year.
- Reasonable Further Progress (RFP) shows that incremental progress will be made toward attaining the NAAQS in the years prior to the attainment date.

[3] https://www.epa.gov/air-quality-implementation-plans/sip-requirements-clean-air-act

[4] https://www.govinfo.gov/content/pkg/FR-2016-08-24/pdf/2016-18768.pdf

- Should Allegheny County fail to attain the NAAQS by the attainment date, a contingency plan will provide for measures to achieve attainment as expeditiously as practicable.
- A Nonattainment New Source Review (NNSR) program will be in place for new sources or major source modifications pertaining to $PM_{2.5}$ and precursors.[5]

Last, several accompanying appendices contain more detailed information to support the analyses and conclusions included in this SIP. Additional material, including modeling files and spreadsheets used for the attainment demonstration, are available upon request to ACHD.

[5] Precursors of $PM_{2.5}$ are sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC), and ammonia (NH_3).

2 Problem Statement

2.1 Introduction

The CAA requires that a SIP be devised for any area designated nonattainment for the annual $PM_{2.5}$ pollution standard of 12.0 µg/m³ and/or for the daily $PM_{2.5}$ pollution standard of 35 µg/m³. On December 14, 2012, the EPA "promulgated a revised primary annual $PM_{2.5}$ NAAQS to provide increased protection of public health and welfare from fine particle pollution" (78 FR 3086; January 15, 2013). In that action, the EPA revised the annual $PM_{2.5}$ standard, strengthening it from 15.0 µg/m³ to 12.0 µg/m³, which is attained when the 3-year average of the annual arithmetic means does not exceed 12.0 µg/m³.

EPA designated all of Allegheny County, PA as a $PM_{2.5}$ moderate nonattainment area (NAA) of the 2012 NAAQS on April 15, 2015, with attainment to be achieved by the end of the 6th calendar year following designation (December 31, 2021). The area was so designated as a result of EPA's consideration of local emission sources with meteorology and topography along with jurisdictional boundary conditions.

The base year for a $PM_{2.5}$ demonstration must include one of the three monitored data years used for the designation (2011-2013). Year 2011 was selected as the base year due to the availability of emissions and modeling inventory resources, and it was also found to be an appropriate year for monitored concentrations and meteorological data over a five-year (2009-2013) weighted timeframe.

2.2 Location and Topography

The $PM_{2.5}$ NAA area consists of the entirety of Allegheny County, located in southwestern Pennsylvania, as shown in Figure 2-1. The county includes rural land, densely populated residential areas, and industrial facilities. The present population of Allegheny County is 1,218,452.[6]

The county is made up of complex river valley terrain. Within the county, some river valleys lie at less than 720 feet in elevation above mean sea level (MSL), while adjacent hilltops can be greater than 1250 feet. Large differences in temperature can be observed between the hilltop and valley floor (e.g. 2 to 7 °F) during clear, light-wind, nighttime conditions. Strong nighttime drainage flows can cause differences of up to 180 degrees in wind direction with 3 to 4 miles per hour (mph) downward flows. Spikes in localized $PM_{2.5}$ concentrations have coincided with temperature inversions.

Allegheny County is home to several industrial sources of $PM_{2.5}$ pollution, including several major (CAA Title V) sources and numerous minor sources. The Monongahela River Valley (or "Mon Valley") contains the Liberty $PM_{2.5}$ monitor site and industrial facilities such as the United

[6] U.S. Census Bureau data, as of July 1, 2018: https://www.census.gov/quickfacts/alleghenycountypennsylvania

States Steel Corporation (U. S. Steel, or USS) Mon Valley Works. The Clairton Plant of the USS Mon Valley Works is the largest coke plant in the country, producing roughly 4.7 million net tons of coke annually.

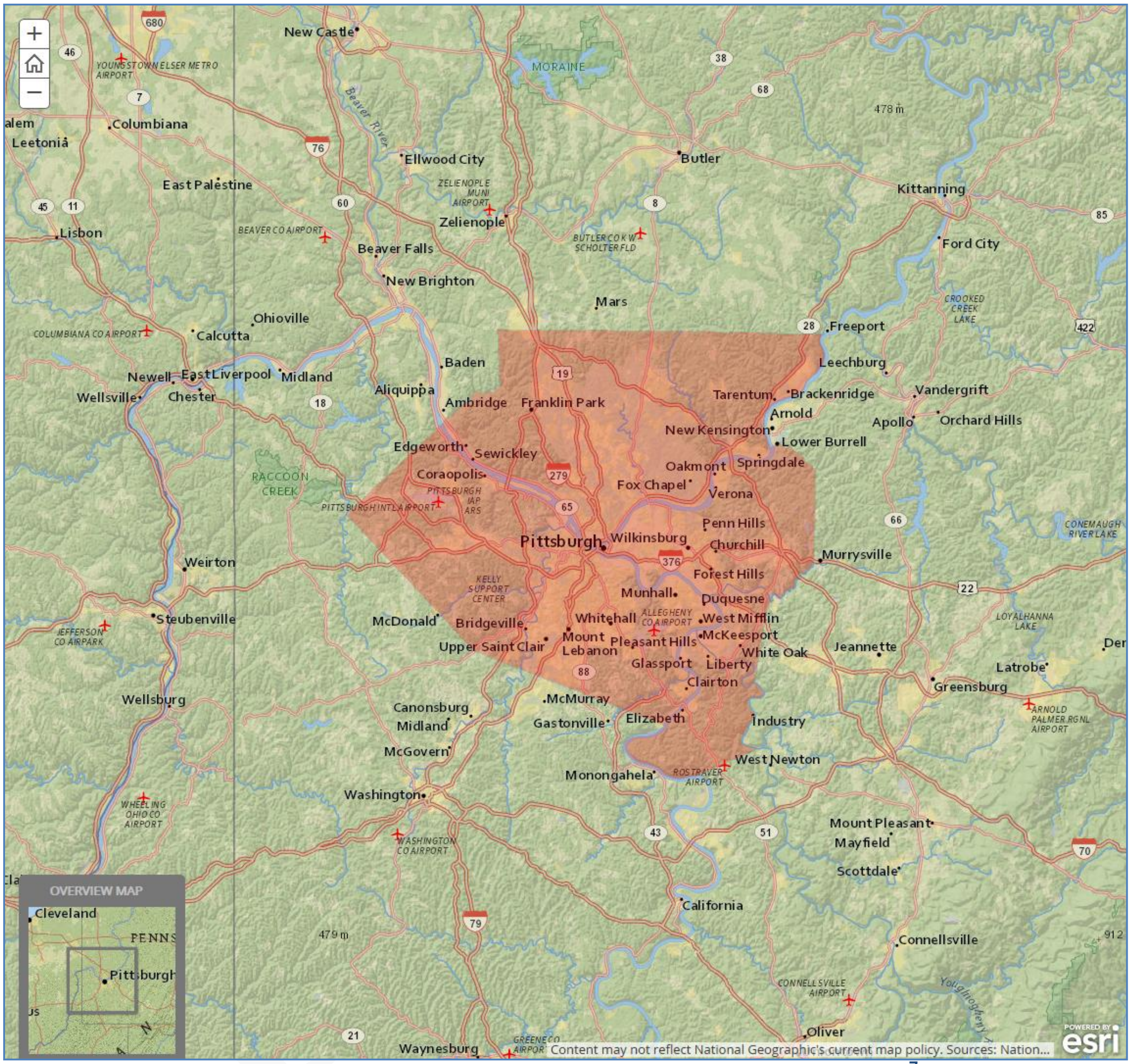

Figure 2-1. Map of the Allegheny County, PA $PM_{2.5}$ Nonattainment Area[7]

[7] Maps of designated areas:
https://epa.maps.arcgis.com/apps/MapJournal/index.html?appid=a76e14f777de49baa5d32f5544c8e20b&webmap=fc297672dd074e4ab5b208aebe21fa52

2.3 Meteorology

Meteorology plays a crucial role in $PM_{2.5}$ concentrations throughout the county. For example, temperature inversions contribute to elevated levels of $PM_{2.5}$. A temperature inversion occurs when the air at the surface becomes cooler than the air above it, that is, the rate of cooling of the air is greater at ground level versus at elevated levels. The cooler, heavier air then becomes trapped at the lower elevation. As pollution sources emit $PM_{2.5}$ and the lower, cooler air becomes buoyantly stable, the $PM_{2.5}$ is limited in its upward movement to disperse into the regional flow.

Typically, upon the dissipation of an inversion, local $PM_{2.5}$ is released into the upper atmospheric flow. Observations have shown that after this break, the Liberty monitor, which typically records the highest $PM_{2.5}$ concentrations in Allegheny County, returns to a level comparable to or less than the concentrations measured at surrounding monitors.

Upper-atmospheric conditions that may indicate the presence of temperature inversions are measured at least twice daily – once in the morning and once in the evening – by balloon-borne sensors sent into the atmosphere by the National Weather Service (NWS) forecasting office near the Pittsburgh International Airport (PIT). The data from these measurements are assumed to represent stability conditions all across the county. However, the many low-lying river valleys throughout the county are more likely to experience a greater frequency of inversions than recorded at the higher elevation PIT NWS location.

Appendix B (Meteorological Analysis) contains documentation of meteorological conditions affecting Allegheny County in general – and the Liberty Borough area in particular – for 2009 through 2013, with a focus on 2011, the base year modeled for the attainment demonstration. Analysis involved review of inversions, winds, temperature, and precipitation in general and for appropriateness for the modeling demonstration.

The five-year 2009-2013 period was characterized by 41% of mornings experiencing, on average, moderately strong surface inversions of 3.8 °C, with an average height above ground of 237 meters and an estimated break time at PIT NWS of about 9:30 a.m. EST. The modeled base year, 2011, was characterized by 37% of mornings with moderate surface inversions of 3.7 °C and an average height of 246 m, with an estimated break time at PIT NWS of about 9:30 a.m. EST.

Temperature data for 2009-2013 Pennsylvania annual average temperatures ranged from below normal to much above normal. Precipitation records from the period show Pennsylvania annual total precipitation amounts ranging from near normal to much above normal. Within Allegheny County, annual average temperature and total precipitation conditions observed at the airports (PIT and AGC) indicate that temperatures at both locations were generally above normal, while precipitation at both locations ranged across the normal level. For 2011, the modeled base year, PIT and AGC average temperature and total precipitation were above normal.

PIT and AGC wind roses for 2009 through 2013 indicate that air generally flows from the southwest through west across the county, except for the preponderance of winds from the south at AGC. Low wind speeds, which occur frequently overnight and often during temperature inversions, can lead to increased $PM_{2.5}$ levels, especially in the many river valleys throughout Allegheny County.

At the Liberty monitor – the location of the county's traditionally highest $PM_{2.5}$ concentrations – Figure 2-2 shows wind frequency and speed, $PM_{2.5}$ concentration, and temperature roses for 2011 and for 2009-2013. For 2011 in particular and for 2009 through 2013 in general, the most frequent wind direction was south-southwest through west-southwest, the fastest wind speed on average was from the southwest through west, the highest average temperature was from the south-southeast through southwest, and the highest concentration of $PM_{2.5}$ on average came from the south-southwest.

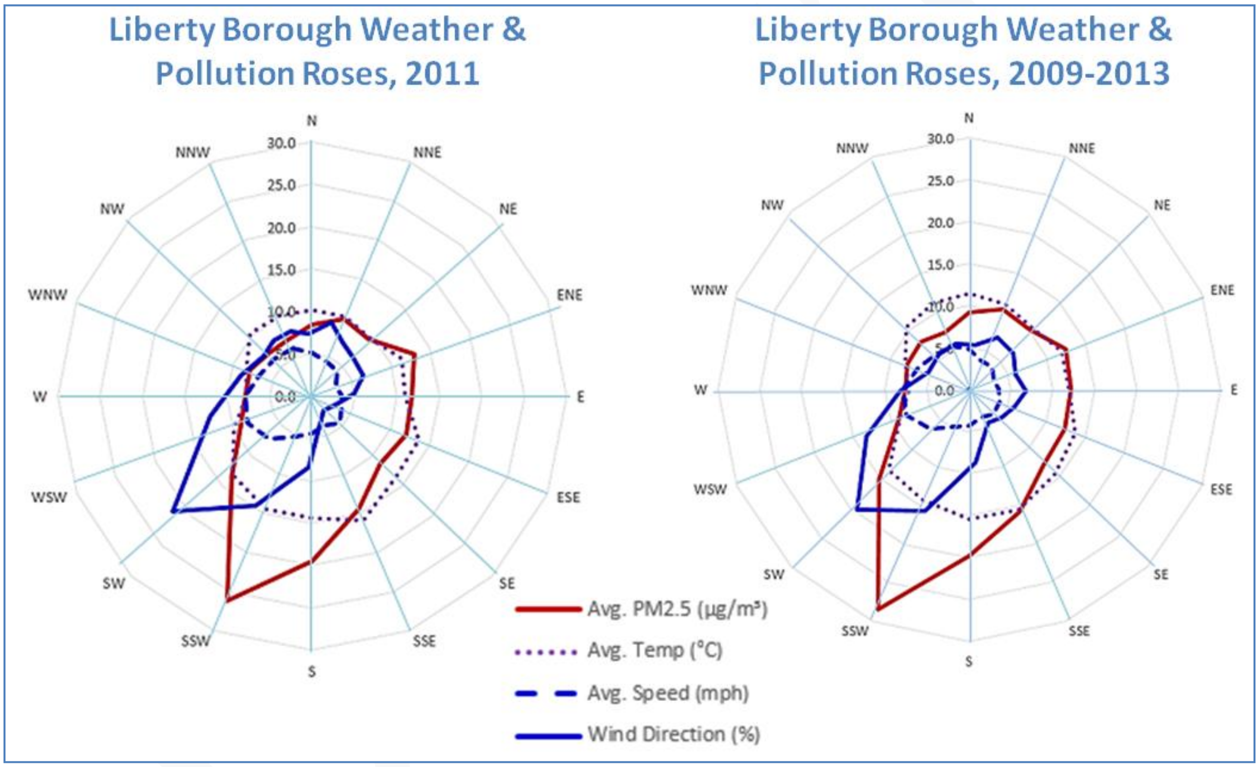

Figure 2-2. Wind Frequency and Speed, $PM_{2.5}$ Concentration, and Temperature Roses for the Liberty Monitoring Site, 2011 and 2009-2013

Overall, the meteorological analysis in Appendix B (Meteorological Analysis) shows that the modeled base year of 2011 is rather suitable to represent typical conditions of the period. Exceptions include one month, October 2011, recording the largest inversion strength of any month during the five-year period, as well as substantially higher than normal precipitation for southwestern Pennsylvania and Allegheny County during the full year. More recent years have recorded above normal average temperatures along with precipitation amounts substantially above normal; therefore, the 2011 base year may well represent these more current conditions.

2.4 Monitored Data

$PM_{2.5}$ Federal Reference Method (FRM) or Federal Equivalent Method (FEM) monitors for population exposure are currently located at eight different monitoring locations throughout Allegheny County.[8] (These locations were also in operation during the designation.) All monitors in Allegheny County are located within the seven-county Pittsburgh Metropolitan Statistical Area (MSA). Chemical Speciation Network (CSN) monitors are also located at two of these sites: Lawrenceville and Liberty.[9]

The Lawrenceville monitor, located roughly two miles northeast of downtown Pittsburgh, is generally used to define urban or regional concentrations of $PM_{2.5}$. The Liberty monitor, located at a high elevation in Liberty Borough, shows the highest concentrations of $PM_{2.5}$ in the NAA.

Appendix A (Monitored Data) contains monitored data details, including design values and EPA Air Quality System (AQS)[10] reports over the timeframe of 2000 (the start year for most sites) through 2018 (the most recent year of monitored data).[11] Figure 2-3 below shows the locations of the $PM_{2.5}$ monitor sites. Design values are 3-year averages of the annual weighted means and 24-hour 98^{th} percentiles at each site.

[8] An additional FEM monitor was deployed in 2016 at the Parkway East site for near-road surveillance purposes. It is not used for official comparison to the NAAQS and has been excluded from this SIP analysis. However, its preliminary design values are showing values below the NAAQS.

[9] Information on EPA monitor networks are available at the following web site: https://www.epa.gov/amtic/amtic-ambient-air-monitoring-networks

[10] Information on AQS is available at the following web site: https://www.epa.gov/aqs

[11] At the time of this version of the SIP, monitored results for 2018 were validated and quality-assured by ACHD but not certified by EPA. ACHD will request certification of the data later in 2019.

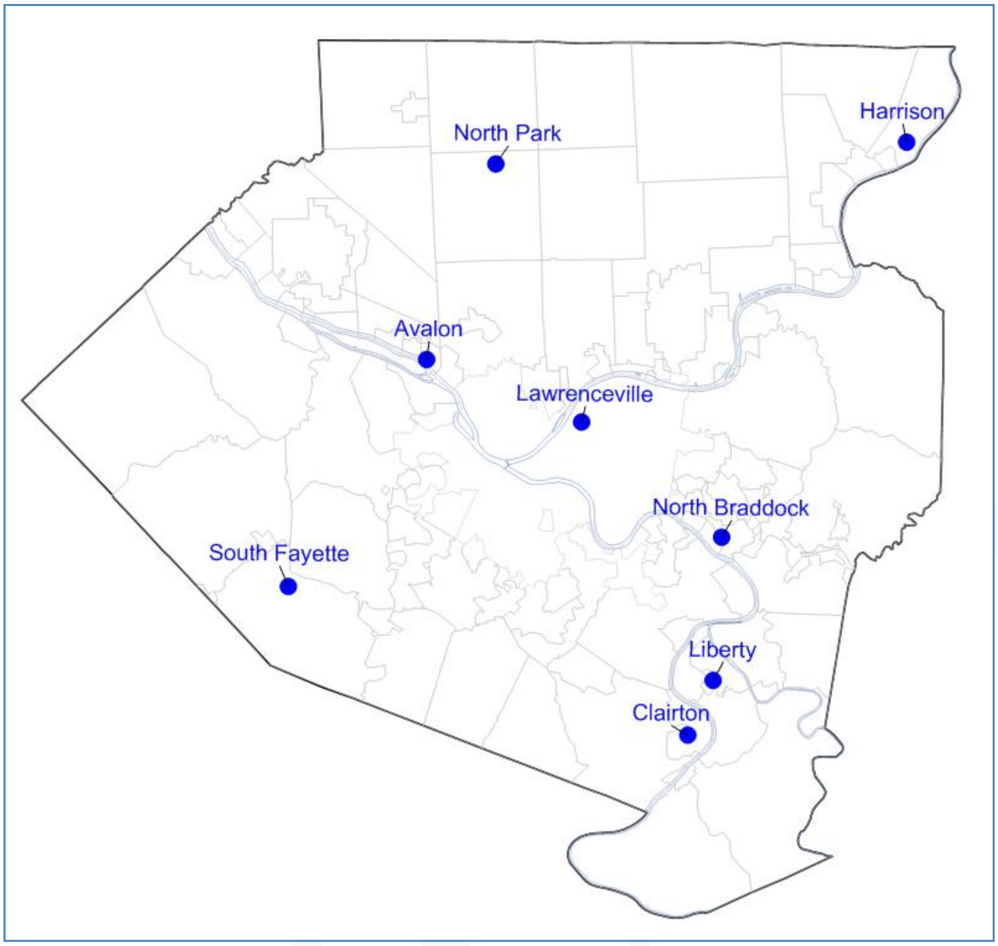

Figure 2-3. $PM_{2.5}$ Monitor Locations in Allegheny County

Allegheny County $PM_{2.5}$ annual and 24-hour design values for the timeframe 2000-2018 are shown in Figures 2-4 and 2-5, respectively. All averages shown are for FRM results except for Avalon, which was a Federal Equivalent Method (FEM) for 2010 and early 2011. (FEM data can also be substituted at Lawrenceville and Liberty for missing FRM samples.) The Liberty monitor shows concentrations that are higher than the rest of the Allegheny County network. (Note the figures include some 3-year periods with low recovery quarters – i.e., less than 75% valid data per quarter – as noted in Appendix A (Monitored Data).)

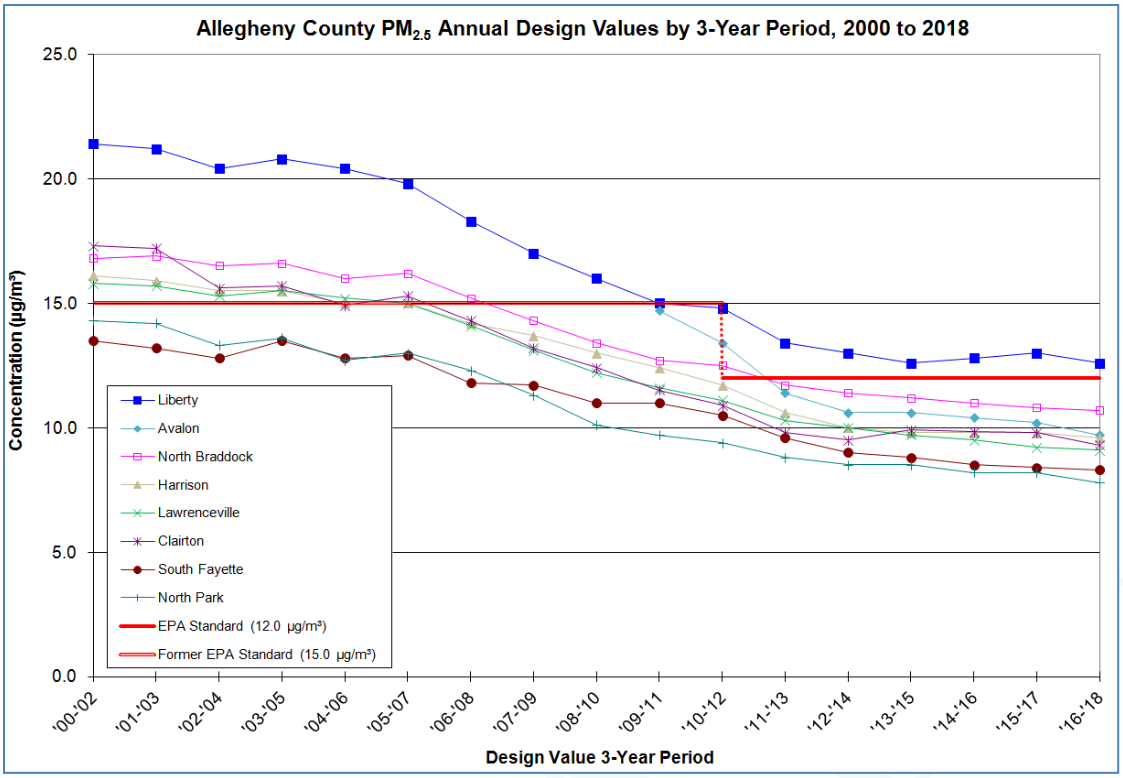

Figure 2-4. $PM_{2.5}$ Annual Design Values, Allegheny County Sites, 2000-2018

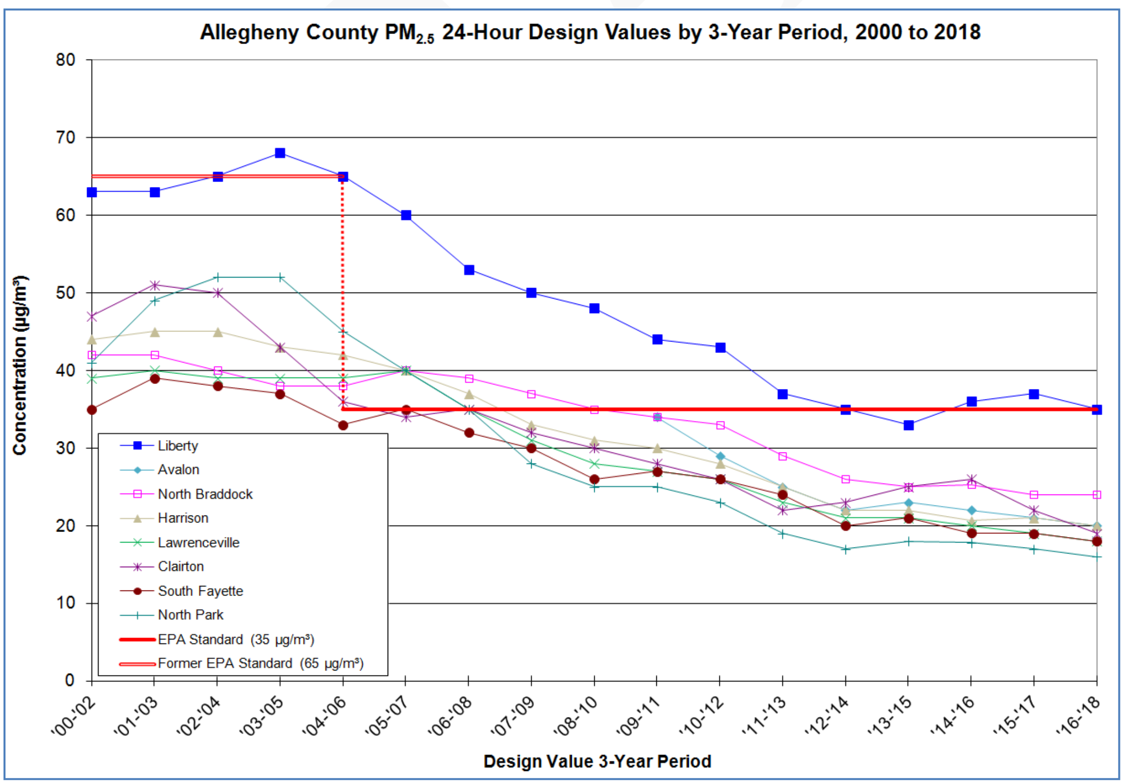

Figure 2-5. $PM_{2.5}$ 24-Hour Design Values, Allegheny County Sites, 2000-2018

Figure 2-6 shows concurrent 24-hour $PM_{2.5}$ concentrations at Liberty compared to the average of other Allegheny County sites on a 1-in-3 day sampling schedule for year 2011 (the base case year for the modeling demonstration). Although the Liberty monitor shows concentrations similar to other sites at times, it also shows recurring peak days that are higher than the rest of Allegheny County. These high days lead to an excess of monitored $PM_{2.5}$ at Liberty on both long-term and short-term bases.

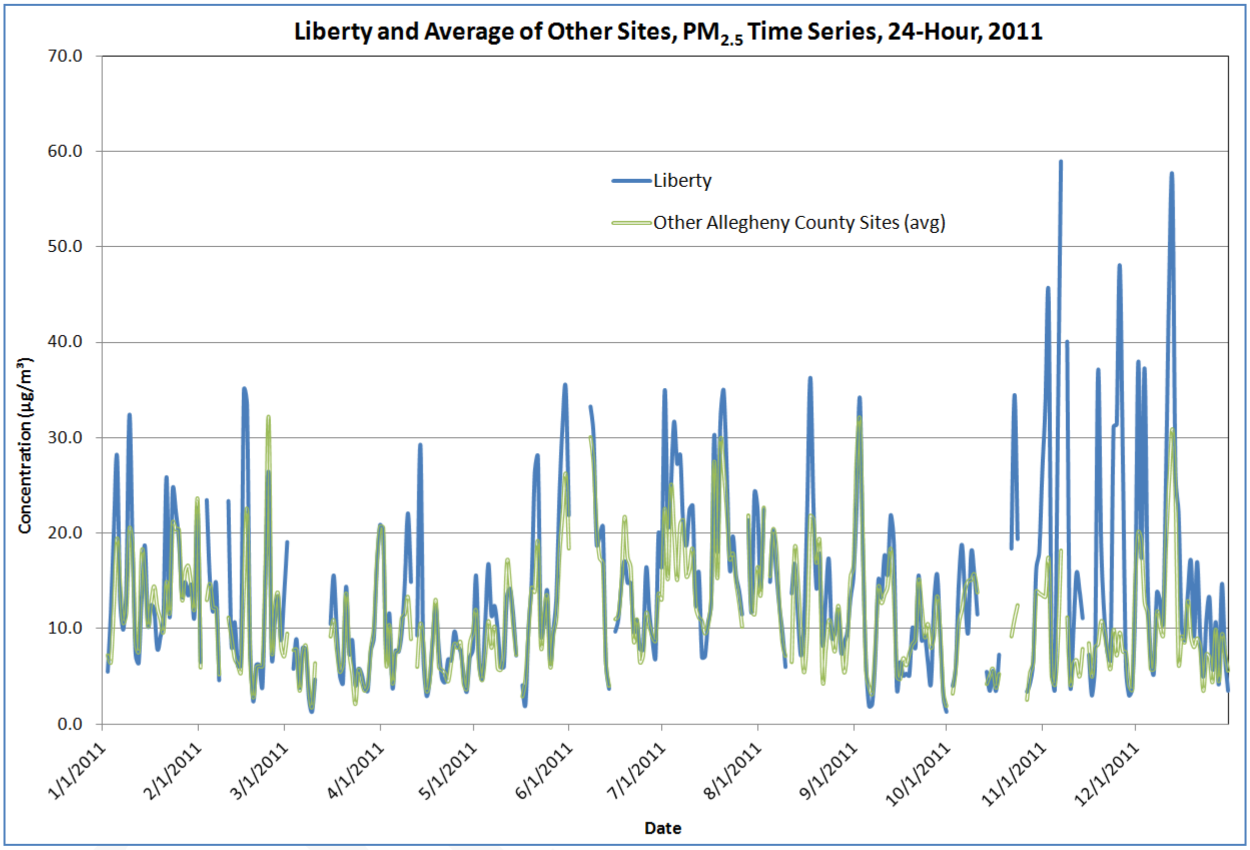

Figure 2-6. 24-Hour $PM_{2.5}$ Concentrations, 2011 Base Year, Liberty and Other Allegheny County Sites

Speciation data are used to examine $PM_{2.5}$ at the component level, specifically the compositions of the different source contributions. A significant portion of the ambient $PM_{2.5}$ concentrations in the MSA can be attributable to upwind sources in Ohio, West Virginia, and other states. Urban activity additionally contributes to concentrations within the Pittsburgh MSA, compounded by localized concentrations in the Liberty area. Liberty is therefore impacted by a diverse combination of regional and local $PM_{2.5}$ sources.

A comparison of regional and local concentrations shows species differences in the Liberty area with respect to the surrounding area. Lawrenceville, Florence, and Greensburg are part of the regional MSA portion of regional $PM_{2.5}$. (Quaker City, OH and Dolly Sods, WV are also shown as the rural/transport portion of regional $PM_{2.5}$.) Figure 2-7 shows long-term major species averages for 2011, from west to east through the tri-state region.

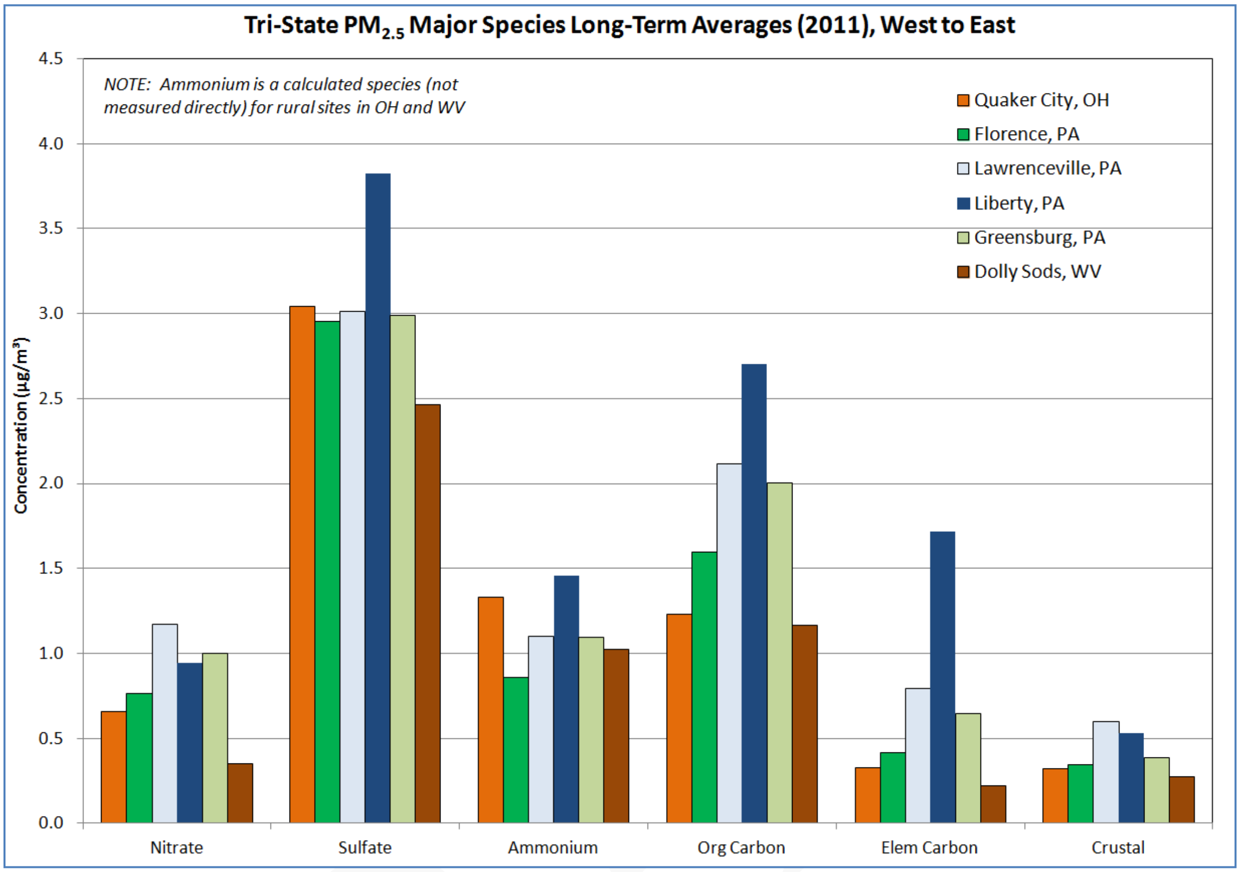

Figure 2-7. Tri-State Major $PM_{2.5}$ Species Concentrations (µg/m³), 2011

Concentrations of major species at speciation sites show increasing averages from west to east through the Pittsburgh MSA, with lower averages at Dolly Sods to the southeast of the MSA. Liberty shows peaks for specific species, indicative of air composition that is not common throughout the greater tri-state region.

Figure 2-8 shows a pie chart of the average observed (monitored) excess $PM_{2.5}$ species at Liberty compared to the regional MSA component for 2011 (i.e., Liberty minus the average of Lawrenceville, Florence, and Greensburg, by species). These local excess species are the focus of the modeling effort, since they are driving the Liberty-specific concentrations.

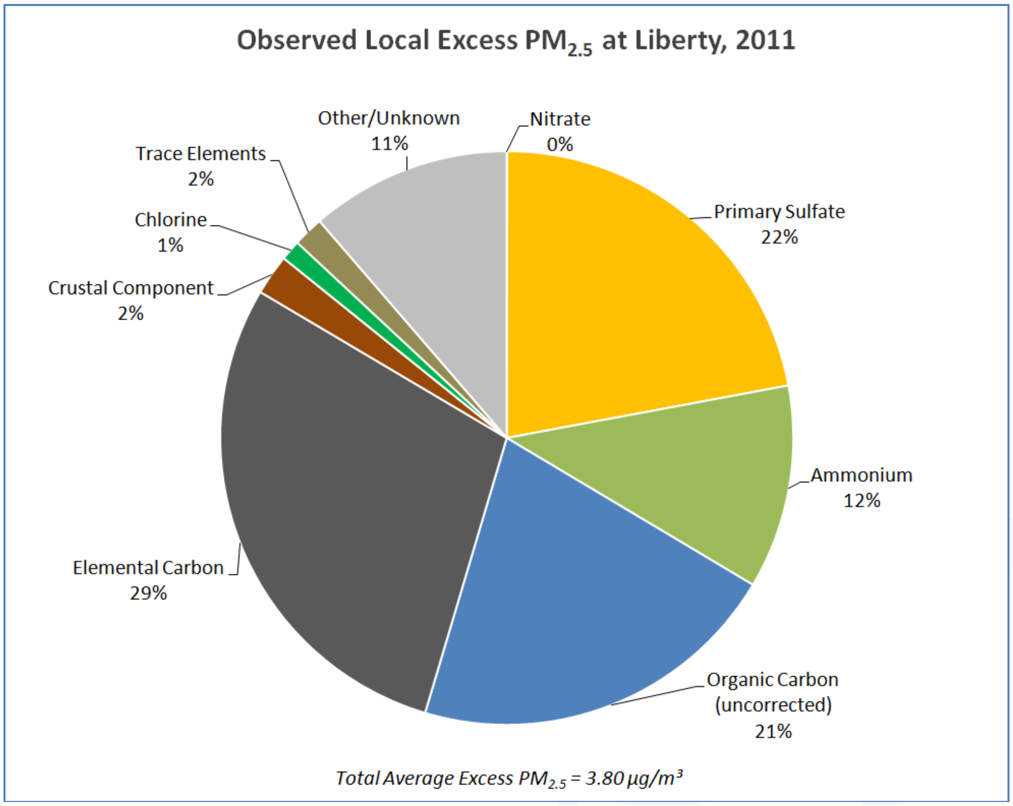

Figure 2-8. Localized $PM_{2.5}$ Excess at Liberty, by Species Composition, 2011

Note: EPA's reconstruction method for the official design values adjusts or calculates some species, including retained nitrates, organic carbon by mass balance, and indirect ammonium. "Other/Unknown" in the observed data can represent particle-bound water, unmeasured/unknown species, or differences due to analytical testing methods used for the speciation data.

More in-depth analysis of speciation data, as well as source apportionment results from the Positive Matrix Factorization (PMF) model, for the SIP timeframe of 2009-2013 and more recent years are given in Appendix C (Speciation and Source Apportionment Analysis).

3 Control Strategy

This section describes the control strategy implemented in order to reduce levels of $PM_{2.5}$ and precursors in the Allegheny County NAA, with a focus on the Liberty portion of the area. These controls have been incorporated in the future case 2021 emissions and modeling inventories for this SIP. Source modifications are federally enforceable through ACHD installation permits (IPs) and operating permits (OPs). Where indicated, the applicable IP or OP number has been provided, and these permits are publicly available.

All sources in Allegheny County require an operating permit in order to conduct operations and an installation permit in order to install new equipment or to expand processes. These permits are federally enforceable via 40 CFR[12] §52.2020, regarding EPA-approved ACHD regulations. Conditions of installation permits and all other applicable regulations are incorporated into operating permits, and all operating permits must be renewed every five years.

Summaries of the base case 2011 and future case 2021 emissions inventories for Allegheny County used in this demonstration are given in Section 4 (Emissions Inventories), with detailed inventories by process given in Appendix D (Emissions Inventories).

3.1 Local Source Modifications

A. U. S. Steel Mon Valley Works Clairton Plant: The USS Clairton coking plant is one of the largest stationary industrial sources of $PM_{2.5}$ in Allegheny County. The Clairton Plant is located in the City of Clairton on the west bank of the Monongahela River, upwind of the Liberty monitor site. The Clairton Plant is the largest industrial source of primary $PM_{2.5}$ emissions near the Liberty monitor.

   In 2013, USS installed new Low-Emission Quench Towers (LEQT) 5A and 7A as the main quench towers for Batteries 13-15 and Batteries 19-20, respectively, with the older Quench Towers 5 and 7 serving as auxiliary quench towers. This installation is enforceable by IP 0052-I014. The Clairton Quench Towers are the largest modeled contributors of $PM_{2.5}$ in the Liberty area (see Appendix I.2 (Liberty Local Area Analysis) for more details). Additional requirements for baffle washing and maintenance at the other quench towers (B and 1) have been incorporated into the 2012 operating permit (OP 0052) for the Clairton Plant.

   USS also installed a new battery (C Battery, IP 0052-I011) at the Clairton Plant in 2012 (with a LEQT), with increases in emissions of other source types, such as underfiring and battery fugitives. As a result, reductions for the Clairton Plant as a whole do not reflect large decreases in $PM_{2.5}$ (only a net decrease of 34.6 tons/year of primary $PM_{2.5}$). However, the quenching processes, the largest modeled contributors of $PM_{2.5}$ impacts, have been controlled for the area, with a reduction of 93.6 tons/year of primary $PM_{2.5}$ from the 2011 inventory to the projected 2021 inventory.

[12] Title 40 of the U.S. Code of Federal Regulations: https://www.epa.gov/laws-regulations/regulations

As part of the C Battery permit, older batteries (Batteries 7-9) were permanently retired in April 2009. While not explicitly part of the control strategy for this SIP (with a base year of 2011), the effect of this shutdown on ambient concentrations is inherently included in the 2009-2013 weighted timeframe of monitored data.

It should also be noted that precursor emissions show little transformation from the Clairton Plant to the Liberty monitor, based on modeled and speciation data results. Localized excess sulfate at the Liberty monitor is primary in nature at the Liberty site. Additionally, VOC and NH_3 have been found to be insignificant precursors for the entire NAA. Section 5 (Modeling Demonstration) provides more details on the modeled results and precursor emissions.

B. GenOn Cheswick: The GenOn (formerly NRG) Cheswick plant in Springdale Borough is the only coal-fired power plant in Allegheny County, and one of the largest of sources of $PM_{2.5}$ and precursors. A flue gas desulfurization system was installed at Cheswick (IP 0054-I004) in 2010, with full operation of the system starting in mid-2011. This system has lowered Cheswick's annual SO_2 emissions by an average of 75% (6968 tons/year) from base case 2011.[13] Requirements for NO_x emissions from Cheswick are also required by OP 0054. For the projected 2021 case, reductions of 6951.3 tons/year of SO_2 and 2128.4 tons/year of NO_x from 2011 base case were used for the emissions inventory and for modeling.

C. ATI Flat Rolled Products (Allegheny Ludlum): The ATI Allegheny Ludlum specialty steel-making facility in Harrison Township installed a new Hot Rolling Processing Facility (HRPF) at the plant (IP 0062-I008) in 2013, along with a consolidation of melt shops in 2011 (IP 0062-I007). These projects led to the shutdown of older furnaces, hot rolling mills, grinders, and torch cutters, for reductions of 46.7 tons/year of primary $PM_{2.5}$ and 36.6 tons/year of $PM_{2.5}$ precursors from the 2011 inventory to the projected 2021 inventory.

D. McConway & Torley: The McConway & Torley steel foundry in the City of Pittsburgh manufactures steel railcar products and mining castings. Since 2011, a number of installations have modified the plant configuration and reduced emissions, including a new electric arc furnace, new baghouses, and new ladle preheater burners (IPs 0275-I007, I008, I011, I013). These modifications represent a reduction of 77.9 tons/year of primary $PM_{2.5}$ from the 2011 inventory to the projected 2021 inventory.

E. Bay Valley: The Bay Valley food manufacturing facility in the City of Pittsburgh permanently switched from coal to natural gas as fuel for all boilers in 2015 (IP 0079-I005). This fuel switch represents reductions of 16.8 tons/year of primary $PM_{2.5}$ and 469.7 tons/year of $PM_{2.5}$ precursors from the 2011 inventory to the projected 2021 inventory.

[13] Based on reported CAMD SO_2 emissions from Cheswick from 2012 through 2017.

3.2 Local Source Shutdowns

The following facilities in Allegheny County have been permanently retired, with all emissions removed from the future case 2021 inventory and modeling. These sources no longer have a permit to operate in Allegheny County, and any future operation at the source properties would require a new permit application and new source review (NSR). Additionally, there are no emissions reduction credits (ERCs) for these sources available in the PA Department of Environmental Protection (PA DEP) registry.[14]

- Shenango: The Shenango coke plant in Neville Township ceased operations in 2016. Shenango was the only coking facility in Allegheny County other than the USS Clairton Plant. This shutdown represents reductions of 97.3 tons/year of primary $PM_{2.5}$ and 901.6 tons/year of $PM_{2.5}$ precursors from the 2011 inventory.

- Guardian: The Guardian glass plant in Jefferson Hills Borough was retired in 2015, for reductions of 21.6 tons/year of primary $PM_{2.5}$ and 1071.2 tons/year of $PM_{2.5}$ precursors from the 2011 inventory.

- GE Bridgeville: The General Electric (GE) Bridgeville glass plant in Collier Township closed in 2017, for reductions of 12.5 tons/year of primary $PM_{2.5}$ and 33.7 tons/year of $PM_{2.5}$ precursors from the 2011 inventory.

- Allegheny Aggregates: Allegheny Aggregates in Harrison Township closed in 2015, for reductions of 1.5 tons/year of primary $PM_{2.5}$ and 11.3 tons/year of $PM_{2.5}$ precursors from the 2011 inventory.

- ACN: ACN (formerly Bakerstown Container) in Richland Township closed in 2013, for reductions of 9.4 tons/year of primary $PM_{2.5}$ and 42.3 tons/year of $PM_{2.5}$ precursors from the 2011 inventory.

- VA Highland: The Veterans Administration (VA) Highland facility in the City of Pittsburgh closed in 2017, for reductions of 1.7 tons/year of primary $PM_{2.5}$ and 8.2 tons/year of $PM_{2.5}$ precursors from the 2011 inventory.

Additionally, the Kosmos (Cemex) cement facility in Neville Township was reclassified as a minor source in 2012. For consistency with the inventories, this source was also removed from the future case inventory, for a small reduction of primary $PM_{2.5}$ only (1.3 tons) from 2011. (The PA DEP ERC registry includes 410 tons of NO_x for this facility from closure of cement kiln equipment. ACHD presumes that these emissions, if traded under the ERC program, would not be used at the same location and have therefore not been included in this SIP analysis.)

[14] As of the April 12, 2019 version of the registry: http://files.dep.state.pa.us/Air/AirQuality/AQPortalFiles/Permits/erc/ERC_PA_Report.pdf

3.3 Regional Controls

Several federal and state rules and programs have been incorporated into the MARAMA[15] inventories used for the future case inventories and modeling. (The MARAMA inventories were developed from the EPA 2011 Version 6.2 Modeling Platform (U.S. EPA, 2015).[16]) These rules and programs have reduced emissions from several emissions sectors – in addition to the reductions to point source emissions mentioned above – and are reflected in the emissions inventories from 2011 to 2021 in Section 4 (Emissions Inventories). Controls used in the future case regional emissions include, but are not limited to, the following:

- Federal tier 3 vehicle emissions and fuel standards (2014)
- Federal emissions and fuel efficiencies for medium and heavy-duty vehicles (2011, 2016)
- Federal emissions and fuel economy standards for light-duty vehicles (2012)
- Federal rules for locomotive and marine compression-ignition engines (2008)
- Federal maximum achievable control technology (MACT) rules for industrial, commercial, and institutional boilers (2013)
- Federal standards for reciprocating internal combustion engines (RICE) (2013)
- Federal standards for commercial and industrial solid waste incinerators (CISWI) (2013)
- Federal standards for nonroad spark ignition equipment (2008)
- Federal clean air nonroad diesel rule (2004)
- Federal standards for residential wood heaters (2011)
- PA sulfur limits for commercial fuel oil (2016)
- PA VOC limits for adhesives and sealants (2012)

Documentation for the MARAMA inventory development is given in Appendix E.1 (MARAMA Alpha2 Technical Support Document). Permanent facility closures in PA and surrounding MARAMA states through 2015 were also included in the MARAMA inventories. Projected emission reductions that are not federally enforceable were used for modeling purposes only.

[15] MARAMA is the Regional Planning Organization (RPO) for the Mid-Atlantic U.S. states. Inventories are available at the following web site: http://www.marama.org/technical-center/emissions-inventory/2011-inventory-and-projections

[16] Available at the following web site: https://www.epa.gov/air-emissions-modeling/2011-version-6-air-emissions-modeling-platforms

4 Emissions Inventories

Section 51.1008 of 40 CFR Part 51 requires an emissions inventory for base and projected attainment years, based on the requirements of Section 172(c)(3) of the CAA, for any $PM_{2.5}$ NAA. As specified by the EPA $PM_{2.5}$ Implementation Rule (U.S. EPA, 2016a), pollutants inventoried for the Allegheny County $PM_{2.5}$ NAA include primary (direct) $PM_{2.5}$ along with precursors SO_2, NO_x, VOC, and NH_3. Many particulate emissions are also transported into the area from surrounding counties in southwestern Pennsylvania and from surrounding and upwind states. The EPA Emissions Inventory Guidance for $PM_{2.5}$ (U.S. EPA, 2017b) also specifies that PM_{10} should be included because PM_{10} emissions are often used as the basis for calculating $PM_{2.5}$.

The emissions inventories were compiled for all major and some minor sources within Allegheny County. Sources in the emissions inventories include stationary point sources, area sources, nonroad mobile sources, and onroad mobile sources. Fire and biogenic emissions are also included in the inventory. All emissions used for the emissions inventories for Allegheny County match those used in the modeling demonstration.

The year 2011 was used for base case emissions inventory, projected to a future case attainment year of 2021. Local projections were focused on $PM_{2.5}$ and precursor reductions from stationary point source emissions, while regional projections were based on reductions from all sectors as incorporated into the MARAMA inventories. Emissions are given in actual values based on pollutant emission factors and throughputs or capacities of each emission source. Emissions do not represent permitted or maximum allowable limits.

Source categories used for the emissions inventories are described below. The inventory listings by process are included in Appendix D (Emissions Inventories), including a summary of specific local source revisions and projections. Documentation of the regional inventory development is included in Appendix E (Emissions Inventory Documentation), and emissions inputs used for the modeling are described in Section 5 (Modeling Demonstration) and Appendix F (Modeling Protocols).

- Stationary point ("point") sources are industrial or commercial sources for which ACHD collects individual annual emissions-related information. These include major and minor sources with the potential to emit 25 tons/year or more of any criteria pollutant. Revisions for some 2011 point source emissions were made by ACHD based on newer estimates since development of the 2011 inventory. Note: The point source inventory also includes airport and helipad emissions, as developed for the 2011 NEI.[17]

- Area (or "nonpoint") sources are industrial, commercial, and residential sources that are too small or too numerous to be inventoried individually. Examples include commercial and residential fuel combustion, solvent utilization, on-shore oil and gas production, agricultural activity, and other sources. Commercial diesel marine vessels and railroad

[17] EPA's National Emission Inventory, compiled every three years for U.S. emissions. (https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei)

locomotives have also been included in the area source inventory (sometimes listed separately or as part of the nonroad mobile sector).

- Nonroad mobile (or “nonroad”) sources encompass a diverse collection of off-highway engines, including (but not limited to) outdoor power equipment, recreational vehicles, farm and construction machinery, lawn and garden equipment, industrial equipment, and other sources.

- Onroad mobile (or “onroad”) sources include passenger cars, light-duty trucks, heavy-duty trucks, buses, and motorcycles. The Motor Vehicle Emissions Simulator (MOVES) model was utilized to generate emissions based on traffic counts, vehicle speeds, vehicle population growth, and other factors.

- Fire and biogenic emissions are included in the inventories as additional sources. Fire emissions from inadvertent (wildfire) or intentional (prescribed) biomass burning are as estimated by EPA’s FIRES inventory. Biogenic (non-anthropogenic) emissions from vegetation and soils are estimated by the Biogenic Emission Inventory System (BEIS) model. These emissions are held constant from base case to future case. (In Appendix D.3 (Area Sources), fire and biogenic emissions are included at the end of the area source inventories.)

Airborne sea salt and NO_x from lightning, as estimated by the CAMx model, were also included as additional emissions for the modeling but not for the inventory (see Appendix F.2 (CAMx Modeling Protocol).)

Emissions inventory summaries for base and future projected cases are shown in Tables 4-1 and 4-2[18] by sector for Allegheny County.

[18] Note: Due to the rounding to whole tons, the sum of the sectors in Tables 4-1 and 4-2 may not add up to the totals. Detailed emissions by process/category in Appendix D (Emissions Inventories) are given in thousandths of a ton (three decimal places).

Table 4-1. Base Case 2011 Emissions by Sector (tons/year)

Allegheny County (2011)	$PM_{2.5}$	$PM_{2.5}$ (filt)	$PM_{2.5}$ (cond)	PM_{10}	SO_2	NO_x	VOC	NH_3
Point Sources	2,503	1,338	1,164	2,987	13,460	11,128	1,669	207
Area Sources	2,491	2,011	480	4,683	1,528	6,979	11,200	621
Nonroad Mobile Sources	361	361	0	378	11	3,921	3,780	5
Onroad Mobile Sources	450	450	0	984	78	13,259	7,383	304
Fires	24	24	0	29	2	5	64	4
Biogenics	0	0	0	0	0	166	5,876	0
Total	**5,829**	**4,185**	**1,644**	**9,061**	**15,080**	**35,460**	**29,972**	**1,141**

Table 4-2. Future Case Projected 2021 Emissions by Sector (tons/year)

Allegheny County (2021)	$PM_{2.5}$	$PM_{2.5}$ (filt)	$PM_{2.5}$ (cond)	PM_{10}	SO_2	NO_x	VOC	NH_3
Point Sources	2,256	1,256	999	2,722	5,921	7,928	1,534	202
Area Sources	2,708	2,226	472	5,486	1,079	6,664	10,221	615
Nonroad Mobile Sources	234	234	0	248	5	2,212	2,752	6
Onroad Mobile Sources	266	266	0	722	31	5,708	3,479	209
Fires	24	24	0	29	2	5	64	4
Biogenics	0	0	0	0	0	166	5,876	0
Total	**5,488**	**4,007**	**1,471**	**9,207**	**7,039**	**22,684**	**23,926**	**1,037**

Note: For the emissions inventories in Tables 4-1 and 4-2 and in Appendix D (Emissions Inventories), primary $PM_{2.5}$ emissions are also separated into filterable and condensable fractions for point and area sources. If not reported as individual fractions, $PM_{2.5}$ emissions are assumed to be composed of filterable component only, with the condensable component equal to zero. For concentrations, total $PM_{2.5}$ (and PM_{10}) includes both primary (released into the air as a particle) and secondary (chemically transformed from precursors) components.

Additionally, PM_{10} by definition includes all $PM_{2.5}$ plus PM_{coarse} (particles greater than 2.5 µm in diameter but less than or equal to 10 µm). The condensable component of particulate matter is considered to exist entirely in the 2.5 µm fraction.

Allegheny County point source locations are shown in the map in Figure 4-1, with total $PM_{2.5}$ and precursor emissions (i.e., the sum of primary $PM_{2.5}$ and all $PM_{2.5}$ precursors) for 2011 indicated by classed icons (from smallest to largest emissions, yellow to red). Facilities with greater than 100 tons/year of total $PM_{2.5}$ and precursors include labels. The largest facilities were the focus of the local control strategy and RACT.

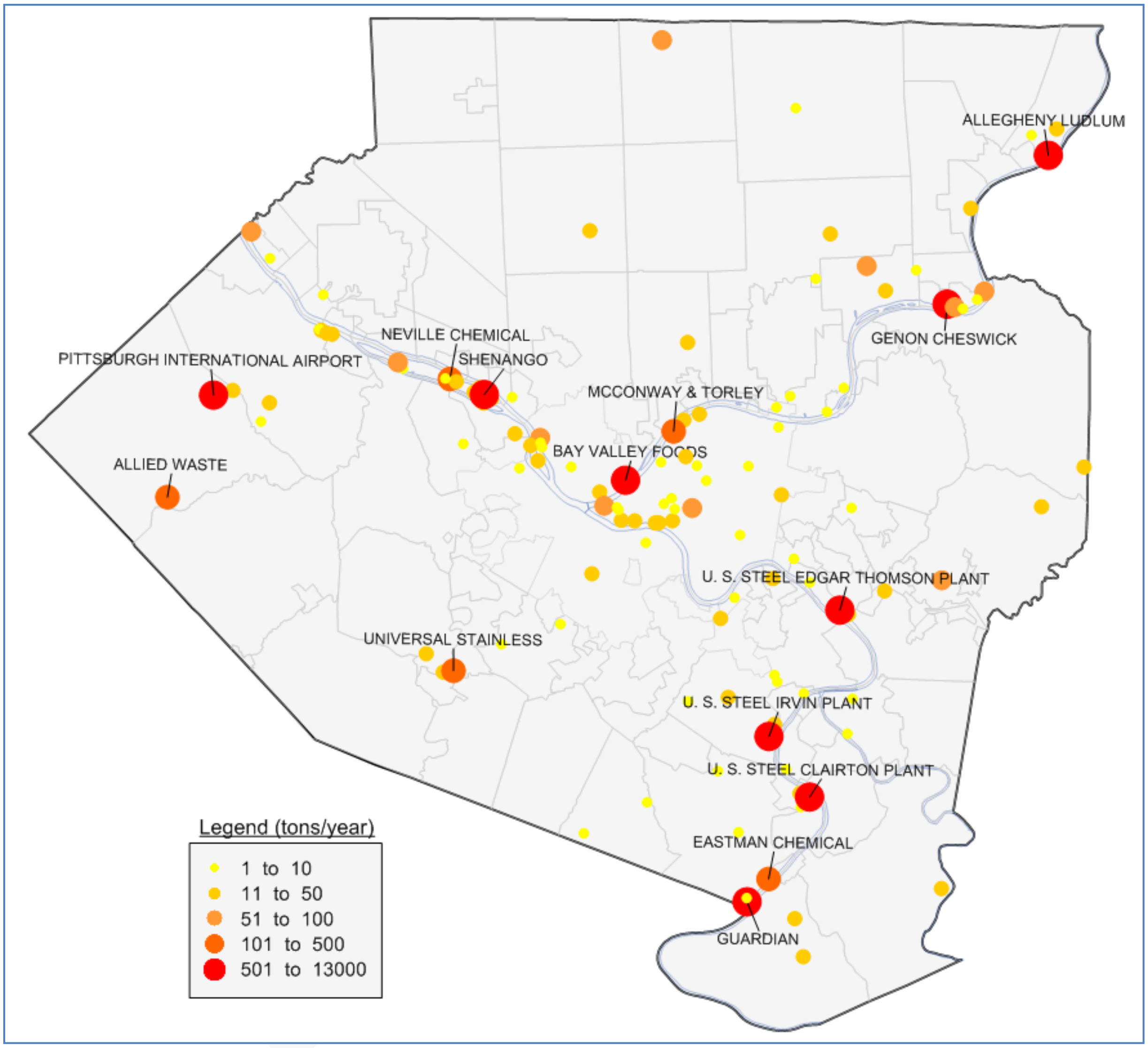

Figure 4-1. Map of Allegheny County Point Sources, with $PM_{2.5}$ and Precursor Emissions (tons/year), 2011

Point source emissions are emitted mainly by large facilities located in industrial river valleys in Allegheny County, with smaller sources of $PM_{2.5}$ and precursors spread throughout the county. Reductions in point source emissions from 2011 to 2021 totaled 11,127 tons/year of $PM_{2.5}$ and precursors for this demonstration.

Looking at emissions from all sectors, Figure 4-2 shows a pie chart of the percentages of total $PM_{2.5}$ and precursor emissions by sector in Allegheny County for 2011.

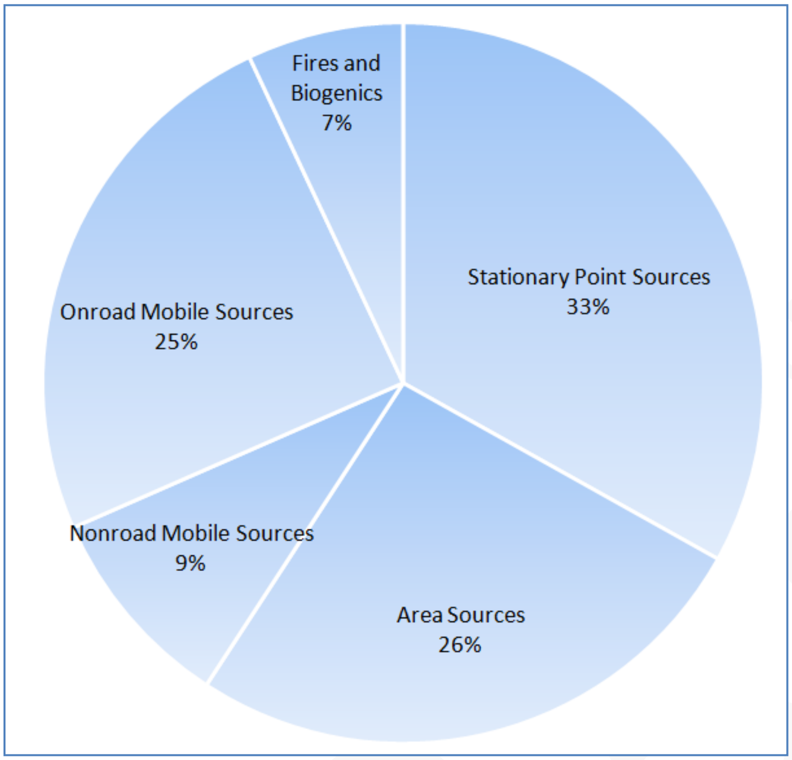

Figure 4-2. Allegheny County Total $PM_{2.5}$ and Precursor Emissions, Percentages by Sector, 2011

Figure 4-2 shows that while point sources are the largest overall contributors of $PM_{2.5}$ and precursors (33%), other sectors such as area and onroad mobile sources are also considerable contributors. Overall emissions from all sectors were reduced by 27,308 tons/year of $PM_{2.5}$ and precursors from 2011 to 2021 in Allegheny County in this demonstration.

5 Modeling Demonstration

5.1 Design/Overview

A modeling demonstration for a SIP shows that an area can attain the NAAQS by a future projected date. Modeling for the Allegheny County, PA NAA was focused on the simulation of regional impacts from $PM_{2.5}$ precursors and localized impacts from primary $PM_{2.5}$ sources. The photochemical model CAMx with plume-tracking options was utilized at fine grid resolution to model both long-range transport and near-field impacts of most sources. AERMOD (U.S. EPA, 2017a) was utilized for localized primary $PM_{2.5}$ impacts at the Liberty monitor only.

5.2 Emissions/Modeling Assistance

For assistance with the modeling effort, ACHD contracted Ramboll Environ US Corporation (Ramboll) of Novato, CA (ACHD contract title *Allegheny County Reactive $PM_{2.5}$ Pollutant Modeling*, Specification No. 7581). Ramboll is a highly qualified consulting firm that provided advanced computer modeling for a realistic representation of $PM_{2.5}$ impacts in Allegheny County.

As part of the contract, Ramboll developed the following:

- Sparse Matrix Operator Kernel Emissions System (SMOKE)[19] emissions modeling inputs from the inventory databases
- Weather Research and Forecasting (WRF)[20] meteorological modeling for base year 2011
- Comprehensive Air quality Model with extensions (CAMx)[21] modeling for base and projected years
- Mesoscale Meteorological Interface Program (MMIF)[22] inputs for AERMOD

Large- and fine- mesh grids at numerous vertical levels were employed to simulate atmospheric conditions across Allegheny County. In addition, the Plume-in-Grid (PiG) model was used to simulate fine particulate matter impacts for sources near monitor sites.

5.3 CAMx Modeling

CAMx was used for photochemical grid model (PGM) results for the modeling demonstration with WRF meteorological simulation for 2011. Ramboll followed modeling procedures outlined in Appendix F.1 (WRF Modeling Protocol), Appendix F.2 (CAMx Modeling Protocol), and EPA Modeling Guidance (U.S. EPA, 2014, 2018b). Modeling included use of the PiG and Particulate Source Apportionment Technology (PSAT) modules for local source tracking.

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[19] https://www.cmascenter.org/smoke/
[20] https://www.mmm.ucar.edu/weather-research-and-forecasting-model
[21] http://www.camx.com/
[22] https://www.epa.gov/scram/air-quality-dispersion-modeling-related-model-support-programs

5.3.1 Model Configuration

CAMx version 6.30 (Ramboll, 2016) was used by Ramboll for the modeling of the Allegheny County, PA NAA. The model was designed to include both regional and localized $PM_{2.5}$ impacts formed by both primary and secondary mechanisms. CAMx includes several features that were deemed important for $PM_{2.5}$ modeling of Allegheny County, in particular:

- Two-way grid nesting to allow regional- and local-scale impacts within the same simulation
- Subgrid-scale PiG module to sample the puffs for the contributions of local sources
- CB6 chemical mechanism that represents the latest understanding of photochemistry
- PSAT, important for obtaining the separate contributions from local sources

Since $PM_{2.5}$ is composed of both primary and secondary components, emission inputs for CAMx included all $PM_{2.5}$ precursor pollutants (SO_2, NO_x, VOCs, NH_3) along with primary $PM_{2.5}$.

Meteorological inputs for CAMx were generated using WRF version 3.7.1 (NCAR, 2016). The WRF grids followed the same grid resolutions as the CAMx, creating several vertical layers of meteorological data for each modeled grid cell.

Local Source Treatment

To account for significant individual emission sources in an area of interest, the PiG option incorporates a puff/plume model within the CAMx grid cells. Additionally, the PSAT option was used to track contributions from a selected group of local sources. This technique enables the results of separate regional and local impacts to be used for modeling and attainment tests.

The local point sources selected for PiG and PSAT handling were based on amount of emissions, release heights, and proximity to monitors. Sources selected for local source treatment are given in Table 5-1 below, along with their base year 2011 primary $PM_{2.5}$ emissions, in tons/year.

Table 5-1. Local Sources for PiG and PSAT Treatment

Facility	**2011 Primary $PM_{2.5}$ (tons/year)**	**Closest $PM_{2.5}$ Monitor Site**
USS Clairton	588.7	Liberty
USS Edgar Thomson	633.2	North Braddock
USS Irvin	71.4	Liberty
ATI Allegheny Ludlum	222.5	Harrison
McConway & Torley	88.9	Lawrenceville
Shenango	97.3	Avalon

The use of PiG allows for specialized treatment of plumes from these sources (similar to refined dispersion modeling), and PSAT allows for separate accounting of impacts from these sources.

5.3.2 Modeling Domains

WRF and CAMx were run for a 36/12/4/1.33 km domain structure, as well as an additional WRF domain at 0.444 km resolution for MMIF only, defined as follows:

- d01: A continental U.S. (CONUS) domain at 36 km resolution is defined to be the standard RPO CONUS domain.
- d02: A northeastern U.S. (NEUS) domain at 12 km resolution, identical to the NEUS domain used by the Ozone Transport Commission (OTC) 12 km domain that is also used by MARAMA.
- d03: A nested domain at 4 km resolution that covers all of Pennsylvania (PA) and adjacent areas in surrounding states.
- d04: A nested domain at 1.33 km resolution for Allegheny County and portions of adjacent counties.
- d05: A nested domain at 0.444 km resolution for MMIF data in the Monongahela Valley, to be used with AERMOD only.

Figures 5-1 through 5-3 show maps of the modeled domains.

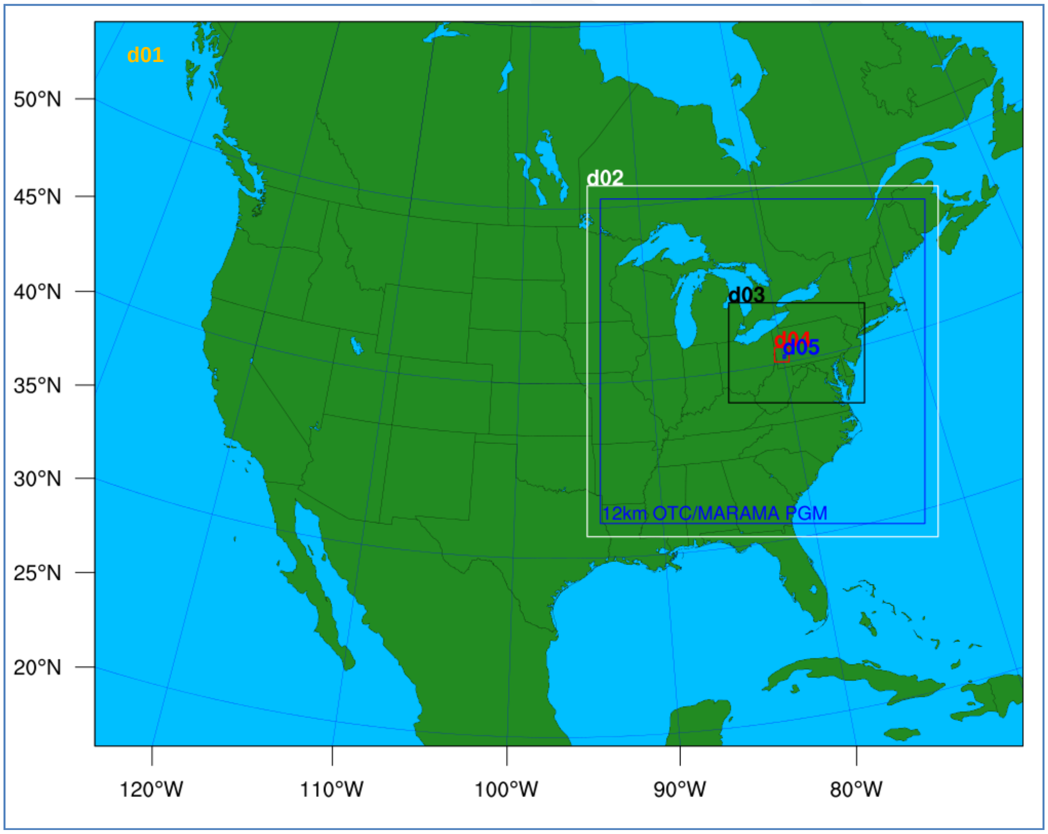
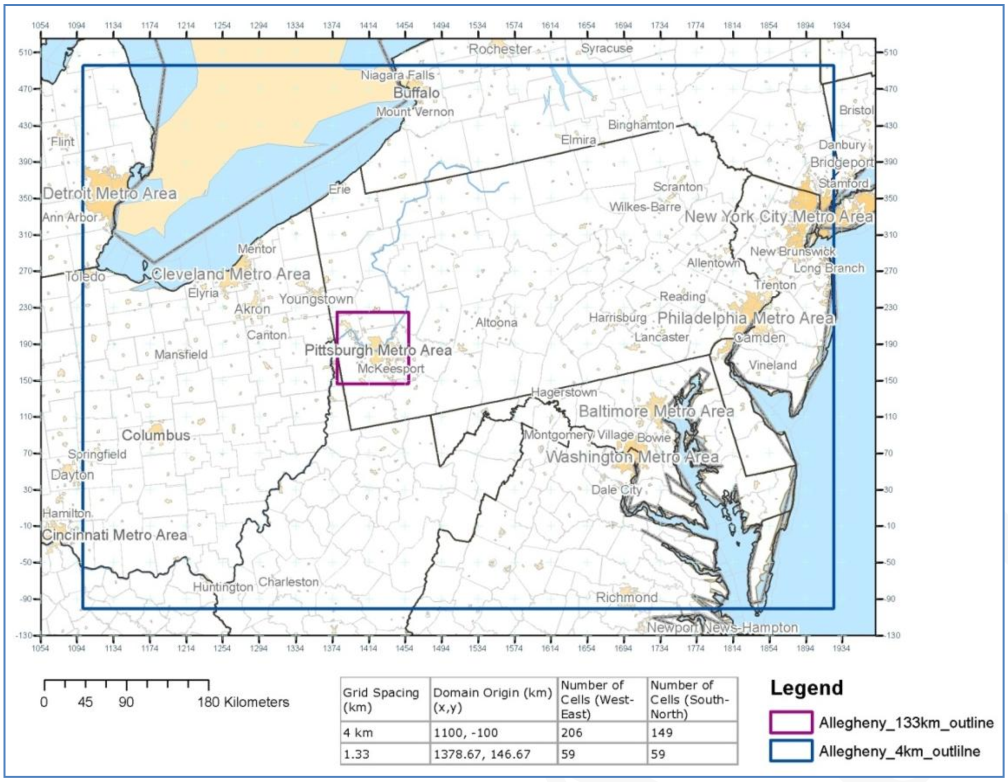


Figure 5-1. WRF/CAMx Modeling Domains, Continental U.S.



Grid Spacing (km)	Domain Origin (km) (x,y)	Number of Cells (West-East)	Number of Cells (South-North)
4 km	1100, -100	206	149
1.33	1378.67, 146.67	59	59

Figure 5-2. 4 km and 1.33 km Modeling Domains

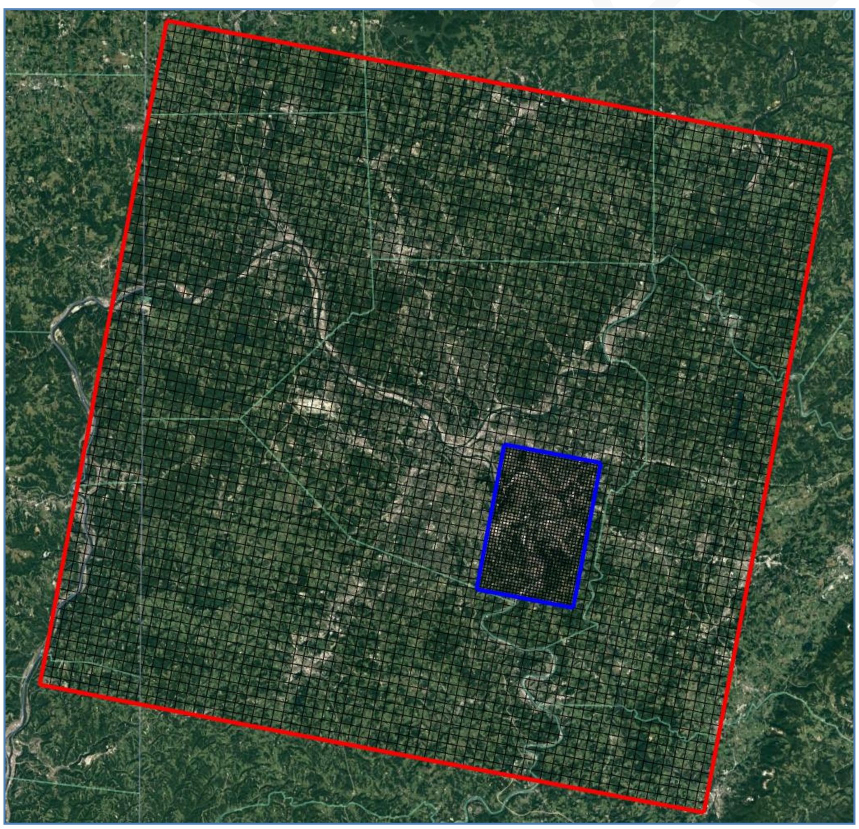


Figure 5-3. Close-Up of 1.33 km (red) and 0.444 km (blue) Modeling Domains

5.3.3 Modeling Inventories

Emissions inventories for the base year modeling were based on MARAMA and EPA inventories and modeling platforms (MPs). Revisions were made by ACHD to Allegheny County sources, based on updated stack test data and corrections to emissions or stack parameters. Details of the inventory development are given in Appendix D (Emissions Inventories), Appendix E (Emissions Inventory Documentation), and Appendix F (Modeling Protocols). Table 5-2 below shows the 2011 modeled inventory databases by U.S. region.

Table 5-2. 2011 Base Case Modeling Inventories by Region/Domain

Source Sector	Allegheny County (1.33 km Domain)	Mid-Atlantic States (4 km Domain)	Eastern U.S. (12 km Domain)	Continental U.S. (36 km Domain)
Point	ACHD Local + MARAMA 2011 Alpha2	MARAMA 2011 Alpha2	EPA 2011 v6.2 MP	EPA 2011 v6.2 MP
EGU Point	EPA 2011 v6.2 MP 2011 w/CAMD CEMS	EPA 2011 v6.2 MP 2011 w/CAMD CEMS	EPA 2011 v6.2 MP 2011 w/CAMD CEMS	EPA 2011 v6.2 MP
Area	MARAMA 2011 Alpha2	MARAMA 2011 Alpha2	EPA 2011 v6.2 MP	EPA 2011 v6.2 MP
Nonroad Mobile	MARAMA 2011 Alpha2	MARAMA 2011 Alpha2	EPA 2011 v6.2 MP	EPA 2011 v6.2 MP
Onroad Mobile	MARAMA 2011 Alpha2	MARAMA 2011 Alpha2	EPA 2011 v6.2 MP	EPA 2011 v6.2 MP
Fires	EPA 2011 v6.2 FIRES	EPA 2011 v6.2 FIRES	EPA 2011 v6.2 FIRES	EPA 2011 v6.2 FIRES
Biogenics	EPA 2011 NEIv2 BEIS	EPA 2011 NEIv2 BEIS	EPA 2011 NEIv2 BEIS	EPA 2011 NEIv2 BEIS

Notes:

- MARAMA Alpha2 and EPA v6.2 MP are developed from 2011 NEIv2
- Point sources include non-EGUs and small EGUs
- EGU emissions include Clean Air Markets Division (CAMD) continuous emission monitoring system (CEMS) data for the SO_2 and NO_x temporal profiles, with EPA 2011 (annualized) emissions for other pollutants
- ACHD Local is corrected MARAMA inventory for emissions, stack parameters, coordinates, etc.
- 36/12 km domains are used to develop boundary conditions for 4/1.33 km domains

Emissions inventories for the future year modeling were based on MARAMA, EPA, and Eastern Regional Technical Advisory Committee (ERTAC) EGU inventories and modeling platforms. Similar to the base case, revisions were made by ACHD to Allegheny County sources for 2021 for known modifications, shutdowns, projected growth, and new sources (see Appendix D.1 (Summary of Inventories and Revisions)). Table 5-3 below shows the 2021 modeled inventory databases by U.S. region. Since MARAMA Alpha2 inventories were projected to years 2018 and 2028, many sectors for the future case year 2021 were based on interpolations.

Table 5-3. 2021 Future Case Modeling Inventories by Region/Domain

Source Sector	Allegheny County (1.33 km Domain)	Mid-Atlantic States (4 km Domain)	Eastern U.S. (12 km Domain)	Continental U.S. (36 km Domain)
Point	ACHD Local + MARAMA Alpha2 Interpolated 2018/2028	MARAMA Alpha2 Interpolated 2018/2028	EPA v6.2 MP Interpolated 2017/2025	EPA v6.2 MP Interpolated 2017/2025
EGU Point	ERTAC v2.4L2 2021	ERTAC v2.4L2 2021	ERTAC v2.4L2 2021	EPA v6.2 MP Interpolated 2017/2025
Area	MARAMA Alpha2 Interpolated 2018/2028	MARAMA Alpha2 Interpolated 2018/2028	EPA v6.2 MP Interpolated 2017/2025	EPA v6.2 MP Interpolated 2017/2025
Nonroad Mobile	EPA v6.2 MP Interpolated 2017/2025	EPA v6.2 MP Interpolated 2017/2025	EPA v6.2 MP Interpolated 2017/2025	EPA v6.2 MP Interpolated 2017/2025
Onroad Mobile	MARAMA Alpha2 2018	MARAMA Alpha2 2018	EPA v6.2 MP 2017	EPA v6.2 MP 2017
Fires	EPA 2011 v6.2 FIRES	EPA 2011 v6.2 FIRES	EPA 2011 v6.2 FIRES	EPA 2011 v6.2 FIRES
Biogenics	EPA 2011 NEIv2 BEIS	EPA 2011 NEIv2 BEIS	EPA 2011 NEIv2 BEIS	EPA 2011 NEIv2 BEIS

Notes:
- MARAMA Alpha2 and EPA v6.2 MP are developed from NEIv2 w/projections
- For the onroad mobile sector, 2018/2017 are used as conservative estimates for future case 2021
- For the nonroad mobile sector in the 1.33 and 4 km domains, EPA interpolations were used due to issues with the MARAMA 2018/2028 files
- ERTAC 2.4L2 2021 is based on projected EGU emissions for OTC, LADCO, SESARM, and CENSARA regions
- Fires and biogenics are held constant for future case
- ACHD Local is projected based on known modifications/shutdowns (with other sources held constant)

The ERTAC EGU Emissions Projection tool[23] has been used in place of EPA interstate rules and Integrated Planning Model (IPM) projections as a best-available approach for these sources. ERTAC version 2.4L2 was used for the future case 2021 emissions for the 12 km and higher resolution (4 km and 1.33 km) domains. ERTAC v2.4L2 is a modified version of ERTAC v2.4, developed by the Lake Michigan Air Directors Consortium (LADCO)[24] in 2015 for Ohio EPA's Cleveland Area $PM_{2.5}$ SIP.[25]

ERTAC 2.4L2 contains emissions information for EGUs in the continental U.S. based on information from state regulators, industry representatives, and RPO members. Growth and control factors are based on Annual Energy Outlook (AEO) 2015,[26] and information on changes such as new units, modifications to control technology, fuel changes, and shutdowns are included in the inventory.

For the ERTAC 2.4L2 2021 emission projections, focus was placed on permanent changes while maintaining a consistent inventory-wide generation capacity from base case to future case. The ERTAC-projected 2021 emissions take into account only enforceable control measures (as of July 2015), fuel changes, and operational status changes (including shutdowns). As a result, some uncontrolled plants were assigned increased emissions from base case in order to account for losses in overall generating capacity due to shutdowns and operational changes. Projected EGU emissions associated with ongoing regulatory actions (e.g., Clean Power Plan (CPP), Cross-State Air Pollution Rule (CSAPR), and Mercury Air Toxics Standards (MATS)) are not included in the projection from base year 2011 to 2021.

More information on the ERTAC 2.4L2 emissions used in the demonstration is included in Appendix K (EGU Analysis).

5.3.4 CAMx Modeled Results

The CAMx modeling produced base year and future year predictions of $PM_{2.5}$ species at each grid cell location in the modeling domains. Figure 5-4 shows the absolute[27] modeled total $PM_{2.5}$ (sum of all species) for base case 2011 and future case 2021 for the 1.33 domain. Reductions in modeled impacts are evident throughout most of Allegheny County, with highest impacts for both cases in the Mon Valley.

[23] https://www.epa.gov/air-emissions-inventories/eastern-regional-technical-advisory-committee-ertac-electricity-generating

[24] LADCO is the RPO for the Midwestern U.S. states. (https://www.ladco.org/)

[25] Available at the following web site: https://www.epa.ohio.gov/dapc/sip/2013

[26] Prepared by the U.S. Energy Information Administration (EIA). (https://www.eia.gov/)

[27] In modeling, "absolute" represents the actual concentration generated by the model for a given scenario. For $PM_{2.5}$ modeling, absolute impacts are not used directly. Instead, impacts are used in a relative sense, with ratios of future case impacts to base case impacts (or relative response factors, RRFs) scaling down monitored concentrations from base case levels to future case levels.

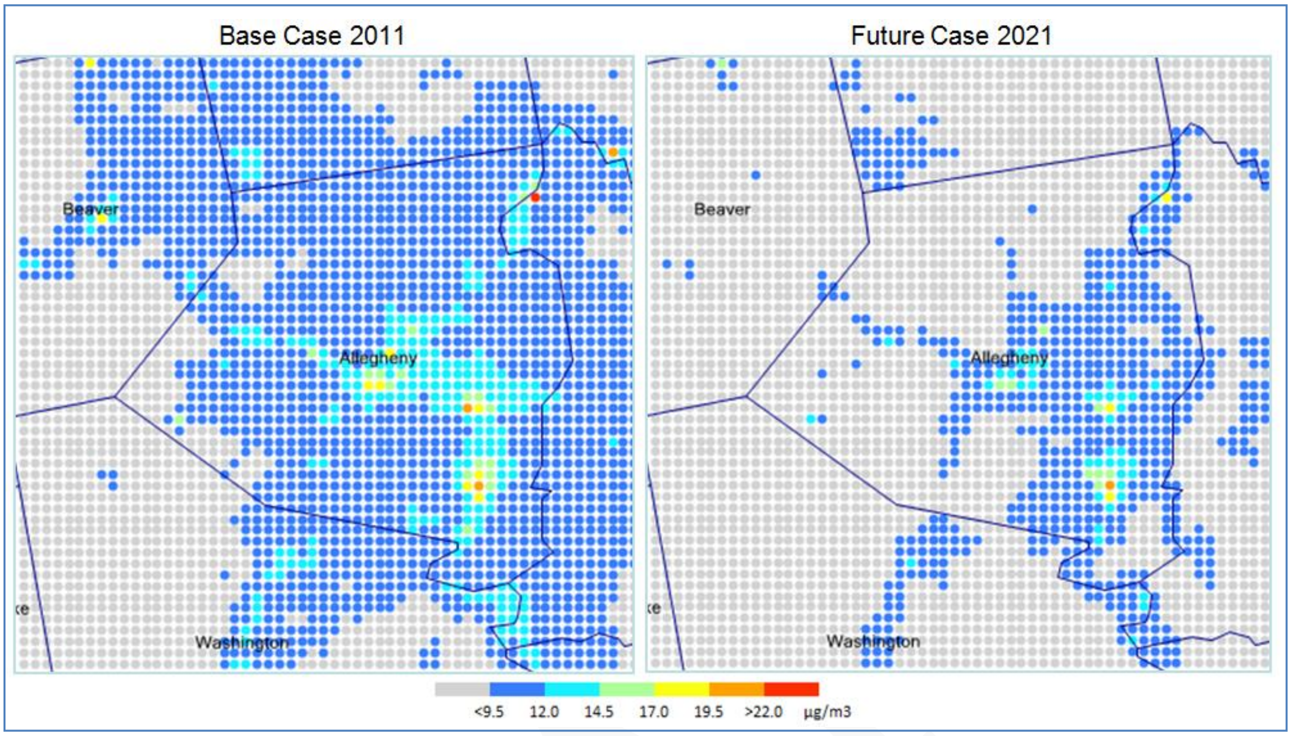


Figure 5-4. Modeled Absolute Annual Total $PM_{2.5}$ (µg/m³) for the 1.33 Domain, Base and Future Cases

5.3.5 MATS Attainment Test Results

Modeled impacts are used to scale down monitored data over the 2009-2013 timeframe for each monitor site using EPA's Modeled Attainment Test Software (MATS) version 2.6.1[28] (Abt Associates, 2014). The MATS software combines modeled relative response factors (RRFs) with monitored species data for each site on annual and 24-hour bases. MATS also adjusts and reconstructs monitored data according to the SANDWICH method (outlined in the EPA Modeling Guidance), which better represents speciation data when used in combination with FRM masses.

The following assumptions were used for the MATS settings:

- Nitrate (NO_3) is based on retained portion (calculated by EPA, included with MATS software)
- Organic carbon (OC) is calculated by mass balance from all other species

[28] Software for the Modeled Attainment Test - Community Edition (SMAT-CE) Version 1.2 has been released as a replacement to MATS 2.6.1, and some maps shown in this SIP and appendices were generated by SMAT-CE. However, testing of the software revealed issues with the monitor (point) design value calculations. Therefore, the official design values were generated with the MATS 2.6.1 software. Software for both SMAT-CE and MATS is available at the following web site: https://www.epa.gov/scram/photochemical-modeling-tools

- Ammonium (NH_4) is calculated from sulfate, nitrate, and degree of neutralization (DON)
- Particle bound water (PBW) is calculated from sulfate, nitrate, and ammonium values
- Monitored sulfate (SO_4), elemental carbon (EC), and crustal component are used directly for the calulations
- Salt and passive (blank) component are held constant from base to future case

Figure 5-5 shows a simplified diagram of the combination of modeled results and monitored data using the SANDWICH approach and the MATS software to project future case concentrations.

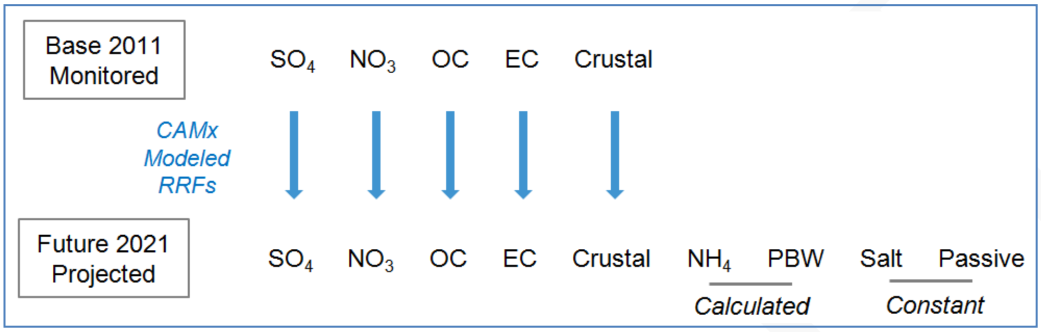


Figure 5-5. Combination of Modeled and Monitored Species using MATS

The resulting attainment test results from MATS showed future case design values that are attaining the NAAQS, both annual and 24-hour bases, for all sites in Allegheny County except Liberty. Base and future case design values (DVs) for these sites are shown in Table 5-4. Full results of CAMx and MATS are given in Appendix I.1 (Air Quality Technical Support Document).

Table 5-4. Base and Future Design Values (μg/m³) for Allegheny County Sites, Except Liberty

Site	AQS Code	Base Annual DV	Future Annual DV	Base 24-Hr DV	Future 24-Hr DV
Avalon	42-003-0002	12.4	10.0	27	21
Lawrenceville	42-003-0008	11.0	9.0	25	20
S. Fayette	42-003-0067	10.3	8.5	26	18
N. Park	42-003-0093	9.3	7.6	22	17
Harrison	42-003-1008	11.5	9.4	28	21
N. Braddock	42-003-1301	12.3	10.0	32	23
Clairton	42-003-3007	10.7	9.2	25	21

Note: Based on NAAQS rounding conventions, annual design values are rounded to the nearest tenth of a μg/m³ and 24-hour design values to the nearest integer.

A review of the CAMx modeling and MATS attainment test results showed that the analysis was inadequate to demonstrate attainment for the Liberty site for the following reasons:

- The ERTAC 2.4L2 projections used in the CAMx modeling were very conservative for 2021 EGU emissions. Compared to recent actual CAMD emissions, future SO_2 and NO_x emissions were overestimated considerably in the Midwest and Mid-Atlantic region. Overestimates of SO_2 and NO_x caused overprediction of future case modeled ammonium sulfates/nitrates as well as particle-bound water with the CAMx impacts.

- Some local primary $PM_{2.5}$ emissions were overestimated with the inventory used for the CAMx modeling. More recent stack tests for primary $PM_{2.5}$ can be used for more accurate modeled inputs.

- The spatial resolution of 1.33 km CAMx gridded cells, used for all locations in Allegheny County, was likely too large to properly simulate localized impacts at Liberty. Impacts are averaged throughout a grid cell, potentially smoothing over concentration gradients (high or low) near the Liberty monitor site.

- Source characterization with CAMx was likely not fully representative of some sources near Liberty, specifically at the USS Clairton Plant. All local stationary sources were configured in CAMx as point sources, with constant emissions and fixed stack parameters. Refined modeling with AERMOD can more accurately account for many processes with the use of different source types (volumes, lines, etc.), building parameters (for downwash), and varying release heights (buoyant volumes). This is especially important for USS Clairton, since some source types have been controlled while other sources types have been added.

- Based on analysis of monitored speciation data in comparison to CAMx modeled species, species are not being properly apportioned by the modeled results and the EPA SANDWICH reconstruction method used by MATS. Modeled primary excess $PM_{2.5}$ does not directly translate into monitored primary excess by species, and localized impacts in this case are better accounted for when modeling a local primary component separately from the regional components.

It was also observed with the CAMx modeling that there is little chemical transformation of precursors from the Clairton Plant to the Liberty monitor. In addition to the tracking of local and regional impacts, the CAMx model configuration allowed for the tracking of primary and secondary impacts from local point source impacts. For base case 2011, modeled results showed that only 4% of the modeled localized excess was composed of secondary ammonium sulfate and nitrate. The modeled excess $PM_{2.5}$ at Liberty is overwhelmingly primary in nature, with secondary impacts from precursors showing negligible contributions.

5.4 AERMOD Modeling

The CAMx model configuration was designed to allow for additional local source modeling, with impacts separated by regional and local major source impacts. A local area analysis (LAA) was developed for refined modeling of the Liberty area using the AERMOD[29] model in combination with the CAMx regional results.

5.4.1 Liberty LAA Methodology

The refined modeling for the Liberty LAA used the AERMOD modeling system version 18081 (U.S. EPA, 2018a) for major local source impacts combined with the regional CAMx impacts. The monitored data timeframe was based on 2009-2013 for the base case calculations, projected to a future case year 2021 using modeled RRFs. This methodology is identical to that used for the other sites, except that the MATS software was not used for the calculations since it is not capable of such combination of impacts.

The sources modeled with AERMOD for the Liberty LAA included the following:

- Near-field sources: USS Clairton, USS Irvin, USS Edgar Thomson
- Distant sources: Shenango, Allegheny Ludlum, McConway & Torley

These sources are the same sources that were modeled as PiG sources and tracked with PSAT in CAMx. Primary $PM_{2.5}$ impacts from these sources were subtracted from the regional contributions of the CAMx impacts. The refined LAA modeling lumped the AERMOD impacts from these sources into a new component called local primary material (LPM), to be summed with the CAMx regional impacts (i.e., without LPM) according to the SANDWICH reconstruction methodology to generate the final design values at Liberty.

The CAMx regional results included secondary impacts (formed from precursor emissions) from all sources and sectors, as well as primary $PM_{2.5}$ impacts from all sources/sectors other than the LPM sources. The LPM results included only impacts from primary $PM_{2.5}$ (filterable and condensable) emissions from the six sources identified above.

5.4.2 Model Configuration

The AERMOD modeling was performed according to procedures outlined in Appendix F.3 (AERMOD Modeling Protocol).

Source types were as follows:

- Stacks/towers: point sources, including building parameters for sources with downwash
- Ambient-temperature process fugitives: volume sources
- Pile erosion sources: area sources

[29] American Meteorological Society/Environmental Protection Agency Regulatory Model (https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models)

- Coke oven (buoyant) battery fugitives: line volume sources with a BLP[30]/AERMOD hybrid approach

The BLP/AERMOD hybrid approach for buoyant line sources was approved for use by the EPA Region 3 regional office as an alternative model on August 16, 2018 (see Appendix H (Alternative Modeling Demonstration for Buoyant Fugitives)).

Meteorological inputs were based on 2011 MMIF version 3.4 (Brashers and Emery, 2018) prognostic site-specific data extracted from WRF at each source location.

An expanded-scale receptor grid was used for Liberty, with several receptors placed near the monitor location within a 500-m radius of Liberty and within 50 ft elevation of the flagpole height of the FRM monitor. Figure 5-6 shows the locations of the Liberty receptors used for the AERMOD LPM impacts.

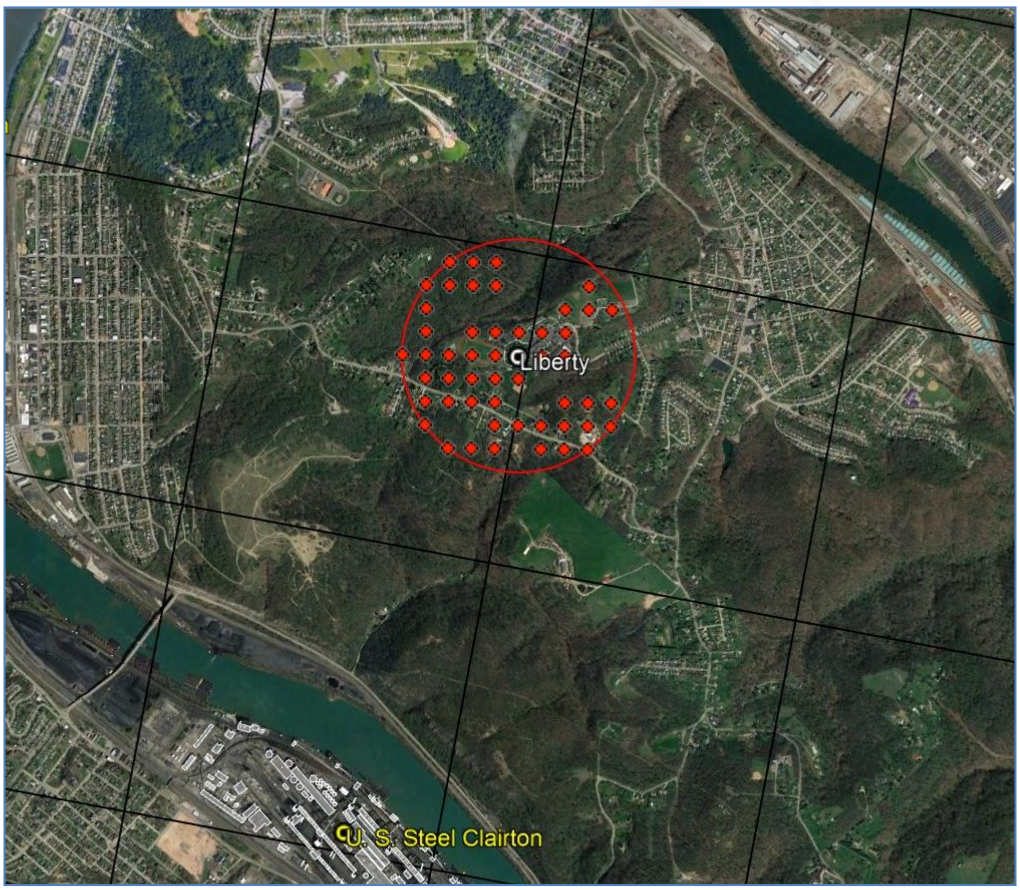


Figure 5-6. Liberty Area Receptors in AERMOD

[30] Buoyant Line and Point Source dispersion model (https://www3.epa.gov/ttn/scram/userg/regmod/blpug.pdf)

The CAMx grid cells corresponding with the Liberty monitor will be used for the non-LPM component of $PM_{2.5}$ at Liberty. Figure 5-7 shows the numbered CAMx 1.33 km resolution grid cells containing or adjacent to the Liberty site. Since Liberty falls near the border of two CAMx grid cells (18042 and 18043),[31] averages of the two grid cells were used in combination with the AERMOD impacts.

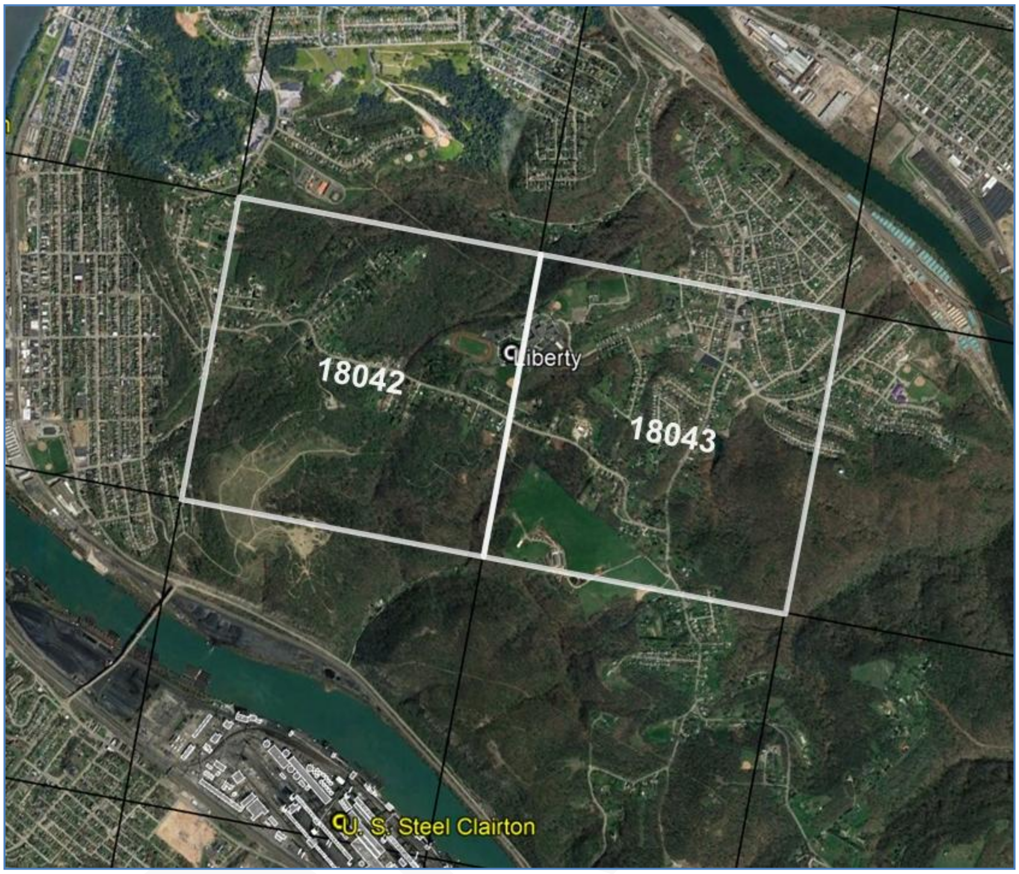


Figure 5-7. CAMx 1.33 km Grid Cells in Liberty Area

Modeled species were averaged by major species on a daily (24-hour calendar day) basis. Modeled RRFs from the AERMOD base and future case model runs were then applied to the monitored LPM component, and the CAMx modeled RRFs were applied to the regional components for Liberty.

5.4.3 Liberty Attainment Test Results

In order to combine the impacts from two different models, the monitored data was first "split" into the localized Liberty LPM component and the regional component. This was done by first calculating the average species compositions of the surrounding speciation sites in the Pittsburgh MSA.[32] The Liberty monitored local excess component was then determined from a series of

[31] CAMx grid cells were numbered according to geographic x-y coordinates used by the model.
[32] The Lawrenceville, Florence, and the Greensburg CSN monitor sites.

calculations that subtracted the average quarterly regional species concentrations from the Liberty quarterly concentrations, on both annual and 24-hour high-day bases. (See Appendix I.2 (Liberty Local Area Analysis) for the calculations.)

Design values are then calculated in the same manner as the MATS software, applying the modeled RRFs to the monitored species data. Figure 5-8 shows the simplified diagram of the combination of modeled and monitored data as used for the LAA, with the species split into regional and LPM components for Liberty.

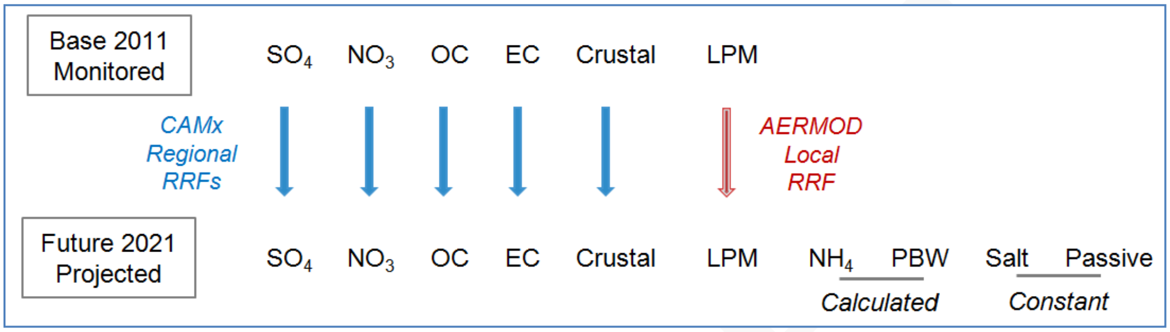


Figure 5-8. Combination of Modeled and Monitored Species for the Liberty LAA

After the more specific combination of the regional and local components, Table 5-5 below shows the final design values for Liberty from the refined LAA modeling. (See Appendix F (Modeling Protocols) and Appendix I (Modeling Demonstration and Analyses) for more details on the combination of regional and local impacts.)

Table 5-5. Base and Future Design Values (µg/m³), Liberty

Site	AQS Code	Base Annual DV	Future Annual DV	Base 24-Hr DV	Future 24-Hr DV
Liberty	42-003-0064	14.4	12.0	41	35

5.5 Model Performance

Model performance review provides a method to examine modeled data in comparison to actual monitored data for the same timeframe. For the base 2011 case, model performance for the Allegheny County, PA NAA was examined by Ramboll and ACHD. Detailed model evaluations for the WRF, CAMx, and AERMOD modeling results are provided in Appendix G (Model Performance Evaluations). Results overall showed good performance in comparison to monitored data and to model benchmarks for photochemical modeling.

EPA Modeling Guidance recommends performance statistics for use in operational evaluation of the modeled results, used to test the accuracy of the modeled results compared to the monitored data. “Goal” benchmarks are considered to be the best performance that a model can achieve, while “criteria” benchmarks are considered to be average or reasonable performance. Statistics shown below in Table 5-6 were generated for total daily $PM_{2.5}$ from the AERMOD modeling at Liberty in combination with CAMx regional impacts.

Table 5-6. Liberty 24-Hour Modeled Statistics and Benchmarks, Quarterly and Yearly, 2011

Metric	Goal	Criteria	1Q	2Q	3Q	4Q	Yearly
Mean Fractional Bias (FB)	<±30%	<±60%	50.8%	12.0%	7.5%	29.2%	24.6%
Mean Fractional Error (FE)	<50%	<75%	53.3%	34.3%	31.2%	45.7%	41.0%
Correlation Coefficient (r)	>0.70	>0.40	0.76	0.69	0.67	0.78	0.68

For year-round concentrations, modeled fractional bias and error are within the goal benchmarks. On a quarterly basis, 2nd and 3rd quarters show the best performance for bias and error, falling well within the goal benchmarks. Correlation coefficient falls just below goal on a year-round basis but well above criteria for all quarters.

Figure 5-9 shows a “soccer plot” that visually displays fractional bias and error of the data points within the goal and criteria ranges (blue and purple boxes, respectively).

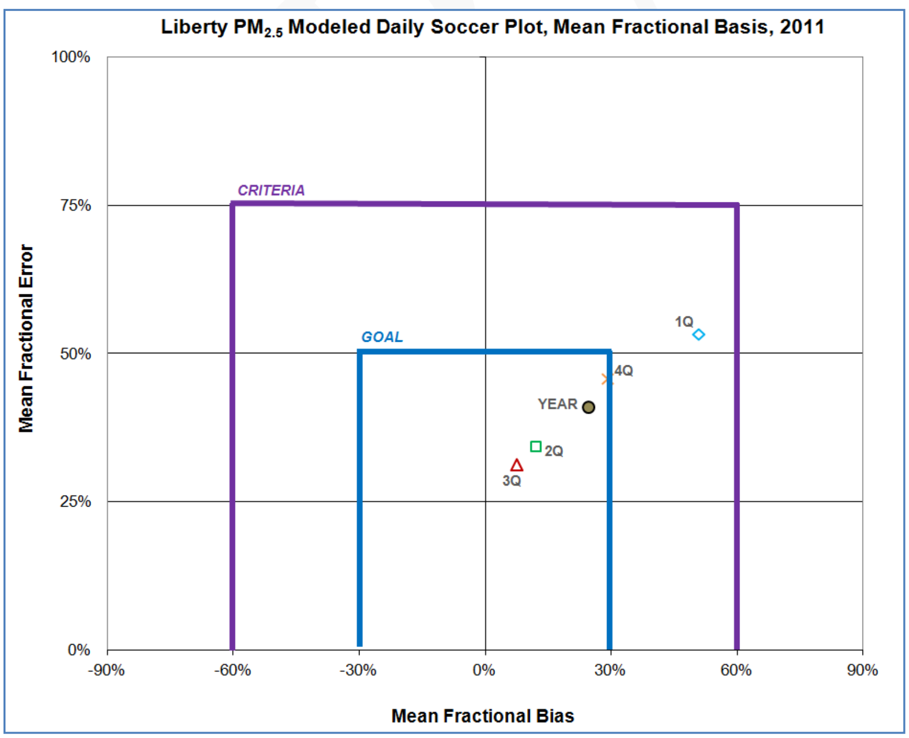


Figure 5-9. Liberty Daily Soccer Plot, Mean Fractional Bias and Error, 2011

The soccer plot shows good performance year-round for the modeling, with 3rd quarter showing the best performance by quarter. The 1st quarter shows reasonable performance, falling in the criteria range.

5.6 Unmonitored Area Analysis

Based on EPA Modeling Guidance, an unmonitored area analysis (UAA) can be performed for gridded model demonstrations to examine predicted concentrations within an entire domain. UAA is a supplemental analysis intended as a means for identifying potentially high $PM_{2.5}$ concentrations in unmonitored locations within a NAA but not for direct comparison to the NAAQS. The most recent ACHD five-year monitor network assessment (ACHD, 2015) found that the current monitor network is appropriate for $PM_{2.5}$ monitoring requirements, with sufficient coverage for population exposure in areas of concern.

UAA was performed for the Allegheny County, PA NAA based on gradient-adjusted spatial fields calculated from CAMx modeled results and monitored results within the 1.33 km domain. The analysis showed that spatial-field projections for 2021 are below the annual $PM_{2.5}$ standard across the vast majority of Allegheny County, with projections exceeding the standard in a few areas without $PM_{2.5}$ monitors that can be attributed to large modeled concentration gradients associated with major facilities within grid cells, sub-optimal characterization of low-level area sources, and difficulty modeling micro-scale features ($PM_{2.5}$ emissions, meteorology) in urban core locations.

Conclusions from the UAA are that the current monitors are located in areas adequate to demonstrate attainment of the $PM_{2.5}$ NAAQS for Allegheny County. More details on the UAA can be found in Appendix I.3 (Unmonitored Area Analysis).

5.7 Insignificance of Precursors

Based on the EPA Precursor Demonstration Guidance (U.S. EPA, 2016b), the effect of a precursor can be demonstrated through a modeled sensitivity analysis. The significance of a precursor can be determined by changes in design values at monitored sites within the NAA due to reduced anthropogenic emissions of that precursor. If changes due to the reductions are equal to or less than the recommended significant contribution thresholds (0.2 $\mu g/m^3$ on an annual basis, 1.3 $\mu g/m^3$ on a 24-hour basis), that precursor can be deemed insignificant to the attainment plan.

Ramboll performed additional CAMx runs to determine the significance of VOC and NH_3 as precursors in the Allegheny County, PA NAA. For the sensitivity model runs, precursor emissions in Allegheny County were reduced as follows, with all other emissions held constant:

1. One CAMx model run with 50% reduction of anthropogenic VOC emissions within Allegheny County
2. One CAMx model run with 50% reduction of anthropogenic NH_3 emissions within Allegheny County

The EPA MATS software was used to generate design values with and without the precursor reductions for monitor sites in the NAA. MATS settings were identical to those described in Appendix I.1 (Air Quality Technical Support Document).

Tables 5-7 and 5-8 show the annual and 24-hour reductions in design values (DVs) for the sensitivity cases at each monitor site.

Table 5-7. Sensitivity Test Reductions in Design Values, Annual Basis (µg/m³)

Site	AQS ID	Reduction in DV w/50% less VOC (µg/m³)	Reduction in DV w/50% less NH_3 (µg/m³)
Avalon	42-003-0002	0.0	0.2
Lawrenceville	42-003-0008	0.0	0.2
Liberty	42-003-0064	0.0	0.2
South Fayette	42-003-0067	0.0	0.1
North Park	42-003-0093	0.0	0.2
Harrison	42-003-1008	0.0	0.1
North Braddock	42-003-1301	0.0	0.2
Clairton	42-003-3007	0.0	0.1

Table 5-8. Sensitivity Test Reductions in Design Values, 24-Hour Basis (µg/m³)

Site	AQS ID	Reduction in DV w/50% less VOC (µg/m³)	Reduction in DV w/50% less NH_3 (µg/m³)
Avalon	42-003-0002	0.0	0.1
Lawrenceville	42-003-0008	0.0	0.0
Liberty	42-003-0064	0.0	0.8
South Fayette	42-003-0067	0.0	0.1
North Park	42-003-0093	0.1	0.9
Harrison	42-003-1008	0.0	0.0
North Braddock	42-003-1301	0.0	0.4
Clairton	42-003-3007	0.0	0.0

All reductions in design values were below the significant contribution thresholds; therefore, VOC and NH_3 were deemed to be insignificant contributors to nonattainment in Allegheny County. These precursors were excluded from the additional analysis required for this SIP.

More details of the precursor sensitivity modeling can be found in Appendix I.4 (Precursor Insignificance Demonstration).

Note that precursor sensitivity analyses were not performed for NNSR requirements for this SIP. For new source review, all precursors are deemed to be significant for the NAA unless an insignificance finding can be demonstrated for one or more precursor.

6 Reasonably Available Control Measures and Technology

Sections 172(c)(1) and 189(a)(1)(C) of the CAA requires the implementation of Reasonably Available Control Measures (RACM), including Reasonably Available Control Technology (RACT) for stationary point sources, as expeditiously as practicable but no later than four years after designation for a moderate NAA.

As further explained in the $PM_{2.5}$ Implementation Rule, RACM/RACT are defined as technologically and economically feasible measures or technology that could be implemented if needed to demonstrate attainment or if such measures would advance the attainment date by one year or more. If the area is able to show attainment through the modeling demonstration, and if it can be demonstrated that reasonable measures would not advance the attainment date for the area, such measures or additional control measures do not need to be adopted for the SIP. Additional control measures are those that could be implemented after four years of designation but within the attainment date (six years after designation).

Therefore, the purpose of this RACM/RACT analysis is to determine if reasonable or additional controls are available – with consideration of technical and economic feasibility – that could collectively advance attainment date by one year or more. Options for the control of primary $PM_{2.5}$ and precursors SO_2 and NO_x were the focus of the RACM/RACT analysis. Based on the insignificance findings for VOC and NH_3 (see Section 5 (Modeling Demonstration)), control options for VOC and NH_3 were not considered. Summaries of the RACM/RACT findings are included in this section, with further details of the analyses found in Appendix J (RACM/RACT Analysis).

6.1 RACM

Several RACM options were examined for Allegheny County area and mobile sources (nonroad and onroad), along with some small point source categories. Current controls or programs in place and RACM alternatives that were evaluated are summarized by source category group in Table 6-1, with detailed analyses by source category group given in Appendix J.1 (RACM Analysis).

For each source category group, the following steps were taken to evaluate the RACM alternatives:

1. Examine source category emissions in the NAA, with priority given to categories with the largest emissions of primary $PM_{2.5}$ and precursors SO_2 and NO_x.
2. Determine technologically feasible control technologies or measures for each source category group.
3. For each technologically feasible emission control technology/measure, examine:
    a. The control efficiency by pollutant.
    b. The possible emission reductions by pollutant.
    c. The estimated cost per ton of pollutant reduced.
    d. The date by which the technology or measure could be reasonably implemented.

Table 6-1. Current Controls and RACM Alternatives Evaluated for Allegheny County

Source Category Group	Existing Controls/Programs	RACM Alternative(s)	Remarks
Agriculture	None.	None identified.	Few sources in Allegheny County, emissions are mostly NH_3, which is an insignificant precursor in the NAA.
Commercial Cooking	None.	1) Charbroiler catalytic oxidizers for chain-driven broilers. 2) HEPA filters for under-fired broilers.	Small reductions county-wide for Option 1. Full implementation could take five years for Option 2.
Cremation	None.	None identified.	Small source of emissions county-wide; permit restrictions are BACT.
Fuel Combustion (Industrial and Commercial)	Federal standards for boilers and engines.	Low NO_x boilers.	Full implementation could take five years.
Fuel Combustion (Residential)	Sulfur limit for home heating oil.	None identified.	Small sources compared to commercial and industrial fuel combustion.
Fuel Combustion (Residential Wood)	Fireplace insert program; non-Phase 2 outdoor wood-fired boilers (OWBs) are prohibited; no outdoor burning on Air Quality Action Days. Wood stove change-out program in past years.	1) Additional wood stove change-out program. 2) Education & outreach on clean burning. 3) Replacement of old stoves when homes are sold. 4) OWB compliance for pre-2011 units.	Options 1 and 4 do not generate significant reductions. Options 2 and 3 are difficult to quantify for reductions and/or costs.
Fugitive Dust	Dust suppressants at various sources.	Paving of unpaved road, with no unpaved roads allowed.	Relatively small reduction county-wide.
Oil and Gas Exploration and Production	None.	None identified.	None.
Petroleum Storage	None.	None identified.	VOC emissions only, insignificant in NAA.
Solvent Utilization	ACHD regulations.	None identified.	VOC emissions only, insignificant in NAA.
Surface Coatings	ACHD regulations.	None identified.	VOC emissions only, insignificant in NAA.

Source Category Group	Existing Controls/Programs	RACM Alternative(s)	Remarks
Marine	Federal standards. A towboat repowering project was implemented in past years.	1) Vessel repowering from Tier 0 to newer engines. 2) Retrofit tugboats with diesel particulate filters. 3) Control idling. 4) Pleasure craft controls.	High costs for Option 1. Small reductions for Option 2. Options 3 and 4 not quantified, with negligible potential reductions.
Railroad	Federal standards.	Replacement of older engines to newer engines.	High costs relative to reductions.
Off-Highway Equipment (Gasoline)	Rebate program for gasoline-fueled equipment exchange.	Additional gas-for-electric exchange programs.	Reductions not quantified, likely not substantial reductions county-wide.
Off-Highway Equipment (Diesel)	Federal standards for specific source types, idling restrictions in effect.	Retrofit construction equipment with a diesel particulate filter (DPF).	Small reductions county-wide.
Off-Highway Equipment (Other)	None.	None identified	None.
Gasoline Refueling	Stage II vapor recovery systems.	None identified.	VOC emissions only, insignificant in NAA.
Gasoline Vehicles (Light-Duty)	Federal emission standards, I/M program.	Ridesharing program.	Reductions not quantified. Light duty gasoline vehicles show large reductions through 2021 from controls in place.
Gasoline Vehicles (Heavy-Duty)	Federal emission standards, idling restrictions.	None identified.	Small portion of the onroad mobile source inventory; options better identified for diesel vehicles.
Diesel Refueling	None.	None identified.	VOC emissions only, insignificant in NAA.
Diesel Vehicles (Light-Duty)	Federal emission standards, idling restrictions.	None identified.	Small portion of the onroad mobile source inventory; options better identified for gasoline vehicles.
Diesel Vehicles (Heavy-Duty)	Federal emission standards, idling restrictions.	1) Additional diesel engine retrofits. 2) Replacement of public or private fleets ahead of normal schedule. 3) Additional compliance with idling law.	Small reductions county-wide for Options 1 and 2. Option 3 not quantified.

Source Category Group	Existing Controls/Programs	RACM Alternative(s)	Remarks
CNG Vehicles (Heavy Duty)	None.	None identified.	Clean vehicles, small portion of onroad mobile source inventory.
Ethanol E-85 Vehicles (Light Duty)	None.	None identified.	Clean vehicles, small portion of onroad mobile source inventory.
Aggregate Processing	Rules in effect for stone, sand, and gravel operations.	Requires water sprays, dust suppressants, telescopic chutes, and baghouse/cyclone dust collectors.	None.

6.2 RACT

As part of RACM, a RACT evaluation identifies controls and reasonable alternative technology for the largest stationary point sources in the NAA. RACT evaluations are required for different analyses in Allegheny County, including evaluations for other NAAQS designations and permitting projects; the RACT analysis provided in this SIP should not be used to satisfy any requirements for other current or future RACT evaluations.

The methodology used for the RACT analysis for this SIP is as follows:

1. Identify the largest stationary point sources of $PM_{2.5}$ and precursors in the NAA. For this determination, a threshold of 100 tons/year of total $PM_{2.5}$ and all precursors, in either the base or future case emissions inventory, was used to identify the largest facilities.
2. Identify the different processes (or process groups) for the largest facilities and the current controls for the processes.
3. Identify potential RACT alternatives for the processes, with emphasis on the largest processes (with a total of 50 tons/year of $PM_{2.5}$ and significant precursors SO_2 and NO_x).
4. Evaluate the technological and economical feasibility of any potential RACT alternatives.

Appendix J.2 (RACT Analysis) contains more information on the methodology and the results of the RACT analysis. Some facilities identified as the largest sources were not evaluated due to plant closures or due to the types of sources/pollutants. Table 6-2 summarizes the facilities identified and the corresponding findings.

Table 6-2. Sources Identified for RACT and Summary of Evaluations

Facility	Summary of Facility/Controls	RACT Findings
Allegheny Energy Springdale	Combined-cycle turbines EGU, natural gas (NG) or fuel oil. Controls: low-NO_x burners (LNB) and selective catalytic reduction (SCR). Production has increased since base case due to electrical grid demand.	Meets RACT requirements.
Allied Waste Imperial	Municipal solid waste landfill. Controls: collection system, enclosed ground flare.	Meets RACT requirements.
ATI Allegheny Ludlum	Specialty steel facility. Controls: baghouses, ultra-low NO_x burners, mist eliminators, other.	Meets RACT requirements.
Bay Valley	Food manufacturing facility. Controls: LNB, switched from coal to natural gas as fuel for all units since base case 2011.	Meets RACT requirements.
Eastman Chemical	Chemical resins facility. Most emissions are VOC (112 tons/year, about 70% of total emissions), which is an insignificant precursor to area.	No evaluation performed.
GenOn Cheswick	Coal-fired EGU. Controls: FGD, LNB with overfire air (OFA), SCR.	Meets RACT requirements.
Guardian	Glass plant, closed permanently in 2015.	No evaluation required.
McConway & Torley	Steel foundry. Controls: baghouses, dust collectors.	Meets RACT requirements.
Neville Chemical	Chemical resins and plasticizers plant. Majority of emissions are VOC (91 tons/year, about 83% of total emissions), which is an insignificant precursor to area.	No evaluation performed.
Pittsburgh International Airport	This source is not inventoried by ACHD but is added a point source by NEI. (This source is not the airport authority, the Air Force Reserve, or the PA Air National Guard sources in the ACHD inventory.)	No evaluation performed.
Redland Brick	Brick manufacturing facility. Controls: dry sorbent injection (DSI), baghouses, dust suppressants. Projected emissions for 2021 are an increase of 20% from base case based on more typical annual production levels.	Meets RACT requirements.
Shenango	Metallurgical coke plant, closed permanently in 2016. Controls:	No evaluation required.

Facility	Summary of Facility/Controls	RACT Findings
Universal Stainless	Specialty steel facility. Controls: LNB, baghouses.	Meets RACT requirements.
USS Clairton	Metallurgical coke and by-products facility. Controls: baghouses, baffles (quench towers), coke oven gas (COG) grain limits, afterburners, visible emission (VE) restrictions.	Meets RACT requirements.
USS Edgar Thomson	Iron and steel making facility. Controls: baghouses, COG grain limits, scrubbers, drift eliminators.	Meets RACT requirements.
USS Irvin	Secondary steel processing facility. Controls: COG grain limits, scrubbers, mist eliminators.	Meets RACT requirements.

6.3 Findings

The finding of RACM analysis is that no feasible controls (or combination thereof) in Allegheny County would advance the attainment date by one year or more, including "additional control measures" that could be implemented after four years but before the attainment date. The RACT analysis for the largest point sources shows that controls have been implemented that represent reasonably (or better) available control technology.

As demonstrated in Section 5 (Modeling Demonstration), the NAA can attain the 2012 annual $PM_{2.5}$ standard by December 31, 2021 via the control strategy in place (see Section 3 (Control Strategy)). Therefore, this SIP satisfies RACM/RACT requirements for the NAA.

7 Reasonable Further Progress

Sections 172(c) and 171(1) of the CAA requires Reasonable Further Progress (RFP) for a $PM_{2.5}$ NAA in order to assure attainment of the NAAQS by the applicable date through annual incremental reductions, with Section 189(c) of the CAA requiring quantitative milestones to be achieved toward RFP until the area is redesignated attainment.

RFP for this SIP includes generally linear reductions in emissions and monitored data prior to the attainment date. Emissions data are taken from the MARAMA databases, and monitored data are based on the most recent available official results through 2017. Milestones are based on the schedule of 4.5 and 7.5 years after designation (years 2019 and 2022, respectively),[33] as outlined in the $PM_{2.5}$ Implementation Rule for a moderate $PM_{2.5}$ NAA.

Emissions milestones were compiled for years 2019 and 2022 for $PM_{2.5}$, SO_2, and NO_x, since VOC and NH_3 were shown to be insignificant precursors for this SIP. Year 2019 emissions were calculated by interpolating base year 2011 and projected case 2021 emissions. Year 2022 emissions were held constant from the projected 2021 case, as a conservative approach beyond the expected attainment timeframe.

Tables 7-1 through 7-3 show the emissions by sector for base year 2011, projected year 2021, and milestone years 2019 and 2022, for $PM_{2.5}$, SO_2, and NO_x, respectively.

Table 7-1. $PM_{2.5}$ Base, Projected, and Milestone Year Emissions Inventories (tons/year)

Year	Base 2011			Milestone 2019			Projected 2021			Milestone 2022		
Allegheny County	**$PM_{2.5}$**	$PM_{2.5}$ (filt)	$PM_{2.5}$ (cond)	**$PM_{2.5}$**	$PM_{2.5}$ (filt)	$PM_{2.5}$ (cond)	**$PM_{2.5}$**	$PM_{2.5}$ (filt)	$PM_{2.5}$ (cond)	**$PM_{2.5}$**	$PM_{2.5}$ (filt)	$PM_{2.5}$ (cond)
Point Sources	2,503	1,338	1,164	2,305	1,272	1,032	2,256	1,256	999	2,256	1,256	999
Area Sources	2,491	2,011	480	2,665	2,183	473	2,708	2,226	472	2,708	2,226	472
Nonroad Mobile Sources	361	361	0	259	259	0	234	234	0	234	234	0
Onroad Mobile Sources	450	450	0	303	303	0	266	266	0	266	266	0
Fires	24	24	0	24	24	0	24	24	0	24	24	0
Biogenics	0	0	0	0	0	0	0	0	0	0	0	0
Total	**5,829**	**4,185**	**1,644**	**5,556**	**4,042**	**1,505**	**5,488**	**4,007**	**1,471**	**5,488**	**4,007**	**1,471**

[33] Quantitative milestones must be achieved every three years starting from the due date of the SIP (i.e., 18 months after designation), which equates to 4.5 years and 7.5 after the designation in 2015. The second milestone of 7.5 years, although beyond the attainment date for a moderate area, is required in case of reclassification to serious for the area.

Table 7-2. SO_2 Base, Projected, and Milestone Year Emissions Inventories (tons/year)

Year	Base 2011	Milestone 2019	Projected 2021	Milestone 2022
Allegheny County	**SO_2**	**SO_2**	**SO_2**	**SO_2**
Stationary Point Sources	13,460	7,429	5,921	5,921
Area Sources	1,528	1,169	1,079	1,079
Nonroad Mobile Sources	11	6	5	5
Onroad Mobile Sources	78	41	31	31
Fires	2	2	2	2
Biogenics	0	0	0	0
Total	**15,080**	**8,647**	**7,039**	**7,039**

Table 7-3. NO_x Base, Projected, and Milestone Year Emissions Inventories (tons/year)

Year	Base 2011	Milestone 2019	Projected 2021	Milestone 2022
Allegheny County	**NO_x**	**NO_x**	**NO_x**	**NO_x**
Stationary Point Sources	11,128	8,568	7,928	7,928
Area Sources	6,979	6,727	6,664	6,664
Nonroad Mobile Sources	3,921	2,554	2,212	2,212
Onroad Mobile Sources	13,259	7,218	5,708	5,708
Fires	5	5	5	5
Biogenics	166	166	166	166
Total	**35,460**	**25,239**	**22,684**	**22,684**

Based on EPA Air Emissions Reporting Requirements (AERR[34]), yearly inventories for large point sources are required to be reported within 12 months of the end of a calendar year (e.g., for year 2019, the inventory is required by Dec. 31, 2020). Additionally, emissions for area and mobile sources are required on a triennial basis, coinciding with NEI years. The NEI generally requires at least two years for development, with the next NEI year (2017) still under development. Therefore, the most representative emissions inventory to represent year 2019 would be a composite inventory of 2018 (or 2019) point source emissions with 2017 NEI area and mobile emissions, if available.

A composite emissions inventory and other supporting analysis applicable to the demonstration of RFP would be provided to EPA by Jan. 14, 2020 (which is 90 days after the first milestone

[34] https://www.epa.gov/air-emissions-inventories/air-emissions-reporting-requirements-aerr

date of Oct. 15, 2019). Supporting analysis could include source/emissions information, monitored data, regulations/plans not included in this demonstration, and/or other analyses.

If the 2022 milestone would be required, following reclassification to a serious area, or if attainment is not achieved by the end of 2021, a composite inventory for 2022 and supporting analysis would be provided to EPA by Jan. 14, 2023 (90 days after the second milestone date of Oct. 15, 2022.)

For a look at the most recently available composite inventory, 2017 point sources emissions[35] and 2014 NEI[36] area and mobile source emissions[37] were used to generate a "current" year inventory, shown below in Table 7-4. Fire and biogenic emissions were held constant, similar to the methodology used for the 2011 to 2021 timeframe.

Table 7-4. Composite "Current" Emissions Inventory (tons/year)

Allegheny County	$PM_{2.5}$	$PM_{2.5}$ (filt)	$PM_{2.5}$ (cond)	SO_2	NO_x
Point Sources (2017)	1,305	775	530	4,712	6,148
Area Sources (2014)	2,646	2,174	473	481	8,687
Nonroad Mobile Sources (2014)	315	315	0	8	3,183
Onroad Mobile Sources (2014)	389	389	0	76	11,754
Fires (2011)	24	24	0	2	5
Biogenics (2011)	0	0	0	0	166
Total	**4,679**	**3,677**	**1,003**	**5,279**	**29,943**

The totals in Table 7-4 show that Allegheny County emissions, based on the combination of 2017 and 2014 inventory years, are already meeting the RFP year 2019 milestone for $PM_{2.5}$ and SO_2, with NO_x still above the 2019 milestone emissions due primarily to the 2014 NEI onroad mobile source emissions. The onroad mobile source sector, once emissions are compiled for

[35] Available at the following web site: https://www.dep.pa.gov/DataandTools/Reports/Pages/Air-Quality-Reports.aspx

[36] Available at the following web site: https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data

[37] 2014 NEI waste disposal area source emissions from open burning (SCC codes: 2610000500 and 2610030000) were excluded, since this activity is prohibited in Allegheny County. (These emissions were also excluded in the 2011 and 2021 inventories.) Some construction dust and mining area source emissions (SCC codes: 2311020000, 325000000) were also excluded for consistency with the 2011 and 2021 inventories. Additionally, airport point source emissions, not tabulated by state/local agencies, from the 2014 NEI were added to the point source emissions.

more recent years, is expected to show substantial decreases through the projected year 2021 and beyond.

For a more linear look at $PM_{2.5}$ in Allegheny County, yearly monitored concentrations can also be examined for progress toward attainment. Tables 7-5 and 7-6 show the annual and 24-hour design values, respectively, for each Allegheny County site for years 2011 through 2018, along with the projected (modeled) design values for 2021.

Table 7-5. Monitored and Projected Annual Design Values (μg/m³) by Site, 2011-2021

Allegheny County Site	Monitored								Projected
	2011	2012	2013	2014	2015	2016	2017	2018	2021
Liberty	15.0	14.8	13.4	13.0	12.6	12.8	13.0	12.6	12.0
Avalon	14.7	13.4	11.4	10.6	10.6	10.4	10.2	9.7	10.0
North Braddock	12.7	12.5	11.7	11.4	11.2	11.0	10.8	10.7	10.0
Harrison	12.4	11.7	10.6	10.0	9.8	9.8	9.8	9.6	9.4
Lawrenceville	11.6	11.1	10.3	10.0	9.7	9.5	9.2	9.1	9.0
Clairton	11.5	10.9	9.8	9.5	9.9	9.8	9.8	9.3	9.2
South Fayette	11.0	10.5	9.6	9.0	8.8	8.5	8.4	8.3	8.5
North Park	9.7	9.4	8.8	8.5	8.5	8.2	8.2	7.8	7.6

Table 7-6. Monitored and Projected 24-Hour Design Values (μg/m³) by Site, 2011-2021

Allegheny County Site	Monitored								Projected
	2011	2012	2013	2014	2015	2016	2017	2018	2021
Liberty	44	43	37	35	33	36	37	35	35
Avalon	34	29	25	22	23	22	21	20	21
North Braddock	34	33	29	26	25	25	24	24	23
Harrison	30	28	25	22	22	21	21	20	21
Lawrenceville	27	26	23	21	21	20	19	18	20
Clairton	28	26	22	23	25	26	22	19	21
South Fayette	27	26	24	20	21	19	19	18	18
North Park	25	23	19	17	18	18	17	16	17

The results in Tables 7-5 and 7-6 show that many sites are already below the future case projected design values on both annual and 24-hour bases. All sites are also below the NAAQS on both annual and 24-hour bases, except for Liberty on an annual basis.

8 Contingency Measures

Section 172(c)(9) of the CAA requires contingency measures to be implemented in the event that a nonattainment area fails to meet RFP or fails to attain the NAAQS by the attainment date.

This attainment demonstration is based on a base year of 2011, with an attainment year of 2021. Thus, the time period for the projected reductions is 10 years. Contingency measures are recommended to be based on approximately one year of emissions reductions achieved over this timeframe. Based on the emissions given in Section 4 (Emissions Inventory), reductions per year by pollutant (for all sectors) in Allegheny County are given in Table 8-1 below.

Table 8-1. Primary $PM_{2.5}$ and Precursor Reductions per Year (tons), 2011-2021

Allegheny County (2011-2021)	$PM_{2.5}$	SO_2	NO_x	VOC	NH_3
Reduction per Year	34	804	1,278	605	10

The implementation of one year's worth of additional reductions of primary $PM_{2.5}$ or $PM_{2.5}$ precursors may or may not help mitigate nonattainment factors. Primary $PM_{2.5}$ may be more important to attainment at specific monitors than $PM_{2.5}$ precursors, due to the transformation required for precursors into the particle phase. Also, as shown in Section 5 (Modeling Demonstration), VOC and NH_3 are insignificant contributors to nonattainment in the NAA.

Failure to reach attainment could occur at any location in Allegheny County and could involve one or more contributing sources/sectors. Current county-wide or local municipal programs in place include idling restrictions, clean wood burning regulations and initiatives, and other programs. (See Section 11 (Weight of Evidence) for examples of programs.) Local industrial source modifications and requirements are in place for the control of localized primary $PM_{2.5}$ influences.

The determining monitor for design values in Allegheny County since 2013 has been the Liberty monitor, with all other sites attaining (and expected to continue to attain) the 2012 NAAQS. The reductions that are pertinent to projected attainment at Liberty are decreases of localized primary $PM_{2.5}$ emissions from specific sources over the 2011 through 2021 timeframe. However, these reductions may not be applicable to future case scenarios, as the emissions and source types have changed at the USS Clairton Plant as well as at surrounding facilities. Additional modifications that are unknown at this time could be implemented as part of voluntary efforts, enforcement actions, or other requirements before the $PM_{2.5}$ attainment date. Further reductions of $PM_{2.5}$ in the Liberty area would likely involve a scenario that differs from the controls and projections used in this SIP.

In the event that the $PM_{2.5}$ design value(s) at one or more monitor location violate the 2012 NAAQS by the end of 2021 or beyond, or if a RFP requirement is not achieved, a new wood burning curtailment campaign would be initiated by ACHD. Residential wood burning represents a substantial portion (20%) of the future case area source inventory and is one of the few source categories projected to increase in emissions from 2011 to 2021. Increased wood burning activities, for both heating and recreational purposes, have been evident in the county in recent years. Source apportionment analysis (see Appendix C (Speciation and Source Apportionment Analysis)) also shows a widespread presence of burning in the tri-state region.

In addition to programs already in place, the new wood burning curtailment campaign would involve new wood stove change-out or "bounty" programs, additional educational and community outreach programs, and/or an "enhanced" Air Quality Action Day program. An enhanced Air Quality Action Day program would declare an action day for lower levels of predicted $PM_{2.5}$ concentrations. §2105.50 "Open Burning" of ACHD Rules and Regulations, Article XXI, Air Pollution Control,[38] prohibits outdoor wood burning in Allegheny County on Air Quality Action Days.

Additionally, if one or more local industrial sources are suspected of contributing to the violating monitor(s), a thorough culpability analysis would be conducted by ACHD. The culpability analysis would begin immediately upon verification of the violation(s)[39] and would be similar to analyses already provided in this SIP. The analysis would involve the following:

- A review of operating conditions at sources near the violating monitor(s), verifying normal operation and work practices/procedures.
- Monitored data analysis for the monitor site(s) and surrounding locations, specifically for the amount of localized monitored excess.
- Meteorological analysis, including a study of temperature inversions, back-trajectories, and other analysis.
- Local source modeling, using on the most recently available models, emissions, and meteorology.
- Source apportionment analysis using the most recently available monitored speciation data.

If local source contributions are found to represent the majority (greater than 50%) of the localized excess $PM_{2.5}$ at the violating monitor(s), an enforcement order would be issued by ACHD for the implementation of additional controls, temporary or permanent, at the culpable source(s). The additional controls would remain in effect until attainment can be achieved at the violating monitor(s).

All contingency measures would be fully implemented within 60 days of notification by EPA of failure to attain the NAAQS or to achieve RFP requirements.

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[38] https://alleghenycounty.us/uploadedFiles/Allegheny_Home/Health_Department/Article-21-Air-Pollution-Control-rev3319(1).pdf

[39] All monitored results are unofficial until fully validated, quality-assured, and certified. However, the immediate response to a violation would assume that concentrations are valid upon initial verification of proper monitor operation and laboratory results.

9 Transportation Conformity

Section 176 of the CAA provides a mechanism by which federally funded or approved highway and transit plans, programs, and projects are determined not to produce new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS or delay any interim milestones. EPA regulations in 40 CFR Part 93 pertaining to transportation conformity set forth policy, criteria, and procedures for demonstrating and assuring conformity of transportation plans, programs, and projects which are developed, funded, or approved by Metropolitan Planning Organizations (MPOs) or other recipients of funds under title 23 U.S.C. or the Federal Transit Laws, to an applicable implementation plan developed pursuant to Section 110 and Part D of the CAA.

In the Pittsburgh area, the Southwestern Pennsylvania Commission (SPC) is the designated MPO responsible for making timely transportation conformity determinations under federal transportation planning requirements for a 10-county region in southwestern PA.

40 CFR 93.102 requires conformity determinations to be applicable to primary emissions of $PM_{2.5}$ and to emissions of NO_x, unless the EPA Regional Administrator and the director of the state air agency have made a determination that transportation-related emissions of NO_x within the NAA are not a significant contributor to the $PM_{2.5}$ nonattainment problem. Emissions of SO_2, VOC, and NH_3 are applicable only if the Administrator or state air agency has made a finding that transportation-related emissions of any of these precursors are significant contributors to the $PM_{2.5}$ nonattainment problem or if an applicable SIP establishes an approved or adequate motor vehicle emissions budget (MVEB) as part of a reasonable further progress, attainment, or maintenance strategy.

There have been no determinations of transportation-related insignificance for NO_x or transportation-related significance for SO_2, VOC, and NH_3 in Allegheny County, and there is no established budget for SO_2, VOC, and NH_3. (Additionally, as shown by the insignificance determination in Section 5 (Modeling Demonstration), VOC and NH_3 are not significant precursors for the attainment demonstration.) Therefore, transportation conformity requirements are applicable to $PM_{2.5}$ and NO_x for Allegheny County.

On October 2, 2015 EPA approved a maintenance plan for the Pittsburgh-Beaver Valley NAA for the 1997 and 2006 $PM_{2.5}$ NAAQS.[40] This maintenance plan included MVEBs for 2017 and 2025, for the larger Pittsburgh-Beaver Valley NAA. Pursuant to 40 CFR 93.109(c)(2)(ii), since a MVEB has not been established for Allegheny County, the approved MVEB for the larger Pittsburgh-Beaver Valley NAA was examined for conformity analysis. Through an interagency consultation process, values for the Allegheny County, PA NAA were developed from the MVEBs for the larger Pittsburgh-Beaver Valley $PM_{2.5}$ NAA.

Conformity determinations for transportation plans and programs under the $PM_{2.5}$ air quality standards are based, as appropriate, on "build/no-build" analyses, comparisons to an emissions

[40] The Pittsburgh-Beaver Valley NAA included all of Allegheny County except for the Liberty-Clairton NAA.

budget, and/or comparison to emissions levels from a base year. The appropriate conformity test for this SIP is a comparison of future year emissions in Allegheny County to Allegheny County's portion of the MVEBs (including allocated safety margin) established for the larger Pittsburgh-Beaver Valley $PM_{2.5}$ NAA in that area's 1997/2006 $PM_{2.5}$ maintenance plan. This analysis should demonstrate lower emissions in a future year (i.e., under the "build" condition) when compared with the Allegheny County portion of the MVEBs established for the larger Pittsburgh-Beaver Valley $PM_{2.5}$ NAA in that area's 1997/2006 $PM_{2.5}$ maintenance plan.

SPC's July 2018 Air Quality Conformity Determination provides information and results for the analysis. (The Federal Transit Administration (FTA) and the Federal Highway Administration (FHWA) approved the Conformity Determination by letter dated September 25, 2018. The letter confirms that FTA and FHWA, in concurrence with the EPA, determined that, "the Conformity Determination for the federal fiscal year 2019-2022 TIPs in all nonattainment and maintenance areas of the Commonwealth, adequately address and meet the requirements as specified in the November 1993 Federal Conformity Rule and subsequent amendments.") $PM_{2.5}$ and NO_x emission factors from the MOVES model, in combination with the highway and transit assignment results from different scenarios, were used to develop the future year emissions under the build condition for the Allegheny County NAA. The total annual vehicle miles traveled (VMT) and $PM_{2.5}$ and NO_x emission estimates and inventory values from SPC's Air Quality Conformity Determination are presented in Table 9-1 for each analysis year. The estimated future year emissions under the build condition and Allegheny County's portion of the MVEBs established for the larger Pittsburgh-Beaver Valley $PM_{2.5}$ NAA in that area's 1997/2006 $PM_{2.5}$ maintenance plan are plotted on Figures 9-1 and 9-2.

Table 9-1. Conformity Assessment Summary for Allegheny County

Conformity Assessment
Allegheny County PM2.5 Nonattainment Area
Annual VMT and Emissions (Tons/Year)

Entire Nonattainment Area

	2020	2022	2025	2035	2040
Annual VMT	8,360,280,869	8,410,667,514	8,506,669,696	8,658,720,051	8,895,038,410
PM 2.5 MVEB	364	364	278	278	278
PM 2.5	257	225	192	132	122
NO_x MVEB	8,748	8,748	5,239	5,239	5,239
NO_x	5,315	4,263	3,093	1,536	1,408

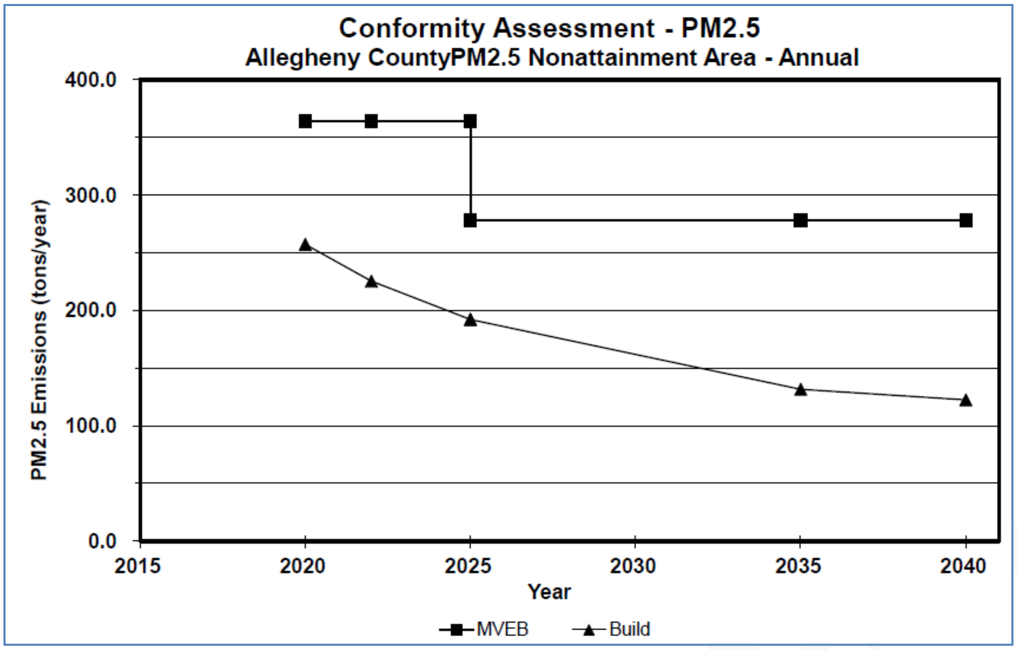

Figure 9-1. Conformity Emissions Estimates (tons/year), 2015-2040, $PM_{2.5}$

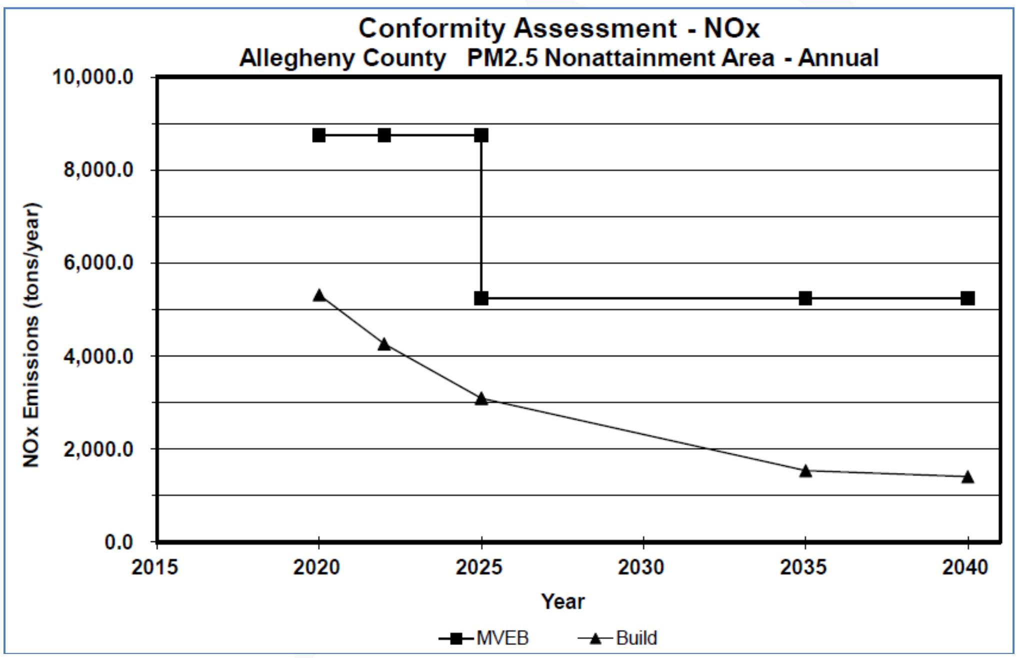

Figure 9-2. Conformity Emissions Estimates (tons/year), 2015-2040, NO_x

Conformity for the Allegheny County, PA NAA under the 2012 NAAQS is demonstrated if future annual emissions under the "build" condition are less than Allegheny County's portion of the MVEBs established for the larger Pittsburgh-Beaver Valley $PM_{2.5}$ NAA in that area's 1997/2006 $PM_{2.5}$ maintenance plan. As can be seen in Figures 9-1 and 9-2, in all analysis years, future annual emissions are less than Allegheny County's portion of the MVEBs established for the larger Pittsburgh-Beaver Valley $PM_{2.5}$ NAA in that area's 1997/2006 $PM_{2.5}$ maintenance plan. The analysis shows that the criteria for transportation conformity under the 2012 $PM_{2.5}$ NAAQs have been satisfied. No goals, directives, recommendations, or projects identified in the SPC analysis contradict in a negative manner any specific requirements or commitments of the applicable SIP, and there are no transportation control measures in the applicable SIP.

10 Nonattainment New Source Review

Title I, Part D, Subpart 1, §172(c)(5) of the CAA requires that a nonattainment plan includes provisions that shall require permits for the construction and operation of new or modified major stationary sources anywhere in the NAA to be in accordance with §173. This is referred to as Nonattainment New Source Review (NNSR).

In Allegheny County, the procedures and conditions for NNSR are stipulated in Article XXI §2102.06, "Major Sources Locating in or Impacting a Nonattainment Area," and §2101.20, "Definitions." §2102.06 incorporates by reference applicable portions of the PA DEP's New Source Review (NSR) regulations codified at 25 Pa. Code Chapter 127.[41]

Revisions for the PA DEP NNSR regulations have been proposed to address the requirements of the 2012 $PM_{2.5}$ NAAQS (81 FR 58010, August 24, 2016) including the addition of new $PM_{2.5}$ precursors. ACHD simultaneously proposed similar regulations as a separate SIP revision in accordance with the $PM_{2.5}$ requirements. These NNSR regulations have been enacted by County Council as a county ordinance signed by the County Chief Executive and have been made effective March 3, 2019.

Revisions to the NNSR regulations include the following:

- VOC and NH_3 added as regulated precursor pollutants of $PM_{2.5}$
- Significant emission rates of 40 tons/year for VOC and 40 tons/year for NH_3
- Significant air quality impact levels (SILs) for $PM_{2.5}$
  - 0.2 $\mu g/m^3$, annual basis
  - 1.2 $\mu g/m^3$, 24-hour basis
- Offset ratios of 1:1 for VOC and ammonia

These regulation changes have been submitted as a separate revision to the Allegheny County portion of the Pennsylvania State Implementation Plan.

[41] http://www.pacode.com/secure/data/025/chapter127/subchapetoc.html

11 Weight of Evidence

EPA Modeling Guidance encourages the use of corroboratory analyses to support the attainment demonstration. These analyses, collectively referred to as "weight of evidence" (WOE), help bolster the assertions that an area will achieve attainment in the allotted time. Controls or programs mentioned in this section have not been included or quantified for the modeled attainment demonstration for this SIP.

11.1 Monitored Data Trends

All Allegheny County sites have shown decreasing trends for $PM_{2.5}$ since 2000, and all sites except Liberty have shown continued attainment of the NAAQS since 2013 (see monitored data in Section 2 (Problem Statement), Section 7 (Reasonable Further Progress), and Appendix A (Monitored Data)). Liberty is also showing trends toward attainment by 2021, including more than one individual year at or below the NAAQS on annual and 24-hour bases.

Figures 11-1 and 11-2 show the yearly Liberty annual weighted means and 24-hour 98th percentiles over a 10-year timeframe (2009-2018), with 2009 as the first year of the weighted base case timeframe and 2018 as the most recent year of monitored results. (Note: Monitored results for 2018 are not certified at this time.) Linear regression is also included in each chart, showing trend lines to the future attainment year 2021.

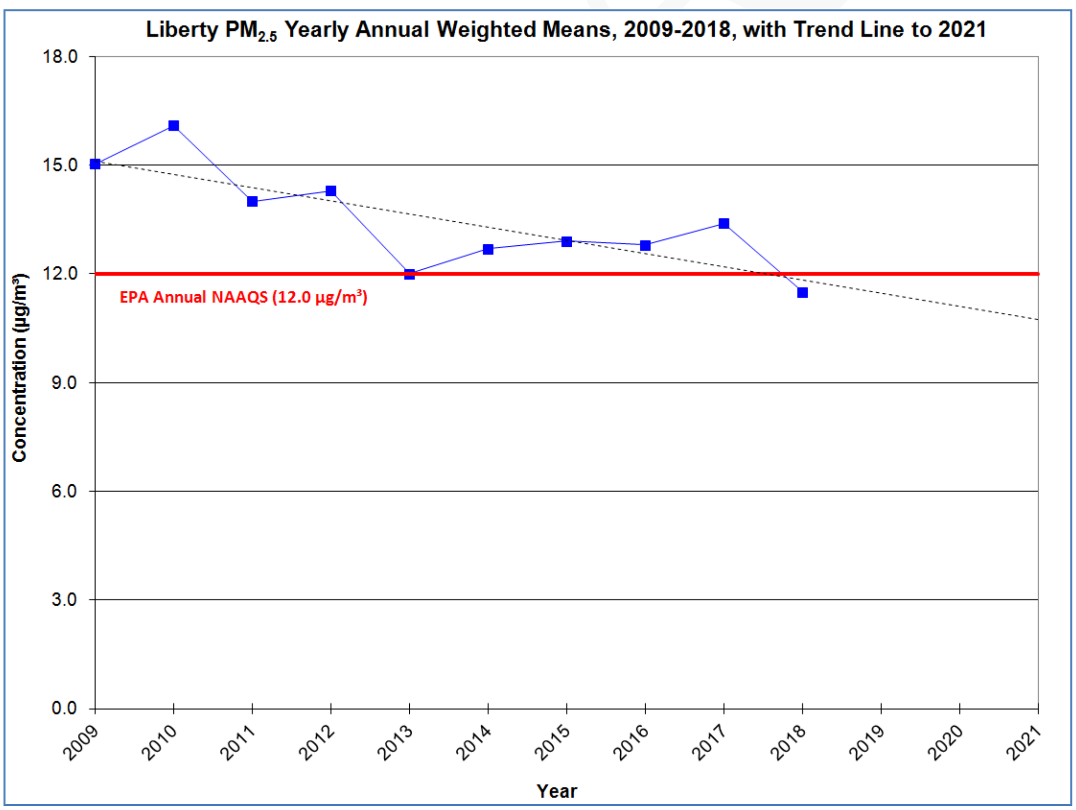

Figure 11-1. Liberty Annual Weighted Means, 2009-2018, with Linear Trend Line to 2021

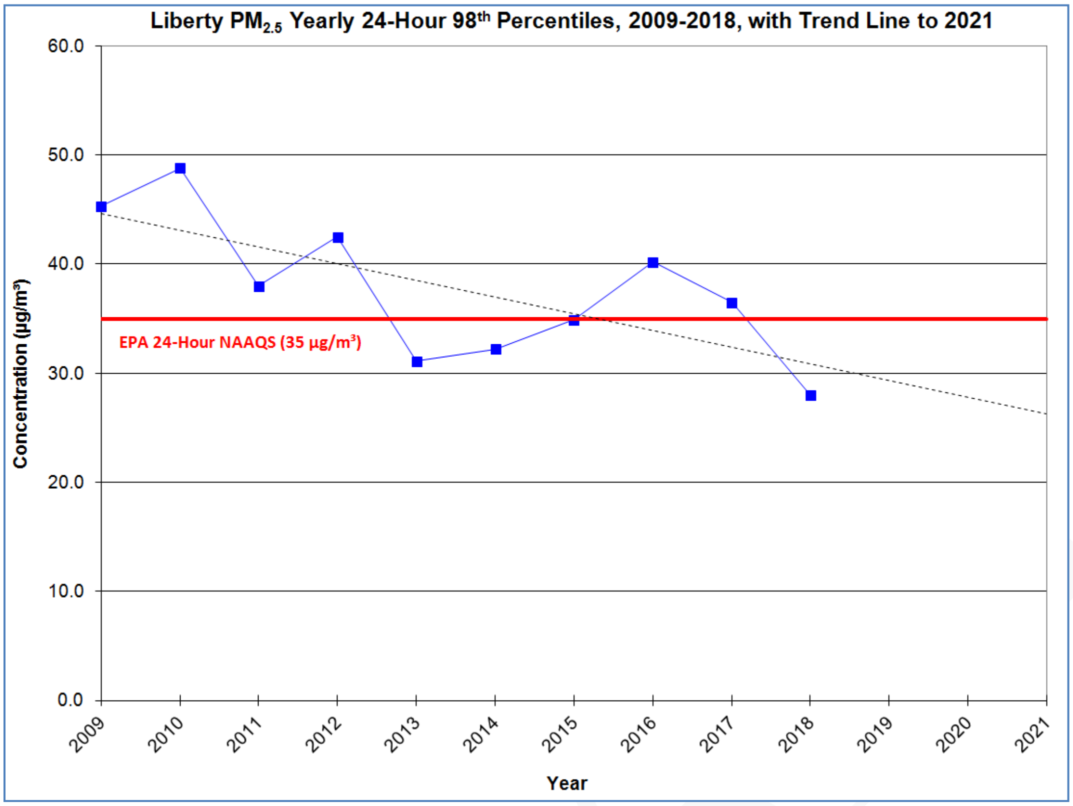

Figure 11-2. Liberty 24-Hour 98th Percentiles, 2009-2018, with Linear Trend Line to 2021

Years 2013 and 2018 show values that are below both the annual and 24-hour NAAQS, with 2014 and 2015 as additional years below the 24-hour NAAQS only. The 2018 values are the lowest ever recorded at the Liberty site, with an annual mean of 11.5 µg/m³ and a 24-hour 98th percentile of 28.0 µg/m³, well below the modeled design values for 2021. Similar results are expected to continue through 2021 and beyond. Based on monitored trends alone, $PM_{2.5}$ values for Liberty are expected to lead to 3-year averages (design values) that are below the NAAQS.

11.2 Additional Source Modifications

Source modifications that were not included in the modeling demonstration will lead to additional reductions of primary $PM_{2.5}$ and precursor emissions within the NAA. These modifications include the following:

- Eastman Chemical Resins, Inc.: In December 2011, Eastman entered into a consent decree and agreement with the U.S. Department of Justice, EPA, and ACHD to install VOC control equipment at its Jefferson Hills plant. Estimates of pollutant reductions due to these controls were not available for the modeling demonstration.

- Koppers Clairton Plant: The Koppers tar refining facility, located adjacent to the USS Clairton Plant, ceased operations in 2016. This source no longer has a permit to operate, and any future operation at these locations would require a new permit and new source review (NSR). As a conservative approach, emissions from Koppers were kept in the future case modeling inventory. Structures at this facility have since been demolished, with no future tar refining operations at this site.

11.3 SO_2 Reductions from 2010 NAAQS

EPA's implementation of the 2010 SO_2 NAAQS included determination of nonattainment areas in several rounds,[42] involving potential controls of SO_2 that were not implemented at the time of the development of this SIP. Therefore, reductions due to several SO_2 plans in PA and surrounding states for the 2010 NAAQS have not been included in this SIP, including estimated reductions of actual emissions due to the Allegheny, PA (Mon Valley) SO_2 SIP. In addition to acting as a precursor to $PM_{2.5}$ over larger areas, SO_2 emissions can also be associated with primary sulfate emissions as a direct component of $PM_{2.5}$ for localized areas.

11.4 Expected EGU Deactivations

Several additional EGU deactivations in PA and surrounding states have been announced after the development of the ERTAC 2.4L2 projections in 2015. These deactivations were not included in the modeled projections and will lead to further reductions of precursor emissions that potentially contribute to $PM_{2.5}$ in Allegheny County.

Expected EGU deactivations from 2016 through 2021 within the PJM Interconnection territory[43] are listed below in Table 11-1, with a map of the PJM Interconnection territory shown in Figure 11-3. Table 11-1 does not include deactivations announced for 2022 and beyond, which will further reduce precursor emissions beyond the attainment date of this SIP.

Table 11-1. EGU Deactivations in PA and Surrounding States, 2016-2021

Plant	State	Capacity (MW)
Avon Lake	Ohio	95
BL England	New Jersey	155
Bruce Mansfield	Pennsylvania	2490
Buggs (Mecklenberg)	Virginia	138
Chesterfield	Virginia	262
Colver	Pennsylvania	110
Conesville	Ohio	810

[42] https://www.epa.gov/sulfur-dioxide-designations

[43] PJM Interconnection LLC is the electric regional transmission organization for the PA and surrounding states. Expected deactivations are current as of Dec. 2018. Note that the electric grid capacity can be modified by PJM, and deactivations do not always constitute permanent retirements.

Plant	State	Capacity (MW)
Crane	Maryland	385
Dale	Kentucky	147
Edgecomb	North Carolina	116
Elmer Smith	Kentucky	100
Hopewell James River	Virginia	92
Hudson	New Jersey	618
Killen	Ohio	600
Mercer	New Jersey	641
Northeastern Power	Pennsylvania	51
Roanoke Valley	North Carolina	209
Sammis	Ohio	669
Spruance	Virginia	202
Stuart	Ohio	2318
Wagner	Maryland	135
Yorktown	Virginia	324

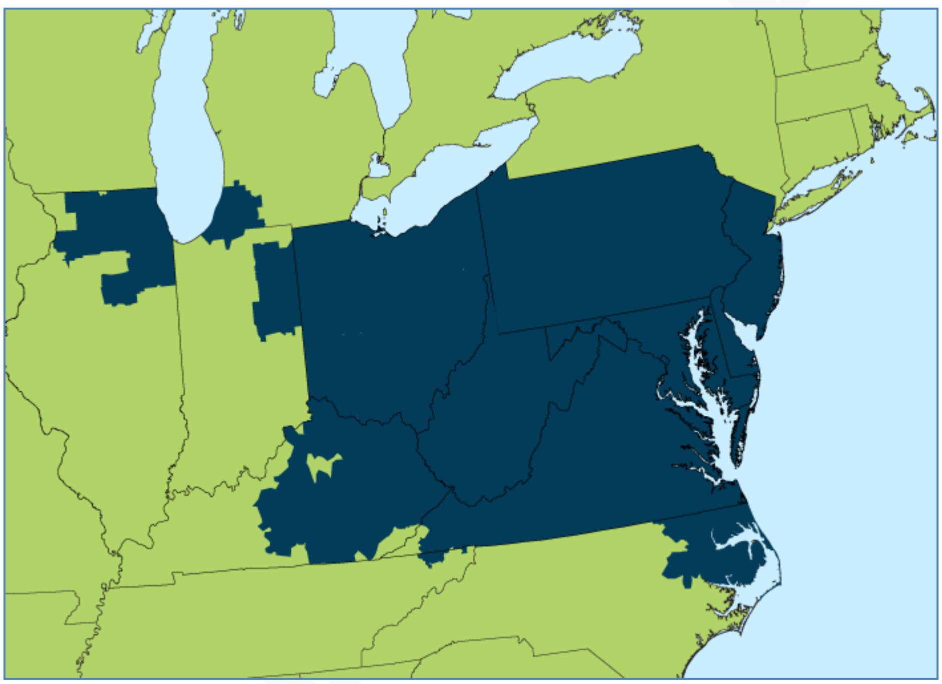

Figure 11-3. PJM Interconnection Territory

The U.S. EIA expects that total U.S. coal consumption in 2018 will be the lowest since 1979 (U.S. EIA, 2018) due to plant retirements and increased competition from natural gas and renewable energy sources.

A detailed analysis of EGU emissions over the SIP timeframe of 2011-2021 is given in Appendix K (EGU Analysis).

11.5 Population Trends

Allegheny County and the Pittsburgh MSA are unique in comparison to other U.S. metropolitan areas in the fact that population has been declining over the recent years. Based on U.S. Census Bureau estimates for 2000 though 2018, Allegheny County showed a decrease of 63,214 in population, and the Pittsburgh MSA showed a decrease of 106,344. The overall decrease in population should lead to less anthropogenic emissions from vehicles, wood burning, power consumption, and other sources of $PM_{2.5}$ and precursors.

Figure 11-4 shows the percent change in population by municipality for Allegheny County and the surrounding region for 2000-2015.[44]

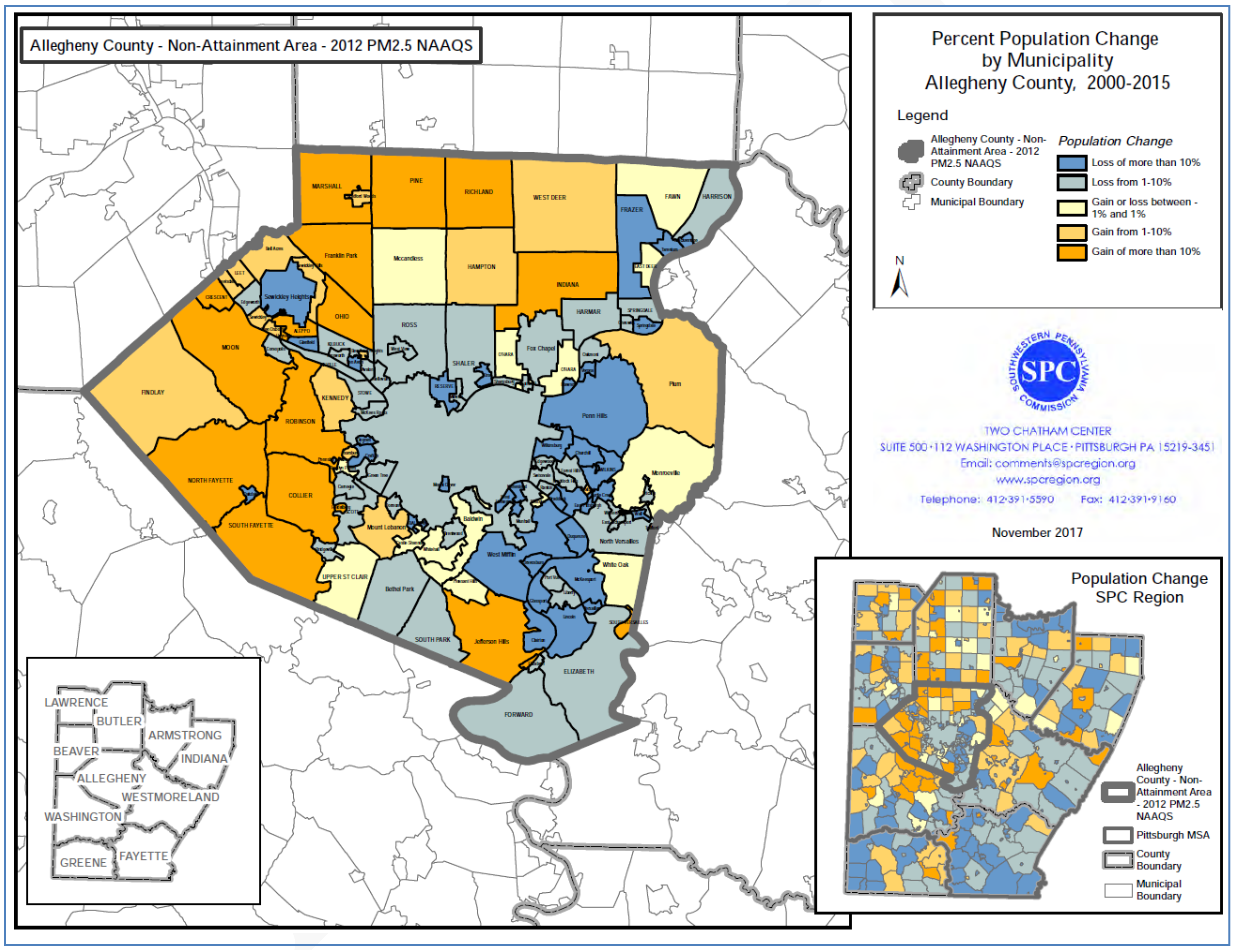

Figure 11-4. Population Change in NAA, by Percent, 2000-2015

[44] Data provided by the Southwestern Pennsylvania Commission (SPC). The Pittsburgh, PA MSA consists of the Allegheny, Armstrong, Beaver, Butler, Fayette, Washington, and Westmoreland Counties. The SPC region additionally includes Indiana, Lawrence, and Greene Counties.

Population growth is occurring in some suburban municipalities, while the City of Pittsburgh and industrial river valley areas show the largest decreases in population.

Population projections by SPC and the Pennsylvania Legislature[45] estimate population growth of about 0.2 to 0.5% per year for 2020 through 2040, which are small increases that should not counteract pollution decreases in the region beyond the attainment timeframe.

11.6 Local County Programs

Wood Burning

Several programs in Allegheny County address the reduction of $PM_{2.5}$ from wood burning activities and have not been included in the modeling demonstration. These include local regulations for wood burning and wood burning equipment, voluntary programs for county residents, and educational campaigns conducted by ACHD.

From 2005 to 2007, ACHD participated in a wood stove change-out program, replacing older non-EPA certified wood stoves in southwestern Pennsylvania with new, cleaner burning "EPA-certified" units. The exchange of 20 wood stoves results in a net reduction of up to 1 ton of particulate matter (PM) pollution. From 2013 to 2015, ACHD conducted a wood stove "bounty" program, providing cash payments to residents who turned in their old, uncertified wood stoves. In 2018 and 2019, ACHD conducted (and continues to conduct) a fireplace conversion program that provides rebates to county residents to encourage them to convert their open-hearth fireplace to natural gas-fueled gas log sets or gas stove inserts.

Outdoor wood-fired boilers (OWBs) have been regulated in Allegheny County. Over recent years, a voluntary federal program in 2007, a state regulation in 2010, and county ordinances since 2012 have been established in order to help control OWB generated pollution. In addition to the newer OWB regulations, Article XXI §2104.01 "Visible Emissions" and §2104.04 "Odor Emissions" are in place which are useful enforcement tools for managing wood burning stoves and boilers.

Article XXI §2105.50 "Open Burning" prohibits outdoor wood burning in Allegheny County on Air Quality Action Days. An Air Quality Action Day is declared when a forecast has been issued by PA DEP, ACHD, or the Southwest Pennsylvania Air Quality Partnership (SPAQP), indicating that ambient concentrations of $PM_{2.5}$ or other criteria pollutants might reach unhealthful levels or exceed the NAAQS.

Additionally, ACHD educational campaigns, covering the health effects and environmental impact of wood smoke, are ongoing. These include campaigns to inform municipalities about pollution from wood stoves, and their ability to curtail it, the availability of cleaner units, and encouraging clean burning practices among those who already own and operate wood stoves.

[45] http://www.rural.palegislature.us/documents/reports/Population_Projections_Report.pdf

The clean-burning educational campaigns ongoing at ACHD encourage all Allegheny County residents to consider how and what they burn and how it impacts their health and environment.

Idling Regulations

Idling regulations are currently in place at the state and county levels. The Pennsylvania Diesel-Powered Motor Vehicle Idling Act, effective in 2009, prohibits the owners and drivers of any commercial diesel-powered onroad motor vehicle with a gross weight of greater than 10,001 pounds from idling for more than five minutes in any 60-minute period (with exemptions for the operator's safety and the comfort of passengers in high or low temperatures). Extensive signage requirements in the law have been integral in spreading the news of this regulation across the state. All truck docks and other places where diesel trucks may park or idle are required to post signs regarding the regulation.

In 2010, Allegheny County enacted Article XXI §2105.93, "In-Use Off-Road Diesel Powered Mobile Equipment Engine Idling," which prohibits idling of off-road vehicles for more than five consecutive minutes, unless exempt. Operators of such vehicles can be reported to ACHD and can be fined up to $500 if they are found in non-compliance. The County regulation primarily affects construction vehicles, which can operate as a nuisance point source at construction sites in highly populated areas.

City Legislation & Industry Initiatives

In 2011, The City of Pittsburgh passed its Clean Air Act of 2011, which required certain publicly subsidized construction projects in Pittsburgh to utilize clean diesel equipment. This legislation will help to reduce diesel particulate pollution from construction projects in the city, both by the direct requirement for retrofitted equipment, and the incentives construction companies now have to retrofit their equipment in advance of securing a contract for a publicly subsidized project, so as to remain competitive.

Other similar efforts to address diesel particulate pollution from construction sources have been taken up by local businesses and other organizations. In 2011, The University of Pittsburgh Medical Center (UPMC) established language for all future contracts that requires all construction equipment used at any UPMC construction site to meet Tier 4 standards. This requirement went into effect in the spring of 2011, three years before EPA will require Tier 4 standards on all newly manufactured equipment. UPMC currently has several hospitals and other health facilities throughout Allegheny County.

ACHD Clean Air Fund

ACHD offers funding for air quality projects through its Clean Air Fund, a restricted fund where penalties from emission violations are deposited. Since 2011, several million dollars have been awarded to projects involving diesel retrofits, rebates for renewable energy equipment, pollution prevention activities, air quality educational efforts, specialized scientific studies, and other efforts. Expenditures from the Clean Air Fund will continue to improve air quality within the NAA.

12 Emergency Episodes

Subpart H of 40 CFR part 51 specifies requirements for SIPs to address emergency air pollution episodes in order to prevent air pollutant levels from reaching levels determined to cause significant harm to the health of persons. No levels are currently recommended by EPA for $PM_{2.5}$ emergency episodes. However, Article XXI §2106.03, "Episode Criteria," which defines the procedures for emergency air pollution episodes as well as the values for air pollutants, includes PM_{10} levels. ACHD will use the levels for PM_{10} as levels for $PM_{2.5}$.

ACHD assumes that, by definition, 1.0 $\mu g/m^3$ of $PM_{2.5}$ is equal to at least 1.0 $\mu g/m^3$ of PM_{10}. Therefore, if any $PM_{2.5}$ monitor exceeds any of the emergency episode levels listed for PM_{10}, it will be assumed that the PM_{10} emergency episode levels have been exceeded, and appropriate action will be taken according to the predetermined actions in Article XXI §2106.04, "Episode Actions."

13 Legal Documents

Notice of Public Hearing and Comment Period

{to be added after public comment}

Transmittals of Public Hearing Notice to PA DEP and EPA

{to be added after public comment}

Proof of Publication and Certification of Public Hearing

{to be added after public comment}

Summary of Public Comments and Responses

{to be added after public comment}

Certification of Adoption

{to be added after adoption}

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