Commonwealth of Pennsylvania

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PROPOSED

VOLUME II: Technical Support Document
State Implementation Plan Revision: NOx Motor Vehicle Emission Budget Revisions Based on the MOVES2010a Model

Reading Eight-Hour Ozone Maintenance Area

March 2013

Bureau of Air Quality
Pennsylvania Department of Environmental Protection
P.O. Box 8468
Harrisburg, PA 17105-8468
717-787-9495

Michael Krancer
Secretary

Tom Corbett
Governor

[This page intentionally left blank.]

Contents

Introduction 1
Point Source Category Emissions 1
2009 Point Source Category Emissions 1
2018 Point Source Category Emissions 6
Area Source Category Emissions 12
2009 Area Source Category Emissions 12
2018 Area Source Category Emissions 17
Nonroad Source Category Emissions 24
Highway Source Category Emissions 25

Tables

Table 1: Point Source Emissions for 2009 – SIP Estimated Versus Actual 2
Table 2: Actual 2009 Annual NO_X Point Source Inventory for the Reading Ozone Maintenance Area by Facility Source 2
Table 3: Reading Ozone Maintenance Plan Emission Estimates for 2018 7
Table 4: Revised Reading Ozone Maintenance Plan Emissions Estimates of Non-EGU and EGU Point Sources for 2018 (MARAMA 2007 Baseline and 2020 Projected Inventories) 7
Table 5: MARAMA 2018 Annual Baseline and Projected NO_X Point Source Inventories for the Reading Ozone Maintenance Area by Facility Source 8
Table 6: Revised Socioeconomic Data for the Reading Ozone Maintenance Area Relative to Projected Growth in the Reading Area Maintenance Plan (2002-2009) 13
Table 7: NO_X Affected Area Source Emission Categories in the Reading Ozone Maintenance Areas for Calendar Year 2009 14
Table 8: Revised Socioeconomic Data for the Reading Ozone Maintenance Area Relative to the Projected Growth in the Reading Area Maintenance Plan (2009-2018) 18
Table 9: Affected NO_X Area Source Emission Categories in the Reading Ozone Maintenance Areas for the Calendar Year 2018 19
Table 10: Revised Motor Vehicle Emissions Using MOVES2010a 25

[This page intentionally left blank.]

Introduction

This Technical Support Document provides detailed information on the categories of point, area, nonroad, and highway sources of oxides of nitrogen (NO_X) emission estimates and assumptions. Data shown in this document were used in the *State Implementation Plan Revision: Maintenance Plan and Base Year Inventory – Reading Eight-Hour Ozone Nonattainment Area*, which is hereafter referred to as the Reading Ozone Maintenance Plan. Other data and assumptions outlined in the Technical Support Document are also used in this proposed State Implementation Plan (SIP) revision to the Reading Ozone Maintenance Plan that is entitled, "*State Implementation Plan Revision: NO_X and VOC Motor Vehicle Emission Budget Revisions Based on the MOVES2010a Model – Reading Eight-Hour Ozone Maintenance Area*" The Reading Ozone Maintenance Plan revision demonstrates that replacing highway emissions estimates using the MOVES model instead of the Mobile6 model to generate emissions estimates will not cause emissions from all sources in the maintenance year to exceed all emissions in the attainment year. This Technical Support Document will describe how emission estimates and emission growth rates that were used in both the Reading Ozone Maintenance Plan and the Reading Ozone Maintenance Plan revision were developed for all source categories (point, area, nonroad, and highway).

Point Source Category Emissions

Point sources include emissions from large commercial, institutional, and industrial facilities, such as chemical manufacturing facilities, large waste disposal sites, and large heating and electric generating units (EGUs). Emission projections used in the Reading Ozone Maintenance Plan were prepared for the point source sector for 11 states, including Pennsylvania, and the District of Columbia, for the Mid-Atlantic Regional Air Management Association (MARAMA) by MACTEC Federal Programs, Inc. Future year projections were developed by MACTEC so that states could use the projections as inventories in their SIPs. Estimates were prepared for years 2009 and 2018, and took into consideration both growth in economic activity and additional controls required by regulation.

For the purpose of projecting emissions into the future for all of the states' ozone maintenance plans, the point source inventory of emissions is divided into two subsectors – the EGU sector and the non-EGU sector. Different projection methods are used for those two sectors. The Reading Area has two EGU emission sources. The Reading Area contains many non-EGU point sources. For the non-EGU sector, growth factors were developed by using The United States Environmental Protection Agency's (EPA) Economic Growth Analysis System (EGAS) Version 5.0. U.S. Department of Energy fuel consumption forecasts were used to replace default values for combustion sources in EGAS 5.0. Also, state-supplied population, employment, and other emission projection data were used if either EGAS 5.0 values did not exist or if the state-supplied data was deemed better than values given by EGAS 5.0.

Point Source Emissions for 2009

Table 1 gives totals of NO_X emissions for both 2009 projected emissions in the Reading Ozone Maintenance Plan and the actual 2009 Reading Area emissions reported to the Department after

the Reading Ozone Maintenance Plan was developed.[1] Table 1 demonstrates that the assumptions that point source emissions in the Reading Ozone Maintenance Plan for 2009 were overestimated for NO_X. Table 2 lists the actual 2009 NO_X emissions from the individual facilities in the Reading Area. Two large facilities in the Reading Area, Titus Generating Station and Lehigh Cement, produce 75 percent of all point source NO_X emissions. Fuel throughputs of these two facilities are such that average summer throughputs are approximately the same as average annual throughputs. Therefore, when the annual emissions were divided by 365 days in a year, the result approximates average summer day emissions.

Actual Emissions for 2009

Table 1: Point Source Emissions for 2009 - SIP Estimated Versus Actual

Emissions for 2009	**NO_X (tons/day)**
Emissions in Maintenance Plan	16.8
Actual Emissions (actual reported annual emissions in Table 2 divided by 365 days)	11.5

Table 2: Actual 2009 Annual NO_X Point Source Inventory for the Reading Ozone Maintenance Area by Facility Source

EPA AFS Number	**Facility Name**	**NO_X (tons per year)**
420110096	ADELPHI KITCHENS INC/ROBESONIA	0.3
420110054	ATLAS MINERALS & CHEM/MERTZTOWN	4.1
420110095	BALDWIN HDWR CORP/READING PLT	4.7
420110354	BERKS CAN CO INC/BERKS CAN PLANT	0.1

[1] Air Information Management System Submittal, Pennsylvania Department of Environmental Protection, 2009

EPA AFS Number	Facility Name	NO_X (tons per year)
420110002	BERKS CNTY/BERKS CNTY COMPLEX	22.4
420110028	BOYERTOWN FOUNDRY CO/FKA EAFCO	2.9
420110075	CAMBRIDGE LEE IND /READING TUBE DIV	15.4
420110101	CAN CORP OF AMER/BLANDON PLT	9.5
420110031	CARPENTER TECH CORP/READING PLT	169.2
420110099	CHIYODA AMER INC/CAERNARVON	3.3
420110438	CRAFT MAID KITCHEN INC/READING	0.3
420111012	DAIRY FARMERS OF AMER INC/READING	9.6
420110365	DELAWARE CNTY SWA/ROLLING HILLS MUNI WASTE LDFL	5.5
420110636	DYER QUARRY INC/DYER QUARRY	6.6
420110274	EAST PENN MFG CO INC/BATTERY ASSEMBLY	41.3
420110478	EAST PENN MFG CO INC/KUTZTOWN	0.9
420110014	EAST PENN MFG CO INC/SMELTER PLT	57.3

EPA AFS Number	Facility Name	NO_X (tons per year)
420110355	EJB PAVING & MATERIALS/ONTELAUNEE	9.5
420110638	EXIDE TECH/READING FORMATION & DIST CTR	3.7
420110034	EXIDE TECH/READING SMELTER	59.4
420110446	FLEETWOOD IND/LEESPORT	0.1
420111066	FR&S INC/PIONEER CROSSING LDFL	16.2
420110045	GENON REMA LLC/TITUS GEN STA	1529.2
420110554	GLEN GERY CORP/MID ATLANTIC PLT	18.6
420110458	GREEN GAS PIONEER CROSSING ENERGY LLC/EXETER	28.1
420110867	ICON REAL ESTATE INC/READING	0.6
420110016	INTERSTATE CONTAINER/READING PLT	0.8
420110039	LEHIGH CEMENT CO LLC/EVANSVILLE CEMENT PLT & QUARRY	1610.2
420110476	MCCONWAY & TORLEY LLC/KUTZTOWN FOUNDRY	27.8
420110091	MORGAN CORP/CAERNARVON TWP	1.5

EPA AFS Number	Facility Name	NO_X (tons per year)
420110820	NEW MORGAN LDFL CO INC/CONESTOGA LDFL NEW MORGAN B	15.8
420110427	ONTELAUNEE POWER OPR CO LLC/ONTELAUNEE PLT	61.4
420110097	OROGRAIN BAKERIES MFG INC/READING PLANT	2.3
420110431	PA DPW/HAMBURG CTR	11.8
420110471	PA DPW/WERNERSVILLE STATE HOSP	15.2
420110008	PA STATE SYS OF HIGHER ED/KUTZTOWN UNIV OF PA	7.9
420110105	READING TERM CORP/SINKING SPRING TERM	0.1
420110089	READING TRUCK BODY /READING	3.1
420111018	ROEBERG ENTERPRISES/YORGEYS CLNRS	0.5
420110637	SEALED AIR CORP/READING PLT	11.0
420110237	SUNOCO PARTNERS MKT & TERM LP/MONTELLO	2.7
420110088	TEXAS EASTERN TRANS/BECHTELSVILLE	211.6
420110087	TEXAS EASTERN TRANS/BERNVILLE STA	163.2

EPA AFS Number	Facility Name	NO_X (tons per year)
420110473	UNITED CORRSTACK LLC/READING	29.8
420112001	WILLIAMS METALFINISHING/SINKING SPRING	0.1
420110090	YUASA BATTERY INC/LAURELDALE	4.8
	Total Actual Annual Emissions	**4200.5**

Point Source Category 2018 Emissions

Ideally, emissions growth could be compared between what was assumed in the Reading Ozone Maintenance Plan and recently revised assumptions for emissions growth. Both sets of assumptions are valid because the EPA requires that assumptions in growth be updated with each revision to the maintenance plan. If the revised assumptions for growth are less than what was assumed in the original maintenance plan, then it can be easily shown that emissions in the maintenance years are still below the emissions in the attainment year. However, when revised growth in some types of point sources is higher, and in some types, the growth is lower, emissions growth cannot easily be compared to show the new assumptions still maintain the ozone standard. Then, a projected emissions inventory needs to be developed and compared. For the Reading Area, a projected point source inventory for the maintenance year 2018 needed to be developed to show maintenance with the ozone standard.

The 2018 point source inventory for the Reading Ozone Maintenance Plan was developed for MARAMA by MACTEC. More recently, an emissions inventory of all emission source categories (point, area, nonroad, and highway) was developed by MARAMA and MACTEC for a regional modeling effort. Table 3 and Table 4 compare total emissions of NO_X produced by non-EGU and EGU sources in the Reading Ozone Maintenance Plan with the recently developed inventories. During the last year, MARAMA developed inventories for the baseline year of 2007 and projected years of 2013, 2017, 2020, and 2025.[2] The difference in the inventory years for the inventory used in the Reading Ozone Maintenance Plan and new MARAMA/MACTEC inventory development efforts did not allow for easy comparison of growth factors used for

[2] MARAMA 2007, 2017, and 2020 Baseline and Projected Inventories, Version 3, Julie McDill, Mid-Atlantic Regional Management Association, Towson, MD, January 2012.

projecting emissions. Projected emissions in 2018 were estimated for the maintenance plan revisions using straight-line interpolation between the 2007 MARAMA baseline inventory and the 2020 MARAMA projected year inventory using the following equation:

2018 emissions = 2007 Emissions - ((2007 Emissions – 2020 emissions) *(2018-2007) ÷ (2020 - 2007))

Emission projections of non-EGU and EGU point sources in the Reading Ozone Maintenance Plan were overestimated for the year 2018 when compared to newer emissions data derived by MARAMA. See Tables 3 and 4.

Table 3: Reading Ozone Maintenance Plan Emission Estimates for 2018

Year	NO_X Emissions (tons/year)	NO_X Emissions (tons/day)
2018	7053*	19.2

*Annual 2018 emissions from Titus Generating Station were not included in the Reading Ozone Maintenance Plan. Annual emissions are an estimate after including Titus's annual emissions, which were based on the daily emissions in the maintenance plan.

Table 4: Revised Reading Ozone Maintenance Plan Emissions Estimates of Non-EGU and EGU Point Sources for 2018 (MARAMA 2007 Baseline and 2020 Projected Inventories)

Year	NO_X Emissions (tons/year)	NO_X Emissions (tons/day)
2007 (Baseline)	5927.9	16.4
2020 (Projected)	4353.8	11.9
2018 (Interpolated)	4595.2	12.6

Table 5 shows actual 2007 and projected 2020 facility emissions of NO_X for non-EGU and EGU point source in the Reading area.

Table 5: MARAMA 2018 Annual Baseline and Projected NO_X Point Source Inventories for the Reading Ozone Maintenance Area by Facility Source

EPA AFS Number	Facility Name	2007 Baseline NO_X Emissions	2020 Projected NO_X Emissions
420110096	ADELPHI KITCHENS INC/ROBESONIA	0.0	0.0
420110054	ATLAS MINERALS & CHEM/MERTZTOWN	12.3	12.3
420110095	BALDWIN HDWR CORP/READING PLT	8.5	11.7
420110354	BERKS CAN INC/BERKS CAN PLANT	0.1	0.2
420110002	BERKS CNTY/BERKS CNTY COMPLEX	21.4	21.4
420110028	BOYERTOWN FOUNDRY CO/FKA EAFCO	3.1	3.2
420110075	CAMBRIDGE LEE IND/READING TUBE DIV	14.3	14.9
420110101	CAN CORP OF AMER/BLANDON PLT	4.0	5.6
420110031	CARPENTER TECH CORP/READING PLT	236.3	281.5
420110099	CHIYODA AMER INC/CAERNARVON	4.4	6.2
420110438	CRAFT MAID KITCHEN INC/READING	0.0	0.0
420111012	DAIRY FARMERS OF AMER. INC/READING	8.3	9.5

EPA AFS Number	Facility Name	2007 Baseline NO_X Emissions	2020 Projected NO_X Emissions
Emissions Reduction Credits	DECORATIVE SPECIALTIES/DSI INC.	9.4	
420110365	DELAWARE CNTY SWA/ROLLING HILLS MUNI WASTE LDFL	9.2	9.7
420110636	DYER QUARRY INC/DYER QUARRY	8.1	8.5
420110274	EAST PENN MFG CO INC/BATTERY ASSEMBLY	37.5	53.2
420110478	EAST PENN MFG CO INC/KUTZTOWN	1.1	1.1
420110014	EAST PENN MFG CO INC/SMELTER PLT	62.1	62.9
420110355	EJB PAVING & MATERIALS/ONTELAUNEE	12.0	12.2
420110638	EXIDE TECH/READING FORMATION & DIST CTR	3.5	3.5
420110034	EXIDE TECH/READING SMELTER	60.8	60.8
420110446	FLEETWOOD IND/LEESPORT	0.3	0.4
420111066	FR&S INC/PIONEER CROSSING LDFL	16.2	17.1
420110045	GENON REMA LLC/TITUS GEN STA/NON-POINT	3.5	4.4
420110045	GENON REMA LLC/TITUS GEN STA/POINT	2474.4	2278.9

EPA AFS Number	Facility Name	2007 Baseline NO_X Emissions	2020 Projected NO_X Emissions
420110554	GLEN GERY CORP/MID ATLANTIC PLT	31.1	31.1
420110040	GLIDDEN DEA/ICI PAINTS/READING	5.0	5.4
420110114	GRAFICA COMMERCIAL PRINTING	0.2	0.2
420110867	ICON REAL ESTATE INC/READING	1.4	1.9
420110016	INTERSTATE CONTAINER/READING PLT	1.1	1.2
420110039	LEHIGH CEMENT CO LLC/EVANSVILLE CEMENT PLT & QUARRY	2296.6	651.0
420110476	MCCONWAY & TORLEY LLC/KUTZTOWN FOUNDRY	22.9	23.5
420110091	MORGAN CORP/CAERNARVON TWP	0.5	0.6
420110820	NEW MORGAN LDFL CO INC/CONESTOGA LDFL NEW MORGAN B	37.9	40.0
420110427	ONTELAUNEE POWER OPR CO LLC/ONTELAUNEE PLT	4.0	4.0
420110427	ONTELAUNEE POWER OPR CO LLC/ONTELAUNEE PLT	31.2	40.6
420110097	OROGRAIN BAKERIES MFG INC/READING PLANT	2.6	3.1
420110431	PA DPW/HAMBURG CTR	11.0	11.3

EPA AFS Number	Facility Name	2007 Baseline NO_X Emissions	2020 Projected NO_X Emissions
420110471	PA DPW/WERNVILLE STATE HOSPITAL	16.4	17.0
420110008	PA STATE SYS OF HIGHER ED/KUTZTOWN UNIV OF PA	25.1	26.8
420110105	READING TERM CORP/SINKING SPRING TERM	0.0	0.0
420110089	READING TRUCK BODY /READING	4.4	5.8
420111018	ROEBERG ENTERPRISES/YORGEYS CLNRS	0.6	0.7
420110637	SEALED AIR CORP/READING PLT	17.5	19.4
420110111	SFS INTEC/WYOMISING	0.1	0.1
420110237	SUNOCO PARTNERS MKT & TERM LP/MONTELLO	2.2	2.3
420110088	TEXAS EASTERN TRANS/BECHTELSVILLE	222.5	316.0
420110087	TEXAS EASTERN TRANS/BERNVILLE STA	167.6	238.0
420110473	UNITED CORRSTACK LLC/READING	19.3	27.4
420112001	WILLIMAS METAL FINISHING/SINKING SPRING	0.2	0.2
420110090	YUASA BATTERY INC/ LAURELDALE	4.9	6.8

EPA AFS Number	Facility Name	2007 Baseline NO_X Emissions	2020 Projected NO_X Emissions
	Total Annual Point Source NOx Emissions	**5937.3**	**4353.8**

Area Source Category Emissions

The area source category includes emissions from sources such as surface coating, solvent use, residential and commercial heating, and other sources that emit small amounts of emissions on a per use basis but have a large number of users. The Reading Ozone Maintenance Plan relied on a number of socioeconomic indicators to estimate emissions, and projections of emissions, such as: population, industrial employment, employment, and industry specific growth factors. In the maintenance plan, a baseline area source inventory of 2002 was grown using socioeconomic factors of expected population and employment growth. For some sources, such as coal-, distillate-, or natural gas-fired boilers, data from the 2005 Annual Energy Outlook or the EGAS model was used to predict future growth and emissions. For other area source categories, state-specific industry growth estimates supplied by the Department were used.

Area Source Category 2009 Emissions

Table 6 shows a recent estimate of actual socioeconomic indicators. Actual growth that occurred from 2002 to 2009 was derived from data published by the U.S. Department of Commerce, Bureau of Census[3,4,5] and the Energy Information Administration, U.S. Department of Energy[6]. The actual growth is compared side-by-side with the predicted growth from the Reading Ozone

[3] U.S. Department of Commerce, Bureau of the Census, "Population Estimates Program," T1. Population Estimates [10] data Set: 2008 Population Estimates, available from http://www.census.gov/popest/counties/CO-EST2009-01.html, accessed October 2011.

[4] U.S. Department of Commerce, Bureau of the Census, Housing Unit Estimates, Data Set 2002 and 2009 Population Estimates, Note: For information on errors stemming from model error, sampling error, and non-sampling error, see: http://www.census.gov/popest/topics/methodology, accessed October 2011.

[5] Employee and establishment numbers: U.S. Census Bureau, County Business Patterns, http://factfinder.census.gov/econ/cbp/index.html

[6] Energy Information Administration, U.S. Department of Energy, State Energy Data System - Consumption, Physical Units, 1960-2006, available from: http://www.eia.gov/state/seds/seds-states.cfm?q_state_a=PA&q_state=Pennsylvania

Maintenance Plan. The Reading Ozone Maintenance Plan over-predicted growth for most area sources for the 2002 to 2009 timeframe. The Reading Ozone Maintenance Plan under-predicted growth for two growth surrogates, population growth and natural gas combustion, and therefore, under-predicted emissions in the Reading Area for sources that depend on those surrogates for determining emissions growth. However, this will not make a large difference in emission estimates because most large emission sources predicted by population growth are sources of volatile organic compounds which this revision does not address. Gains in emissions from natural gas use were offset by lower emissions from other fossil fuels. Table 7 compares the NO_X area sources emissions in the Reading Ozone Maintenance Plan with emissions predicted by the MARAMA inventory to determine within a reasonable amount what the exact effect on emissions will be due to this under-prediction. The emissions are derived from a 2007 baseline emissions inventory that was grown to 2017 and linearly interpolated to determine 2009 emissions. Emissions estimated based on updated assumptions by MARAMA indicate that area source emissions of NO_X in the Reading Ozone Maintenance Area are approximately 76 tons per year more than what was included in the Maintenance Plan. Given that these NO_X-producing area sources are mostly fuel combustion sources, the increase in area source NO_X emissions would mostly occur outside of the ozone season during colder temperatures. Increased NO_X emissions for area sources as a result of updated growth estimates would be minimal. After adjusting annual emissions to obtain summer weekday emissions, increased emissions in 2009 were less than 0.1 tons of NO_X per summer week day more than what was given in the Berks Ozone Maintenance Plan which would be more than offset by emission reductions from other sectors in the Reading Ozone Maintenance Plan, for instance, point sources.

Table 6: Revised Socioeconomic Data for the Reading Ozone Maintenance Area Relative to Projected Growth in the Reading Area Maintenance Plan (2002-2009)

Surrogate Indicator for Growth	Actual Use 2002	Actual Use 2009	Actual Growth 2002-2009	Maintenance Plan Growth (2002-2009)
Population	**380,629**	**407,125**	**1.0696**	**1.0381**
Total Employees	**145,505**	**144,462**	**0.9928**	**1.0645**
Total Coal Consumption (short tons)	**274,048**	**178,741**	**0.6522**	**0.7488**
Total Natural Gas Consumption (million cubic ft.)	**15,972**	**17,094**	**1.0702**	**---**
Natural Gas Boilers	**---**	**---**	**---**	**1.0105**
Natural Gas, Residential	**---**	**---**	**---**	**1.0841**
Distillate Oil Consumption (barrels)	**1,738,815**	**1,703,461**	**0.9797**	**1.0731**

Table 7: NO_X Affected Area Source Emission Categories in the Reading Ozone Maintenance Areas for Calendar Year 2009

Source Classification Code	Source Classification Description	2009 Projected Emissions	2009 NO_X Emissions in the Maintenance Plan
2102001000	Total: All Boiler Types, Anthracite Coal, Industrial, Stationary Source Fuel Combustion	536.869	238.816
2102004000	Stationary Fuel Comb /Industrial /Distillate Oil /Total: Boilers and IC Engine	39.636	0.000
2102005000	Stationary Fuel Comb /Industrial /Residual Oil /Total: All Boiler Types	55.836	0.000
2102006000	Stationary Fuel Comb /Industrial /Natural Gas /Total: Boilers and IC Engine	0.000	0.000
2102007000	Stationary Fuel Comb /Industrial /Liquefied Petroleum Gas /Total: All Boilers	29.948	0.000
2102011000	Stationary Fuel Comb /Industrial /Kerosene /Total: All Boiler Types	0.628	0.000
2103001000	Total: All Boiler Types, Anthracite Coal, Commercial/Institutional, Stationary Source Fuel Combustion	69.185	129.404
2103004000	Total: Boilers and IC Engines, Distillate Oil, Commercial/Institutional, Stationary Source Fuel Combustion	44.435	85.210
2103005000	Total: All Boiler Types, Residual Oil, Commercial/Institutional, Stationary Source Fuel Combustion	5.778	11.215
2103006000	Total: Boilers and IC Engines, Natural Gas, Commercial/Institutional, Stationary Source Fuel Combustion	103.115	137.548

Source Classification Code	Source Classification Description	2009 Projected Emissions	2009 NO_X Emissions in the Maintenance Plan
2103007000	Total: All Combustor Types, Liquefied Petroleum Gas (LPG), Commercial/Institutional, Stationary Source Fuel Combustion	3.643	0.253
2103011000	Total: All Combustor Types, Kerosene, Commercial/Institutional, Stationary Source Fuel Combustion	4.913	6.076
2104001000	Total: All Combustor Types, Anthracite Coal, Residential, Stationary Source Fuel Combustion	2.203	19.907
2104004000	Total: All Combustor Types, Distillate Oil, Residential, Stationary Source Fuel Combustion	324.421	389.084
2104006000	Total: All Combustor Types, Natural Gas, Residential, Stationary Source Fuel Combustion	223.435	226.049
2104007000	Total: All Combustor Types, Liquefied Petroleum Gas (LPG), Residential, Stationary Source Fuel Combustion	50.398	37.041
2104011000	Total: All Heater Types, Kerosene, Residential, Stationary Source Fuel Combustion	18.033	65.687
2601010000	Total, Industrial, On-site Incineration, Waste Disposal, Treatment, and Recovery	---	40.090
2601020000	Total, Commercial/Institutional, On-site Incineration, Waste Disposal, Treatment, and Recovery	---	40.633
2610000100	Yard Waste - Leaf Species Unspecified, All	---	3.473

Source Classification Code	Source Classification Description	2009 Projected Emissions	2009 NO_X Emissions in the Maintenance Plan
	Categories, Open Burning, Waste Disposal, Treatment, and Recovery		
2610000400	Yard Waste - Brush Species Unspecified, All Categories, Open Burning, Waste Disposal, Treatment, and Recovery	---	2.770
2610000500	Land Clearing Debris (use 28-10-005-000 for Loggin, All Categories, Open Burning, Waste Disposal, Treatment, and Recovery	79.669	101.918
2610010000	Total, Industrial, Open Burning, Waste Disposal, Treatment, and Recovery	---	3.715
2610020000	Total, Commercial/Institutional, Open Burning, Waste Disposal, Treatment, and Recovery	---	5.857
2610030000	Household Waste (use 26-10-000-xxx for Yard Wastes, Residential, Open Burning, Waste Disposal, Treatment, and Recovery	---	28.787
2810001000	Total, Forest Wildfires, Other Combustion, Miscellaneous Area Sources	---	0.251
2810015000	Total, Prescribed Burning for Forest Management, Other Combustion, Miscellaneous Area Sources	---	0.483
2810030000	Total, Structure Fires, Other Combustion, Miscellaneous Area Sources	---	0.575
	Total 2009 Annual Areas Source NOx Emissions	**1592.145**	**1586.511**
	Total 2009 Summer Week Day Area Source NOx Emissions	**2.305**	**2.239**

Area Source Category 2018 Emissions

The Reading Ozone Maintenance Plan estimated area source sector growth using a baseline inventory from 2002 and growing emissions to the maintenance years of 2009 and 2018, based on the growth of socioeconomic activity.[7] Data used to revise growth estimates was obtained from the same MARAMA inventory effort described in the point source section above. The effort used a baseline inventory of 2007[8] and maintenance year inventories of 2017 and 2020.[9] Just as in the point source emissions, these inventory years made a direct comparison of emissions and growth rates difficult because the MARAMA baseline years and projected inventory years were too dissimilar from what was included in the Reading Ozone Maintenance Plan. Therefore, the emissions growth predicted to occur from 2009 to 2018 was determined through linear interpolation by using emission estimates for 2007 and 2020 from the new MARAMA inventory. Projected growth between 2009 and 2018 in the Reading Ozone Maintenance Plan was estimated using the 2009 and 2018 emission estimates. In Table 8, the revised growth projections are given.

The growth rate predicted in the maintenance plan from 2009 to 2018 is derived by the following formula:

$$\text{Growth Factor}_{(2009\text{-}2018)} = ((\text{Growth Factor}_{(2002\text{-}2018)} - \text{Growth Factor}_{(2002\text{-}2009)}) \div \text{Growth Factor}_{(2002\text{-}2009)}) + 1$$

A linear interpolation between the 2007 MARAMA baseline emissions and the 2020 MARAMA projected emissions was used to calculate emissions for the years 2009 and 2018. From these interpolated emissions (see equations 1 and 2 below), the projected growth between 2009 and 2018 was calculated (see equation 3 below). Fossil fuel combustion surrogates in Table 8 represent most emissions of NO_X. The surrogates for growth shown in Table 8 are used to predict revised growth for a large majority of emissions from area source categories in the Reading Ozone Maintenance Plan revision.

(1) 2009 Emissions = 2007 Emissions - (2020 Emissions – 2007 Emissions) * ((2009 – 2007) ÷ (2020-2007))

(2) 2018 Emissions = 2007 Emissions - (2020 Emissions – 2007 Emissions) * ((2018 – 2007) ÷ (2020-2007))

[7] State Implementation Plan Revision: Maintenance Plan and Base Year Inventory Lancaster Eight-Hour Ozone Nonattainment Area, September 2006, Appendix B-1, Area Source Methodology, p.2.

[8] Mid-Atlantic Regional Air Management Association, Technical Support Document for the Development of the 2007 Emissions Inventories for Regional Air Quality Modeling in the Northeast/Mid-Atlantic Region Version 3.3, January 23, 2012

[9] Mid-Atlantic Regional Air Management Association, Technical Support Document for the Development of the 2017/2020 Emissions Inventories for Regional Air Quality Modeling in the Northeast/Mid-Atlantic Region Version 3.3, January 23, 2012

(3) Emissions Growth $_{(2009\text{-}2018)}$ = ((2018 Emission – 2009 Emissions) ÷ 2009 Emissions) + 1

Table 8 shows that, for the most part, growth in the Reading Ozone Maintenance Plan is comparable to newer assumptions developed by the MARAMA inventory effort. It deserves mentioning that the two sets of employee growth that are compared in Table 8 were estimated using two different methods. It is safe to assume that, due to the severe economic downturn experienced from 2007 to 2009, employee growth does not approach what was predicted in the Reading Ozone Maintenance Plan. Emissions of NO_X from area sources are dominated by fossil fuel combustion. Table 8 shows that the Reading Ozone Maintenance Plan under-predicted indicators for growth from 2009 to 2018 for population, commercial anthracite coal use, distillate oil, and commercial natural gas use. It is difficult to discern from comparing growth factors in the Maintenance Plan to updated growth estimates whether emissions were under-predicted. Table 9 compares estimated NO_X emissions in the Reading Ozone Maintenance Plan with emissions predicted by the updated MARAMA inventory. The 2009 and 2018 NO_X emission from the MARAMA inventory were linearly interpolated between a 2007 baseline inventory and an estimated 2020 inventory. Table 9 shows that the Reading Ozone Maintenance Plan NO_X emissions are slightly larger than the newer MARAMA inventory by about 75 tons per year. Therefore, updated area source NO_X emissions are higher than what is inventoried in the Reading Ozone Maintenance Plan for 2018.

Table 8: Revised Socioeconomic Data for the Reading Ozone Maintenance Area Relative to the Projected Growth in the Reading Area Maintenance Plan (2009-2018)

Indicator for Growth	Revised Growth in MARAMA Inventory (2009-2018)	Maintenance Plan Growth (2009-2018)
Population	**1.0851**	**1.0472**
Employees	**1.0113***	**1.0779**
Anthracite Coal, Industrial	**0.9136**	**0.9983**
Anthracite Coal, Commercial	**1.0230**	**0.9865**
All Combuster Types, Distillate Oil	**0.9615**	**0.9598**
Boilers and Internal Combustion Engines, Natural Gas, Commercial	**1.0687**	**1.0521**
Combuster Types, Natural Gas, Residential	**1.0188**	**1.0181**

*The MARAMA inventory estimated growth in employment based on statewide North American Industry Classification System codes. NAICS codes proved too cumbersome to establish employment growth on the county level. Employment growth in Table 8 was derived from U.S Census Bureau industrial employment data and was not developed by MARAMA.

Table 9: Affected NO_X Area Source Emission Categories in the Reading Ozone Maintenance Areas for Calendar Year 2018

Source Classification Code	Source Classification Description	2018 Projected Emissions	2018 NO_X Emissions in the Maintenance Plan
2102001000	Total: All Boiler Types, Anthracite Coal, Industrial, Stationary Source Fuel Combustion	490.489	238.402
2102004000	Stationary Fuel Comb /Industrial /Distillate Oil /Total: Boilers and IC Engines	37.372	0.000
2102005000	Stationary Fuel Comb /Industrial /Residual Oil /Total: All Boiler Types	39.392	0.000
2102006000	Stationary Fuel Comb /Industrial /Natural Gas /Total: Boilers and IC Engine	0.000	0.000
2102007000	Stationary Fuel Comb /Industrial /Liquefied Petroleum Gas /Total: All Boilers	28.045	0.000
2102011000	Stationary Fuel Comb /Industrial /Kerosene /Total: All Boiler Types	0.592	0.000
2103001000	Total: All Boiler Types, Anthracite Coal, Commercial/Institutional, Stationary Source Fuel Combustion	70.774	127.655
2103004000	Total: Boilers and IC Engines, Distillate Oil, Commercial/Institutional, Stationary Source Fuel Combustion	36.232	89.222
2103005000	Total: All Boiler Types, Residual Oil, Commercial/Institutional, Stationary Source Fuel Combustion	6.119	11.553

Source Classification Code	Source Classification Description	2018 Projected Emissions	2018 NO_X Emissions in the Maintenance Plan
2103006000	Total: Boilers and IC Engines, Natural Gas, Commercial/Institutional, Stationary Source Fuel Combustion	110.202	144.709
2103007000	Total: All Combustor Types, Liquefied Petroleum Gas (LPG), Commercial/Institutional, Stationary Source Fuel Combustion	3.646	0.258
2103011000	Total: All Combustor Types, Kerosene, Commercial/Institutional, Stationary Source Fuel Combustion	6.268	5.980
2104001000	Total: All Combustor Types, Anthracite Coal, Residential, Stationary Source Fuel Combustion	1.600	18.291
2104004000	Total: All Combustor Types, Distillate Oil, Residential, Stationary Source Fuel Combustion	266.855	373.431
2104006000	Total: All Combustor Types, Natural Gas, Residential, Stationary Source Fuel Combustion	227.640	230.129
2104007000	Total: All Combustor Types, Liquefied Petroleum Gas (LPG), Residential, Stationary Source Fuel Combustion	39.784	44.211
2104008001	Fireplaces: General, Wood, Residential, Stationary Source Fuel Combustion	----	1.970
2104008002	Fireplaces: Insert; non-EPA certified, Wood, Residential, Stationary Source Fuel Combustion	----	4.902
2104008004	Fireplaces: Insert; EPA certified;	----	0.088

Source Classification Code	Source Classification Description	2018 Projected Emissions	2018 NO_X Emissions in the Maintenance Plan
	catalytic, Wood, Residential, Stationary Source Fuel Combustion		
2104008010	Woodstoves: General, Wood, Residential, Stationary Source Fuel Combustion	----	3.505
2104008030	Catalytic Woodstoves: General, Wood, Residential, Stationary Source Fuel Combustion	----	0.063
2104008100	Stationary Fuel Comb /Residential /Wood /Fireplace: general	11.295	----
2104008210	Stationary Fuel Comb /Residential /Wood /Woodstove: fireplace inserts; non-	6.813	----
2104008220	Stationary Fuel Comb /Residential /Wood /Woodstove: fireplace inserts; EPA	1.697	----
2104008230	Stationary Fuel Comb /Residential /Wood /Woodstove: fireplace inserts; EPA	0.621	----
2104008310	Stationary Fuel Comb /Residential /Wood /Woodstove: freestanding, non-EPA	19.634	----
2104008320	Stationary Fuel Comb /Residential /Wood /Woodstove: freestanding, EPA certified	4.889	----
2104008330	Stationary Fuel Comb /Residential /Wood /Woodstove: freestanding, EPA certified	1.791	----

Source Classification Code	Source Classification Description	2018 Projected Emissions	2018 NO_X Emissions in the Maintenance Plan
2104008400	Stationary Fuel Comb /Residential /Wood /Woodstove: pellet-fired, general	11.863	----
2104008510	Stationary Fuel Comb /Residential /Wood /Furnace: Indoor, cordwood-fired	1.473	----
2104008610	Stationary Fuel Comb /Residential /Wood /Hydronic heater: outdoor	3.324	----
2104009000	Stationary Fuel Comb /Residential /Firelog /Total: All Combustor Types	4.720	----
2104011000	Total: All Heater Types, Kerosene, Residential, Stationary Source Fuel Combustion	17.880	69.041
2601010000	Total, Industrial, On-site Incineration, Waste Disposal, Treatment, and Recovery	----	43.212
2601020000	Total, Commercial/Institutional, On-site Incineration, Waste Disposal, Treatment, and Recovery	----	43.797
2610000100	Yard Waste - Leaf Species Unspecified, All Categories, Open Burning, Waste Disposal, Treatment, and Recovery	----	3.637
2610000400	Yard Waste - Brush Species Unspecified, All Categories, Open Burning, Waste Disposal, Treatment, and Recovery	----	2.900
2610000500	Land Clearing Debris (use 28-10-005-000 for Logging, All Categories, Open Burning, Waste Disposal, Treatment,	79.669	106.724

Source Classification Code	Source Classification Description	2018 Projected Emissions	2018 NO_X Emissions in the Maintenance Plan
	and Recovery		
2610010000	Total, Industrial, Open Burning, Waste Disposal, Treatment, and Recovery	----	4.004
2610020000	Total, Commercial/Institutional, Open Burning, Waste Disposal, Treatment, and Recovery	----	6.313
2610030000	Household Waste (use 26-10-000-xxx for Yard Wastes, Residential, Open Burning, Waste Disposal, Treatment, and Recovery	----	30.145
2680001000	All Processes, 100% Bio-solids (e.g., sewage sludge, manure, mixture, Composting, Waste Disposal, Treatment, and Recovery	----	0.000
2680002000	All Processes, Mixed Waste (e.g., a 50:50 mixture of bio-solids an, Composting, Waste Disposal, Treatment, and Recovery	----	0.000
2810001000	Total, Forest Wildfires, Other Combustion, Miscellaneous Area Sources	----	0.251
2810015000	Total, Prescribed Burning for Forest Management, Other Combustion, Miscellaneous Area Sources	----	0.483
2810030000	Total, Structure Fires, Other Combustion, Miscellaneous Area Sources	----	0.602
	Total Annual Area Source NOx	**1530.679**	**1605.476**

Source Classification Code	Source Classification Description	2018 Projected Emissions	2018 NO_X Emissions in the Maintenance Plan
	Emissions		
	Total 2018 Summer Week Day Area Source NOx Emissions	**2.106**	**2.313**

Nonroad Source Category Emissions

Emissions from the nonroad category are produced by many different types of vehicles and equipment. The EPA's NONROAD model estimates emissions for over 200 types of equipment, engines and vehicles. Nonroad engines and vehicles can be used for such applications as construction, lawn and garden care, farming, and commercial and industrial applications. In addition, emissions from three types of activities including aircraft, locomotives, and commercial marine vessels are not estimated in the NONROAD model but are still included in the nonroad category. The aircraft, rail, and commercial marine emissions are estimated outside of the NONROAD model. In the approved Reading Ozone Maintenance Plan, the NONROAD2005 model was used to estimate nonroad emissions. The model went through one major revision since it was used for the maintenance plan. NONRAOD2008a is the latest version of this model. This new version of the model incorporated two reduction strategies that affect engines and vehicles in the nonroad sector:

- Diesel recreational marine standards in the 2008 final rule on locomotive and marine engines (73 FR 25098); and
- The October 2008 small spark ignition and spark ignition and recreational marine rule (73 FR 59034).

For the Reading Ozone Maintenance Plan, the Department modified files in the NONROAD model, when state specific data was available for emission categories such as residential lawn and garden.

Emissions from nonroad sources have decreased since the submittal of the Reading Ozone Maintenance Plan, as a result of the additional controls mentioned and other tier level controls that have been phased in with fleet turnover since 2004. The fleet turnover that occurs as older, more polluting nonroad equipment and vehicles are replaced by newer equipment and vehicles that meet more stringent emission standards has continued to lower emissions in the nonroad sector since the late 1990s and will continue to do so for the next 10 years. Emission reductions occurred across all segments of the nonroad category, including construction equipment, farming equipment, locomotives, and lawn and garden equipment. Modeling runs were not completed for the nonroad emission source categories. The Department will treat nonroad emissions in the

Reading Area as non-changing from their 2004 levels for the purpose of this SIP revision, even though full scale modeling runs using the NONROAD2008a would show nonroad emissions in a decline.

Highway Source Category Emissions

Highway emissions were estimated by Michael Baker, Jr., Inc., who is a consultant to the Pennsylvania Department of Transportation. The methodology for estimating emissions of highway vehicles is greatly different than what was used in the Reading Ozone Maintenance Plan because an entirely new highway emissions model is being used. Highway emissions are being estimated using the MOVES model instead of the Mobile6 model. With this change, a new set of inputs was used in the MOVES model. The method for forecasting traffic growth and vehicle miles travelled remains the same as that used in the Reading Ozone Maintenance Plan. Both the revised maintenance plan and the original maintenance plan used the *Statistical Evaluation of Projected Traffic Growth.* A revised Appendix C, Maintenance Plan Update for the Reading (Berks County) Eight-Hour Ozone Maintenance Area: Motor Vehicle Emission Budget Revisions Using MOVES2010a, is attached. Also attached, please find Appendix C-1, Mobile Source Highway Emissions Inventory – An Explanation of Methodology.

The MOVES model estimates that highway vehicle emissions increase greatly for NO_X for the 2009 and 2018 attainment years when compared to the highway vehicle emission estimates included in the Reading Ozone Maintenance Plan for those same years. (See Table 10). MOVES also increases the emission estimates of the 2004 attainment year. Since the emissions increase in both the attainment and maintenance years, MOVES modeled emissions, like Mobile modeled emissions, of highway vehicles still show a large decrease in emissions between 2004 and 2009 and between 2004 and 2018.

Table 10: Revised Motor Vehicle Emissions Using MOVES2010a

Pollutant	Original MOBILE6.2 Emissions			Revised MOVES2010a Emissions		
	2004	**2009**	**2018**	**2004**	**2009**	**2018**
NO_X (tons/day)	**29.8**	**21.3**	**9.0**	**34.4**	**27.0**	**12.9**