

Technical Memorandum

MOVES Based Analyses

PM_{2.5} and Ozone Conformity Analyses for Transportation
Plans, Programs, and Projects in the Cleveland-Akron-
Lorain, Ohio Metropolitan Area

April 2021

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PM_{2.5} and Ozone Conformity Analyses for Transportation Plans, Programs, and Projects in the Cleveland-Akron-Lorain, Ohio Metropolitan Area

April 2021

Prepared by

NORTHEAST OHIO AREAWIDE COORDINATING AGENCY

On behalf of the Akron Metropolitan Area Transportation Study, the Erie Regional Planning Commission, the Northeast Ohio Areawide Coordinating Agency, and the Ohio Department of Transportation

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Abstract

This report documents the transportation system emissions analyses required to maintain access to federal funds for transportation plans, programs, and projects in the Northeast Ohio area. At this time, analyses are required for the 2008 and 2015 8-hour ozone standards and for the 2006 and 2012 annual fine particulates standards. Analyses are done for the 8-hour ozone standard against the approved VOC and NO_x budgets. Analyses for the fine particulate standards are conducted against the PM_{2.5} and NO_x budgets found adequate for this purpose by U.S. EPA.

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Executive Summary

Ozone and PM_{2.5} Conformity Analyses for Transportation Plans, Programs, and Projects in the Cleveland-Akron-Lorain, Ohio Metropolitan Area

Akron Metropolitan Area Transportation Study (AMATS) Northeast Ohio Areawide Coordinating Agency (NOACA) City of Vermilion, Lorain County portion

What is required?

Nonattainment areas, through a process called transportation conformity, are required to demonstrate that emissions resulting from planned transportation system improvements will not exceed an area's emissions budgets. The U.S. Department of Transportation (U.S. DOT) issues nonattainment areas formal transportation conformity determinations following a quantitative analysis demonstrating that emissions from vehicles traveling on the planned transportation system are less than the area's emissions budget (or other emission target in the absence of an approved budget). Transportation conformity determinations ensure that the transportation sector is contributing to an area's progress toward meeting national air quality standards.

The Metropolitan Planning Organizations (MPOs) and the Ohio Department of Transportation (ODOT) must reestablish conformity for the 2006 and 2012 fine particulate matter (PM_{2.5}) standards and for the 2008 and 2015 8-Hour ozone standard as a result of the adoption of the 2050 long-range plan. Because conformity is determined on a nonattainment area, rather than a sub area basis, each of the area's planning partners must approve a new conformity finding for the area based on these updates. The analysis for each standard covers the pertinent portions of the counties of Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage and Summit. The current analyses reflect a comparison of projected transportation emissions against the approved budgets for each standard.

Why are these tests required?

These tests are required because all areas with a current or former designation of nonattainment must maintain conformity findings for the designated pollutants. The tests ensure that transportation planning efforts are not hindering efforts to bring the area into attainment of the standards or maintain attainment of the standards.

What tests are being conducted?

The first test is a comparison of projected emissions against the draft budgets for ozone precursors (volatile organic compounds (VOCs) and nitrogen oxides (NO_x)).

The second test is a comparison of projected emissions with draft budgets for PM_{2.5} and NO_x.

For all tests, projected emission levels beneath the respective budgets is considered conformance with the goals of the Clean Air Act.

What are the results of the tests?

The results of the tests, as displayed in the following Tables, are that the area’s existing plans, programs, and projects meet the conformity requirements.

Conformity Analysis Summary

8-Hour Ozone

Attainment status: 2015 8-Hour Ozone standard – marginal nonattainment area (Federal Register / Vol. 83, No. 107 / Monday, June 4, 2018)

SIP Status: Federal Register /Vol. 82, No. 4 /Friday, January 6, 2017 – direct final rule adequacy finding for Motor Vehicle Emission Simulator (MOVES) based 2008 ozone standard MVEB
 No submittals required under 2008 8-Hour ozone standard until approved budgets are received. The budgets found adequate for 2008 standard will satisfy the 2015 tests, per U.S. EPA.

8-Hour Geography: Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit Counties, OH

Conformity Tests: 2008 Standard 8-Hour budget tests

Analysis Years: 2021 Attainment and 1st Analysis year
 2030 Interim and SIP Budget year
 2040 Interim year
 2045 AMATS/ERPC Plan horizon year
 2050 NOACA Plan horizon year

8-Hour Ozone Test	2021 Emissions	2030 8-Hour Budget	2030 Emissions	2040 Emissions	2045 Emissions	2050 Emissions
AMATS	tons / day					
VOC	7.07		3.26	2.95	3.05	2.96
NOx	9.74		4.05	3.31	3.28	3.28
NOACA	tons / day					
VOC	21.88		13.22	9.02	8.66	9.20
NOx	29.01		14.75	8.95	8.74	8.29
Totals	tons / day					
VOC	28.95	30.80	16.48	11.97	11.71	12.16
NOx	38.75	43.82	18.8	12.26	12.02	11.57

8-Hour Ozone

Attainment status: 2008 8-Hour Ozone standard – maintenance area (Federal Register / Vol. 82, No. 4 /Friday, January 6, 2017)
 1997 8-Hour Ozone Standard - maintenance area (Federal Register Notice Final Rule Tuesday, September 15, 2009)

SIP Status: Federal Register /Vol. 78, No. 53 /Tuesday, March 19, 2013 – direct final rule adequacy finding for MOVES based 1997 Ozone standard MVEB
 No submittals required under 2008 8-Hour Ozone standard until approved budgets are received. The budgets found adequate for the 1997 standard will satisfy both 1997 and 2008 tests for the time being per U.S. EPA.

8-Hour Geography: Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit Counties, OH

Conformity Tests: 1997 Standard 8-Hour budget tests

Analysis Years: 2021 1st Analysis year
 2030 Interim and SIP Budget year
 2040 Interim year
 2045 AMATS/ERPC Plan horizon year
 2050 NOACA Plan horizon year

8-Hour Ozone Test	2021 Emissions	2030 8-Hour Budget	2030 Emissions	2040 Emissions	2045 Emissions	2050 Emissions
AMATS	tons / day					
VOC	7.07		3.26	2.95	3.05	2.96
NOx	9.74		4.05	3.31	3.28	3.28
NOACA	tons / day					
VOC	21.88		14.26	9.88	8.66	9.20
NOx	29.01		15.54	8.95	8.74	8.29
Ashtabula County	tons / day					
VOC	1.16		0.53	0.50	0.51	0.50
NOx	1.50		0.62	0.52	0.51	0.52
Totals	tons / day					
VOC	30.11	30.80	17.01	12.47	12.22	12.66
NOx	40.25	43.82	19.42	12.78	12.53	12.09

PM_{2.5} 2006 Standard

Attainment/ 2006 Annual PM_{2.5} Standard – maintenance area (Federal Register / Vol. 78, No. 144 / Friday, July 26, 2013)

SIP Status: Cleveland area to attainment for 1997 and 2006 PM_{2.5} Standards – FR notice included an adequacy finding for the MOVES based MVEBs

Geography: Cuyahoga, Lake, Lorain, Medina, Portage, Summit Counties, OH, and Ashtabula Township (Ashtabula County, OH)

Conformity Tests: Budget tests

Analysis Years: 2022 PM_{2.5} Budget Year
2030 Interim year
2040 Interim year
2045 AMATS/ERPC Plan horizon year
2050 NOACA Plan horizon year

PM _{2.5} Test	2022 Budget	2022 Emissions	2030 Emissions	2040 Emissions	2045 Emissions	2050 Emissions
AMATS	tons/year					
Direct PM		111.92	90.78	93.92	88.26	89.61
NOx		2,108.06	1,414.19	1,297.58	1,291.22	1,297.47
NOACA	tons/year					
Direct PM		397.13	262.18	209.93	209.24	208.49
NOx		10,447.02	4,721.64	2,988.83	2,930.40	2,891.73
Ashtabula Twp	tons/year					
Direct PM		1.9	1.53	1.61	1.5	1.53
NOx		33.8	22.78	20.88	20.77	20.7
Totals	tons/year					
Direct PM	880.89	510.95	354.49	305.46	299.0	299.63
NOx	17,263.65	12,588.88	6,158.61	4,307.29	4,242.39	4,209.9

PM_{2.5} 2012 Standard

Attainment status: 2012 Annual PM_{2.5} Standard – maintenance area (80 FR 2205 / January 14, 2015)

SIP Status: Federal Register /Vol. 83, No. 246 /Wednesday, December 26, 2018 – approval of SIP and finding in support of MOVES based 2012 standard PM_{2.5} MVEB

Geography: Cuyahoga and Lorain County, OH

Conformity Tests: 2012 SIP Maintenance Plan tests

Analysis Years: 2022 PM_{2.5} Budget year
2030 Interim year
2040 Interim year
2045 AMATS/ERPC Plan horizon year
2050 NOACA Plan horizon year

PM_{2.5} Test	2022 Budget	2022 Emissions	2030 Budget	2030 Emissions	2040 Emissions	2045 Emissions	2050 Emissions
	tons/year						
Direct PM _{2.5}	406.79	290.22	270.57	186.73	149.28	148.61	148.04
NOx	9,432.04	7,492.24	4,907.54	3,152.17	1,971.1	1,928.35	1,899.30

For additional detail on these topics, visit the following U.S. EPA websites:

<http://www.epa.gov/air/ozonepollution/> (general ozone information)

<http://www.epa.gov/ttn/naaqs/ozone/ozonetech/> (technical ozone information)

<http://www.epa.gov/air/particlepollution/fastfacts.html> (fast facts on particulate matter)

<http://www.epa.gov/air/particlepollution/basic.html> (general particulate matter information)

http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html (technical particulate matter information)

PM_{2.5} and Ozone Conformity Analyses for Transportation Plans, Programs, and Projects in the Cleveland-Akron-Lorain, Ohio Metropolitan Area

Introduction

Northeast Ohio's planning partners are reestablishing transportation conformity for the counties of Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage and Summit with the 2008 8-Hour Ozone, 2015 8-Hour Ozone, 2006 and 2012 annual PM_{2.5} (fine particulates) standards.

Because conformity is determined on a nonattainment area, rather than a sub area basis, each of the area's planning partners must approve a new conformity finding for the area based on updates to transportation plans and/or programs. The Ohio Department of Transportation (ODOT) conducts the sub-area analyses for Ashtabula County (ozone) and Ashtabula Township (PM_{2.5}) which is not part of an MPO area. NOACA conducts the analyses for the Lorain County portion of the City of Vermilion on behalf of the Erie Regional Planning Commission (ERPC).

ODOT, NOACA, and AMATS have conducted the necessary analyses to demonstrate conformity of the transportation system for the respective standards. This document describes the procedures used to establish conformity under the 8-Hour Ozone NAAQS and the fine particulate matter NAAQS.

Reestablishing Conformity for the Eight-Hour Ozone Standard

1. Conformity Analysis Interagency Consultation Process

A continuing major and important requirement of the conformity analysis process is the maintenance of an effective interagency consultation process between the federal, state, and local agencies involved in the development of transportation plans and programs. Ohio Administrative Code (OAC) section 3745-101-04 defines the consultation procedures for the state formally. In general, Ohio has chosen the "straw man" process, whereby the lead agencies in the conformity process assume responsibility for preparing and distributing draft documents, with supporting information, and assuring that each affected party involved in the conformity process is included in the consultation process.

Memoranda of Understanding exist between the nonattainment area's planning partners which facilitate these joint analyses efforts. The planning partners also communicate via phone, teleconference and e-mail in an effort to ensure a standardized analysis effort for the region.

2. Conformity Analysis Tests

The interagency consultation process resulted in the following procedures being established for this analysis:

- ◆ Volatile Organic Compounds (VOCs) and Oxides of Nitrogen (NOx) emission forecasts were generated for calendar years 2021, 2030, and 2040 for all areas;
- ◆ Resulting total emissions for the area were compared with the applicable State Implementation Plan (SIP) emission budgets. The table below displays the applicable draft SIP mobile source budgets for the Cleveland/Akron/Lorain area.

8-Hour Ozone Standard Budgets		
	(tons/day)	
	VOC	NOX
2030 Budget	30.80	43.82

3. Transportation Plan Updates and STIP/TIP Development

The Ohio Department of Transportation (ODOT) incorporates the results from the AMATS and NOACA metropolitan transportation planning processes into the Ohio STIP. This process ensures continuing consistency between the MPO and State planning efforts.

4. STIP/TIP Conformity Analysis Project Networks

The analyses for these conformity tests utilized the relevant long-range transportation plans for the NOACA and AMATS areas. ODOT included known projects from Ashtabula County in its analysis of that area. The transportation networks for the years 2021, 2030, 2040, 2045, and 2050 were analyzed.

These networks meet the conformity requirement that analysis years be no more than ten years apart, include a year from the TIP include the attainment year (where applicable), and include the final year of the area's transportation plans.

5. Latest Planning Assumptions

The planning assumptions for these analyses were arrived upon via the previously describe interagency consultation process.

Methodology

The general methodology for mobile source inventory preparation involves three steps:

- 1) Development of vehicle miles of travel (VMT) estimates for the required analysis years and transportation system networks;
- 2) Development of VOC and NOx emission factors corresponding to the required analysis years; and
- 3) Multiplication of emission factors by VMT to calculate estimated pollutant emissions from mobile sources in the required analysis years.

Vehicle Miles of Travel (VMT)

As noted previously, the nonattainment area contains three distinct planning areas. NOACA uses a 4-step model on a CUBE Voyager platform to model VMT in its five counties. AMATS and ODOT cooperatively use a travel demand model also utilizing Cube Voyager to develop VMT for Summit and Portage counties. Ashtabula County is not covered by a travel demand model. ODOT develops VMT for Ashtabula's transportation system by factoring Highway Performance Monitoring System (HPMS) counts.

The transportation networks and socio-economic data used within the models were modified to reflect year 2021, 2030, 2040, 2045, and 2050 conditions. The models use a modified four step – trip generation, trip distribution, mode choice, and assignment – process to generate VMT. Reiteration and other features improve the validity of the modeled outcomes in these high-tech models.

NOACA generates average daily VMT and then aggregates it by county for 24-hour time period. For ozone season analyses, average daily VMT is expanded by 8% to reflect the higher proportion of travel that occurs during the ozone season. AMATS/ODOT prepare VMT and associated speeds for each link within their models for each hour of the day and pair these with emission factors within the congestion mitigation/air quality (CMAQ) process they have developed. ODOT uses HPMS data to identify rural and urban portions of VMT across 12 different classes (rural interstate, rural principal arterial, rural minor arterial, rural major collector, rural minor collector, rural local, urban interstate, urban freeway/expressway, urban principal arterial, urban minor arterial, urban collector, and urban local) in preparation for pairing them with emission factors for those geographies not covered by a travel demand model.

Emission Factors

NOACA, AMATS and ODOT utilize the USEPA-developed and required MOVES2014Aa emission factor model to develop emission factors for pairing with the VMT generated in step one. USEPA and Ohio EPA provide policy and technical guidance in the preparation of input files of the model runs.

NOACA runs the MOVES2014a model separately and pairs the resulting emission factors with the VMT from its travel demand model in a programmed process. ODOT does similarly for Ashtabula County. ODOT's CMAQ process generates MOVES emission factors and pairs them with VMT

from its models in a dynamic programmed process for the AMATS area. A summary of the emissions calculated by the process is printed out at its conclusion.

Each MOVES runspec contains detailed information about the pollutants being analyzed, time frame of analysis, geographic bounds, fuel and vehicle combinations, corresponding road types, advanced fuel and technology strategies etc. Vehicle miles travelled, source type population, vehicle age distribution, ramp fractions, inspection & maintenance program information, fuel specifications data, meteorological data, average speed distribution and zone road activity are associated to corresponding runspec using the County Data Manager. While locally available data is used wherever possible, default data from MOVES database is also used for a few parameters. The table below describes the corresponding assumptions.

RunSpec Parameter Settings	
MOVES Version	MOVES2014A (November 2015)
Scale	County
MOVES Modeling Technique	Emission Factor Method Rates per Distance Rates per Vehicle
Time Span	Time Aggregation: Hour 1 Month representing average annual temperatures All hours of day selected 16 speed bins Weekdays only
Geographic Bounds	Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties
Vehicles/Equipment	All related source types, gasoline and diesel;
Road Type	All road types including off-network
Pollutants and Processes	Total Gaseous Hydrocarbons, Non-Methane Hydrocarbons, Volatile Organic Compounds, NO _x
Strategies	Alternative Vehicle Fuels and Technologies for 2021, 2030, 2040, 2045, and 2050 to offset impact of CNG
General Output	Units = grams, joules and miles
Output Emissions	Time = hour, Location = county, on-road emission rates by road type and source use type.
Advance Performance	None
County Data Manager Sources	
Source Type Population	Combination of local and default data Local BMV Vehicle Registration Total Local BMV population for motorcycle (11), moped (11), bus (41, 42,43), mobile home (54), house vehicle (54) MOVES default fractions for the rest (21, 31, 32, 51, 52, 53, 61, 62) Future year growth rate based on TFM's household growth rates
Vehicle Type VMT	Travel Demand Forecast Model's daily VMT and MOVES distance travelled by source type EPA annual VMT converter Hourly VMT fractions - ODOT Hourly Percentage

I/M Program	I/M program information supplied by Ohio EPA
Fuel Formulation	Default
Fuel Supply	Default
Meteorology Data	Local data obtained from NOAA National Climatic Data Center. Data will consist of monthly high and low temperatures and daily relative humidity for 2006.
Ramp Fraction	Travel Demand Forecast Model
Road Type Distribution	ODOT's 2006 DVMT by FC
Age Distribution	Local data supplied by ODOT from 2009 motor vehicle registration data. The same age distribution will be used for all analysis years
Average Speed Distribution	Default as a place holder
Zone Activity	Default with necessary modification as prescribed in MOVES user guide.

Temperature and Relative Humidity

Temperatures used for the single season approach are representative of 12 months in 2006 based on NOAA data from the National Climate Data Center website. The month of July was used as the representative month. Data for Cleveland Hopkins International Airport (CLE) was used for NOACA's area. Data for Akron-Canton Airport (CAK) was used for AMATS and Ashtabula Areas.

Temperature and Relative Humidity Data for NOACA portion of area

Hour	Average Temperature	Average Relative Humidity
1	66.4	74.0
2	65.3	78.0
3	64.4	79.0
4	63.8	80.0
5	63.3	81.0
6	62.8	83.0
7	62.3	82.0
8	62.7	78.0
9	65.1	72.0
10	68.9	66.0
11	72.8	61.0
12	76.1	58.0
13	79.1	56.0
14	80.7	55.0
15	81.2	53.0
16	81.4	54.0
17	81.0	54.0
18	79.9	55.0

Hour	Average Temperature	Average Relative Humidity
19	78.0	56.0
20	75.5	58.0
21	73.0	62.0
22	70.9	68.0
23	69.4	70.0
24	67.9	72.0

Temperature and Relative Humidity Data for AMATS portion of area

Hour	Average Temperature	Average Relative Humidity
1	44.90333333	76
2	43.77166667	78
3	42.8825	79
4	42.23583333	81
5	41.75083333	82
6	41.185	83
7	40.7	82
8	41.10416667	79
9	43.52916667	74
10	47.40916667	71
11	51.37	68
12	54.765	63
13	57.75583333	61
14	59.3725	58
15	59.93833333	56
16	60.1	55
17	59.69583333	57
18	58.56416667	60
19	56.62416667	65
20	54.11833333	69
21	51.6125	71
22	49.43	73
23	47.89416667	74
24	46.35833333	75

Ramp Fraction

Ramp fractions were derived using the travel demand model VHT fractions. Ramp fractions can be seen in the table below. Fractions were kept the same for all analysis years.

Ramp Fractions

County	roadTypeID	roadDesc	rampFraction
Ashtabula	2	Rural Restricted Access	0.010
	4	Urban Restricted Access	0.180
Cuyahoga	2	Rural Restricted Access	0
	4	Urban Restricted Access	0.116
Geauga	2	Rural Restricted Access	0.061
	4	Urban Restricted Access	0.061
Lake	2	Rural Restricted Access	0.092
	4	Urban Restricted Access	0.092
Lorain	2	Rural Restricted Access	0.107
	4	Urban Restricted Access	0.107
Medina	2	Rural Restricted Access	0.058
	4	Urban Restricted Access	0.058
Portage	2	Rural Restricted Access	0.010
	4	Urban Restricted Access	0.180
Summit	2	Rural Restricted Access	0.010
	4	Urban Restricted Access	0.009

Source Type Population

Source type population is based on a combination of local and MOVES default data. Local data was obtained from ODPS Bureau of Motor Vehicles Motor Vehicle Registrations by county and vehicle type. The MOVES default source type population data was obtained from the national level MOVES inventory runs for each county.

OBMV’s vehicle registration data was used as a control total for all source type population and a sub total for Intercity Bus (41), Transit Bus (42), and School Bus (43). The same data was also used to assign source type population of Motorcycle (11) and Motor Home (54). For the rest of source types 21, 31, 32, 51, 52, 53, 61 and 62, the fraction of each source type from the MOVES default data was used and adjusted to match up with the control total for source type population. We assumed a zero growth rate for each of the analysis years. Table 8 shows source type population for the analyzed counties in 2021.

Table 8 – Source Type Population for year 2021

sourceTypeID	sourceTypeName	Cuyahoga	Geauga	Lake	Lorain	Medina
11	Motorcycle	28165	4654	8238	11834	9250
21	Passenger Car	530903	59762	120853	159200	114580
31	Passenger Truck	368044	42273	79826	105746	78596
32	Light Commercial Truck	122956	14123	26668	35328	26257
41	Intercity Bus	405	16	66	34	21
42	Transit Bus	217	9	37	19	12
43	School Bus	2766	112	455	236	148
51	Refuse truck	284	55	73	98	94
52	Single Unit Short-haul Truck	17844	3160	4173	5624	5362
53	Single Unit Long-haul Truck	2130	341	451	608	579

54	Motor Home	4597	1640	2140	4779	3425
61	Comb Short-haul Truck	3641	588	1078	1192	1770
62	Comb Long-haul Truck	4154	633	1161	1285	1907

I/M Program

I/M program information was supplied by Ohio EPA. The I/M program was applied to all analysis years for every geography with the exception of Ashtabula County. The I/M program MOVES inputs reflect:

- 1) ASM 2525 Phase-in Cutpoints, for model years up to 1995
- 2) Evaporative Gas Cap Check, for model years up to 1995
- 3) Evaporative System OBD Check, for model years 1996 & newer
- 4) Exhaust OBD Check, for model years 1996 & newer

The compliance rate and failure rates are obtained from Ohio EPA and compliance factors are calculated. These are applied to Cuyahoga, Geauga, Lake, Lorain, Medina, Portage and Summit counties and for all model years.

Sample IM File

polProcessID	stateID	countyID	yearID	sourceTypeID	fuelTypeID	IMProgramID
101	99	99018	2021	21	1	4
inspectFreq	testStandardsID	begModelYearID	endModelYearID	useIMyn	complianceFactor	
2	43	1996	2022	Y	98.5036	

Vehicle Age Distribution

Vehicle age distribution information was derived using ODPS vehicle registration data (2009). The data was given to OEPA who supplied a VIN decoder that allowed ODOT to create correctly formatted MOVES inputs. A different age distribution file is used for each county. The distributions for other areas can be found in the electronic input submittals. The same age distributions were used for all analysis years.

Sample Age Distribution for Motorcycles in Lorain County

yearid	sourcetypeid	ageid	ageFraction
2040	11	0	0.000995272
2040	11	1	0.021249067
2040	11	2	0.045732769
2040	11	3	0.070913162
2040	11	4	0.082259268
2040	11	5	0.073052998
2040	11	6	0.069619308
2040	11	7	0.073152526
2040	11	8	0.058422493
2040	11	9	0.053894003
2040	11	10	0.045085842

yearid	sourcetypeid	ageid	ageFraction
2040	11	11	0.037671062
2040	11	12	0.027817865
2040	11	13	0.021249067
2040	11	14	0.021199303
2040	11	15	0.020303558
2040	11	16	0.014630505
2040	11	17	0.01263996
2040	11	18	0.009056979
2040	11	19	0.007464543
2040	11	20	0.008061707
2040	11	21	0.007812889
2040	11	22	0.007862652
2040	11	23	0.010699179
2040	11	24	0.015078378
2040	11	25	0.014680269
2040	11	26	0.012241851
2040	11	27	0.016023887
2040	11	28	0.021945758
2040	11	29	0.016471759
2040	11	30	0.102712117

Road Type Distribution

Road type distribution is based on the ODOT’s 2006 daily vehicle miles of travel (DVMT) by functional classification (FC). These inputs vary by county. A sample road type distribution input for Cuyahoga County can be seen in Table below. Cuyahoga County does not contain rural road types 2 and 3.

Road Type Distribution for Lorain County

sourceType	roadType	roadTypeVMTFra
11	1	0
11	2	0.02262
11	3	0.10778
11	4	0.32177
11	5	0.54783
21	1	0
21	2	0.02262
21	3	0.10778

sourceType	roadType	roadTypeVMTFra
21	4	0.32177
21	5	0.54783
31	1	0
31	2	0.02262
31	3	0.10778
31	4	0.32177
31	5	0.54783
32	1	0

sourceType	roadType	roadTypeVMTFra
32	2	0.02262
32	3	0.10778
32	4	0.32177
32	5	0.54783
41	1	0
41	2	0.02262
41	3	0.10778
41	4	0.32177
41	5	0.54783
42	1	0
42	2	0.02262
42	3	0.10778
42	4	0.32177
42	5	0.54783
43	1	0
43	2	0.02262
43	3	0.10778
43	4	0.32177
43	5	0.54783
51	1	0
51	2	0.02262
51	3	0.10778
51	4	0.32177
51	5	0.54783
52	1	0

sourceType	roadType	roadTypeVMTFra
52	2	0.02262
52	3	0.10778
52	4	0.32177
52	5	0.54783
53	1	0
53	2	0.02262
53	3	0.10778
53	4	0.32177
53	5	0.54783
54	1	0
54	2	0.02262
54	3	0.10778
54	4	0.32177
54	5	0.54783
61	1	0
61	2	0.02262
61	3	0.10778
61	4	0.32177
61	5	0.54783
62	1	0
62	2	0.02262
62	3	0.10778
62	4	0.32177
62	5	0.54783

Vehicle Type VMT and VMT Fractions

VMT by MOVES vehicle types is subdivided into four sections namely HPMS base year VMT, monthly VMT fractions, daily VMT fractions and hourly VMT fractions. For NOACA's counties, HPMS base year VMT was derived by using the converter tool, U.S.EPA's AADVMT Calculator_HPMS.xls. The converter takes average annual daily VMT (AADVMT) and generates MOVES input data based on default factors. AADVMT is computed by using total daily VMT obtained from travel demand model and fractioning it with the MOVES default distance travelled by each source type to generate vehicle type VMTs. The same method was used to generate data for other analysis years.

ODOT uses weigh in motion (WIM) data to develop inputs for the counties it models. The inputs for each geographic area can be seen in the supplied input files. Sample HPMS VMT for 2021 is provided in table below.

Table 11 – Yearly HPMS VMT for 2021

HPMS VType ID	Cuyahoga	Geauga	Lake	Lorain	Medina
10	1,012,351	89,014	198,026	260,644	202,571
25	9,387,589,850	825,436,295	1,836,309,017	2,416,966,215	1,878,453,346
40	53,499,168	4,704,099	10,464,987	13,774,109	10,705,164
50	333,108,027	29,289,675	65,159,352	85,763,317	66,654,796
60	318,976,171	28,047,083	62,395,016	82,124,874	63,827,017

Output Emission Factors

The table below shows a record in a MOVES sample output (rate per distance) emission file for year 2021. For any given month, day of week, hour of the day, pollutant, and process; the rate per distance varies by road type, and speed bin. Rates per distance emissions are applied to link and intrazonal VMT.

Sample Emission File (Rate per Distance) for year 2021

Heading:	MOVESscenarioID	MOVESRunID	yearID	monthID	dayID	hourID
Record:	Lorain	1	2021	7	5	1
Heading:	linkID	pollutantID	processID	sourceTypeID	SCC	fuelTypeID
Record:	390930201	1	1	21		0
Heading:	modelYearID	roadTypeID	avgSpeedBinID	temperature	relHumidity	ratePerDistance
Record:	0	2	1	66.4383	74	0.17934

The table below shows a record in a MOVES sample output (rate per vehicle) emission file for year 2021. The rate per vehicle varies for any combinations of month, day of week, hour of the day, pollutant, and process. Rates per vehicle emissions are applied to the vehicle source type population.

Sample Emission File (Rate per Vehicle) for year 2021

Heading:	MOVESscenarioID	MOVESRunID	yearID	monthID	dayID
Record:	Lorain	1	2021	7	5
Heading:	hourID	zoneID	pollutantID	processID	sourceTypeID
Record:	1	390930	87	2	54
Heading:	SCC	fuelTypeID	modelYearID	temperature	ratePerVehicle
Record:		0	0	67.8708	0.034378

The table below shows a record in a MOVES sample output (rate per profile) emission file for year 2021. The rate per vehicle varies for any combinations of month, day of week, hour of the day, pollutant, and process. Rates per vehicle emissions are applied to the vehicle source type population.

Sample Emission File (Rate per Profile) for year 2021

Heading:	MOVESscenarioID	MOVESRunID	yearID	temperatureprofileID	dayID
Record:	Lorain	1	2021	3909300700	5
Heading:	hourID	pollutantID	processID	sourceTypeID	SCC
Record:	1	79	12	61	
Heading:	fuelTypeID	modelYearID	temperature	ratePerVehicle	
Record:	0	0	67.8708	0.00000636262	

Emissions

Total emissions were computed with the aid of several custom programs designed and developed by ODOT. The process uses data on daily and directional traffic distributions as well as more up to date volume/delay functions from the 2000 Highway Capacity Manual (HCM). This process, illustrated in the figure below, also uses rewritten code able to handle the newer model network formats and MOVES generated emission factors. Emissions computation was automated using CUBE scripts which use the link VMT, intrazonal VMT and trips, source type population, emissions factors, and execute the FORTRAN based programs in background.

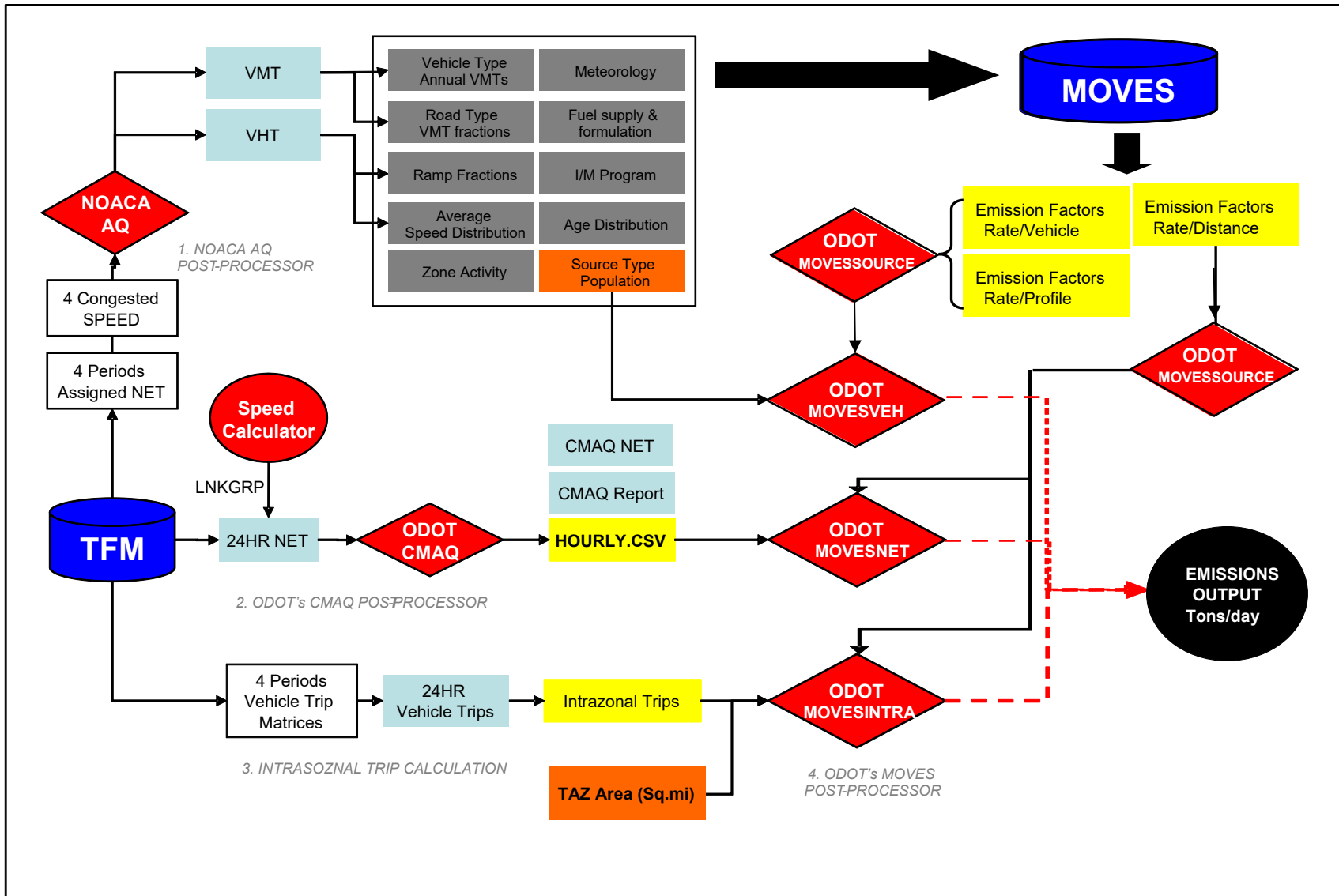


Figure 4 – Emission Calculation Process

6. Timely Implementation of TCMs

Until adoption of a new SIP for the eight-hour ozone standard there are no active TCM requirements.

7. Urban Travel Demand Modeling

NOACA maintains a PC-based regional travel demand forecasting model on a CUBE Voyager platform for use in its urban transportation planning process. This model employs the traditional four step modeling process to project existing and future traffic volumes and travel patterns on the regional transportation networks. The four step process consists of trip generation, trip distribution, mode split, and route assignment. Output from the model is link-by-link directional for peak and off peak periods and is converted to 24-hour traffic volumes for the existing or future regional transportation networks.

The Ohio Department of Transportation (ODOT) holds the transportation model for the AMATS area. AMATS prepares and submits networks for its planning area to ODOT. ODOT prepares networks for Ashtabula County. ODOT's modeling is conducted in Cube Voyager as well.

Travel demand models are uniquely suited to perform the emission analyses required by the final conformity rule. The modeling process identifies growth in vehicle miles of travel and changes in regional travel patterns resulting from the projects that are proposed in the area's transportation plans and programs.

8. Air Quality Area Geography not Covered by an Urban Model

All urbanized portions of the Cleveland/Akron/Lorain area are covered by a transportation model. Emissions for Ashtabula County, a rural portion of the area, are generated by ODOT using HPMS based non-model procedures.

9. Off Model Emission Reduction Credits

The current conformity analyses for the Cleveland/Akron/Lorain area do not utilize emission reduction credits from any transportation improvements that cannot be captured in the urban modeling process. Ohio defines this type of emission reduction as an "off model" credit.

Projects funded through the Congestion Mitigation and Air Quality (CMAQ) Program are an example of the type of projects that generate off model credits. Typical CMAQ projects are park and ride lots, Compressed Natural Gas (CNG) bus conversions, and traffic flow operational improvements.

10. MPO TIP Conformity Analysis Geographic Coverage Issues

The Cleveland/Akron/Lorain area's geographic coverage issue is the presence of three metropolitan planning organizations, AMATS, NOACA, and the Erie Regional Planning Commission (representing the Lorain County portion of the City of Vermilion) in the urban airshed, as well as a county, Ashtabula, which is not part of either MPO. As a result, NOACA, AMATS and ODOT,

which is responsible for transportation planning in Ashtabula County, perform conformity analyses for their respective portions of the area. NOACA also conducts the modeling and analyses for the Lorain County portion of the City of Vermilion for the Erie Regional Planning Commission. The results of these analyses are then combined to make a conformity determination for the area as federally required.

11. Non-Federal Projects

The Cleveland/Akron/Lorain area periodically contains regionally significant projects that are not federally funded. These projects are generally associated with the Ohio Turnpike. The air quality impacts of these projects (VMT, traffic redistribution, emissions) are also accounted for in the conformity analyses for this area.

12. Public Involvement

Public involvement for this conformity action was conducted in keeping with the public involvement policies of the participating MPOs and ODOT.

13. Rural County Conformity Demonstrations: Ashtabula County

Ashtabula County is a rural county in the northeastern corner of Ohio. The 1990 Clean Air Act Amendments included Ashtabula County in the eight county Cleveland/Akron/Lorain airshed. The Intermodal Surface Transportation Efficiency Act of 1991 required entire nonattainment areas to be included in a Metropolitan Planning Organization “except as otherwise provided by agreement between the MPO and Governor.” Ashtabula was not in an MPO area, while the other seven nonattainment area counties were included in either the Cleveland or Akron MPO. In September 1993, at the request of Ashtabula County, an agreement was executed between the county, the Cleveland and Akron MPOs, OEPA, and ODOT (as the Governor’s representative) exempting Ashtabula County from the Federal 3-C urban transportation planning process requirements (the MPO requirement). This agreement also established an interagency consultation process that is used to meet the transportation conformity requirements for the entire area. The Agreement provides for ODOT to conduct the conformity analysis for the Ashtabula County portion of the area while the Cleveland and Akron MPOs conduct analyses for their respective portions of the area. Following these individual efforts, the agencies combine the data to generate one conformity analysis for the entire area. While Ashtabula County was not included in the ozone nonattainment area for the 2015 NAAQS, it is still included in this conformity determination as part of the 2008 NAAQS maintenance area.

14. Ozone Conformity Demonstration

The tables below display the individual and aggregate emission estimates for the Ashtabula County, AMATS, and NOACA areas. A demonstration of conformity is achieved when the aggregate emissions for the area in each analysis year are less than the 2030 mobile source budget contained in the State Implementation Plan submittal. As demonstrated by the totals, the Cleveland/Akron/Lorain area meets this test.

8-Hour Ozone

Attainment status: 2015 8-Hour Ozone standard – marginal nonattainment area (Federal Register / Vol. 83, No. 107 / Monday, June 4, 2018)

SIP Status: Federal Register /Vol. 82, No. 4 /Friday, January 6, 2017 – direct final rule adequacy finding for Motor Vehicle Emission Simulator (MOVES) based 2008 ozone standard MVEB
No submittals required under 2008 8-Hour ozone standard until approved budgets are received. The budgets found adequate for 2008 standard will satisfy the 2015 tests, per U.S. EPA.

8-Hour Geography: Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit Counties, OH

Conformity Tests: 2008 Standard 8-Hour budget tests

Analysis Years: 2021 Attainment and 1st Analysis year
2030 Interim and SIP Budget year
2040 Interim year
2045 AMATS/ERPC Plan horizon year
2050 NOACA Plan horizon year

8-Hour Ozone Test	2021 Emissions	2030 8-Hour Budget	2030 Emissions	2040 Emissions	2045 Emissions	2050 Emissions
AMATS	tons / day					
VOC	9.11		4.22	3.76		
NOx	12.21		5.29	4.21		
NOACA	tons / day					
VOC	16.20		9.77	6.58		
NOx	22.13		10.90	7.47		
Totals	tons / day					
VOC	25.31	30.80	13.98	10.35		
NOx	34.34	43.82	16.19	11.68		

8-Hour Ozone

Attainment status: 2008 8-Hour Ozone standard – maintenance area (Federal Register / Vol. 82, No. 4 /Friday, January 6, 2017)
1997 8-Hour Ozone Standard - maintenance area (Federal Register Notice Final Rule Tuesday, September 15, 2009)

SIP Status: Federal Register /Vol. 78, No. 53 /Tuesday, March 19, 2013 – direct final rule adequacy finding for MOVES based 1997 Ozone standard MVEB
No submittals required under 2008 8-Hour Ozone standard until approved budgets are received. The budgets found adequate for the 1997 standard will satisfy both 1997 and 2008 tests for the time being per U.S. EPA.

8-Hour Geography: Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit Counties, OH

Conformity Tests: 1997 Standard 8-Hour budget tests

Analysis Years: 2021 1st Analysis year
 2030 Interim and SIP Budget year
 2040 Interim year
 2045 AMATS/ERPC Plan horizon year
 2050 NOACA Plan horizon year

8-Hour Ozone Test	2021 Emissions	2030 8-Hour Budget	2030 Emissions	2040 Emissions	2045 Emissions	2050 Emissions
AMATS	tons / day					
VOC	9.11		4.22	3.76		
NOx	12.21		5.29	4.21		
NOACA	tons / day					
VOC	16.20		9.77	6.58		
NOx	22.13		10.90	7.47		
Ashtabula County	tons / day					
VOC	16.20		9.77	6.58		
NOx	22.13		10.90	7.47		
Totals	tons / day					
VOC	25.31	30.80	13.98	10.35		
NOx	34.34	43.82	16.19	11.68		

15. Final Ozone Conformity Determination

Based upon the process and procedures described above, the Cleveland/Akron/Lorain area has re-established conformity for the long-range range transportation plans and TIPs in that area with the 8-Hour Ozone NAAQs. The conformity determination analyses for these documents were conducted consistent with the *Criteria and Procedures for Determining Conformity to State or Federal Implementation Plans of Transportation Plans, Programs and Projects Funded or Approved Under Title 23 U.S.C. or the Federal Transit Act*, 40 CFR Parts 51 and 93, issued November 24, 1993 and the *Ohio State Transportation Conformity Rules, Ohio Administration Code Part 3745-101-01 through 20*, issued August 21, 1995, and subsequent amendments thereof. **Accordingly, the State of Ohio requests U.S. DOT conformity determinations for the referenced analyses.**

Reestablishing Conformity For The Fine Particles Standard

1. Conformity Analysis Interagency Consultation Process

See discussion under ozone analyses above.

2. Conformity Analysis Tests

The interagency consultation process resulted in the following procedures being established for this analysis:

- Annual emissions of direct PM_{2.5} and Oxides of Nitrogen (NO_x) were generated for calendar years 2022, 2030, 2040, 2045, and 2050 for all areas;
- Resulting total emissions for the area were compared with budgets for the 1997 and 2012 annual fine particle NAAQS;
- Emissions for the daily standard are reported on an annual basis to make them consistent with the annual form of the draft budget;
- The table below displays the draft emissions budgets for the Cleveland/Akron/Lorain fine particulates maintenance area for the 2006 NAAQS and the nonattainment area for the 2012 NAAQS.

PM_{2.5} Budgets – 2006 NAAQS		
	Total (tons/year)	
	PM_{2.5}	NO_x
2022 Budget	880.89	17,263.65

PM_{2.5} Budgets – 2012 NAAQS (Cuyahoga & Lorain Counties)		
	Total (tons/year)	
	PM_{2.5}	NO_x
2022 Budget	406.79	9,432.04
2030 Budget	270.57	4,907.54

3. Transportation Plan Updates and STIP/TIP Development

See discussion under ozone analyses above.

4. STIP/TIP Conformity Analysis Project Networks

The analyses for these conformity tests utilized the updated transportation plans for the NOACA

and AMATS areas. ODOT included known projects from Ashtabula County in its analysis of that area. The transportation networks for the years 2022, 2030, 2040, 2045, and 2050 were analyzed.

These networks meet the conformity requirement that analysis years be no more than ten years apart, include the attainment year (where applicable), and include the final year of the area's transportation plans.

5. Latest Planning Assumptions

See discussion under ozone analyses above for issues relevant to both ozone and fine particulate analyses. Differences between the ozone and fine particulates analyses are discussed below.

The transportation networks and socio-economic data used within the models were modified to reflect year 2022, 2030, 2040, 2045, and 2050 conditions. VMT expansion is not performed during PM_{2.5} analysis.

Emission Factors

The analyses for fine particulates (PM2.5) are different from those prepared for the ozone standard. For fine particulates, the planning partners generate annual rather than daily emission estimates. Regulations require annual estimates because the area's nonattainment status is tied to annual rather than daily levels of PM2.5. Consultation among the partners regarding how to model annual emissions resulted in the MOVES input decisions. Differences between ozone and fine particles meteorology inputs are outlined below.

Temperature and Relative Humidity

Temperatures used for the single season approach are representative of 12 months in 2005 based on NOAA data from the National Climate Data Center website. The month of April was used as the representative month.

Temperature and Relative Humidity Data for NOACA portion of area

Hour	Average Temperature	Average Relative Humidity
1	42.1	68.0
2	41.0	73.0
3	40.1	75.0
4	39.4	76.0
5	39.0	76.0
6	38.4	77.0
7	37.9	70.0
8	38.3	68.0
9	40.7	63.0
10	44.6	58.0
11	48.6	58.0
12	52.0	56.0
13	55.0	53.0
14	56.6	54.0
15	57.1	52.0
16	57.3	52.0
17	56.9	52.0
18	55.8	52.0
19	53.8	53.0
20	51.3	56.0
21	48.8	57.0
22	46.6	61.0
23	45.1	64.0
24	43.6	66.0

Temperature and Relative Humidity Data for AMATS portion of area

Hour	Average Temperature	Average Relative Humidity
1	44.9033	76
2	43.7717	78
3	42.8825	79
4	42.2358	81
5	41.7508	82
6	41.1850	83
7	40.7000	82
8	41.1042	79
9	43.5292	74
10	47.4092	71
11	51.3700	68
12	54.7650	63
13	57.7558	61
14	59.3725	58
15	59.9383	56
16	60.1000	55
17	59.6958	57
18	58.5642	60
19	56.6242	65
20	54.1183	69
21	51.6125	71
22	49.4300	73
23	47.8942	74
24	46.3583	75

In addition, the MOVES default fuel formulations for the month of April are different compared to the month of July.

Emissions

Once the previously discussed modeling efforts have been completed, the vehicle miles of travel (VMT) from each area’s modeling process is multiplied by its associated emission factors to generate an estimate of emissions for each evaluated calendar year. In keeping with past practice, gram/year emissions were converted to tons/year for purposes of reporting.

6. Timely Implementation of TCMs

Until adoption of a SIP for the fine particles standard there are no active TCM requirements.

7. Urban Travel Demand Modeling

See discussion under ozone analyses above.

8. Air Quality Area Geography not Covered by an Urban Model

See discussion under ozone analyses above.

9. Off-Model Emission Reduction Credits

See discussion under ozone analyses above.

10. MPO TIP Conformity Analysis Geographic Coverage Issues

See discussion under ozone analyses above.

11. Non-Federal Projects

See discussion under ozone analyses above.

12. Public Involvement

See discussion under ozone analyses above.

13. Rural County Conformity Demonstrations: Ashtabula County

See discussion under ozone analyses above.

14. Fine Particles Conformity Demonstration

The tables below display the individual and aggregate emission estimates for the Ashtabula County, AMATS, and NOACA areas.

Using this test, a demonstration of conformity is achieved when aggregate emissions for the area in each analysis year are less than the mobile source emissions budgets for the area. As demonstrated by the totals, the Cleveland/Akron/Lorain area meets this test.

PM_{2.5} 2006 Standard

Attainment/ 2006 Annual PM_{2.5} Standard – maintenance area (Federal Register / Vol. 78, No. 144 / Friday, July 26, 2013)

SIP Status: Cleveland area to attainment for 1997 and 2006 PM_{2.5} Standards – FR notice included an adequacy finding for the MOVES based MVEBs

Geography: Cuyahoga, Lake, Lorain, Medina, Portage, Summit Counties, OH, and Ashtabula Township (Ashtabula County, OH)

Conformity Tests: Budget tests

Analysis Years: 2022 PM_{2.5} Budget Year
2030 Interim year
2040 Interim year
2045 AMATS/ERPC Plan horizon year
2050 NOACA Plan horizon year

PM _{2.5} Test	2022 Emissions	2030 8-Hour Budget	2030 Emissions	2040 Emissions	2045 Emissions	2050 Emissions
AMATS	tons / day					
VOC	9.11		4.22	3.76		
NOx	12.21		5.29	4.21		
NOACA	tons / day					
VOC	16.20		9.77	6.58		
NOx	22.13		10.90	7.47		
Ashtabula Twp.	tons / day					
VOC	16.20		9.77	6.58		
NOx	22.13		10.90	7.47		
Totals	tons / day					
VOC	25.31	30.80	13.98	10.35		
NOx	34.34	43.82	16.19	11.68		

PM_{2.5} 2012 Standard

Attainment status: 2012 Annual PM_{2.5} Standard – maintenance area (80 FR 2205 / January 14, 2015)

SIP Status: Federal Register /Vol. 83, No. 246 /Wednesday, December 26, 2018 – approval of SIP and finding in support of MOVES based 2012 standard PM_{2.5} MVEB

Geography: Cuyahoga and Lorain County, OH

Conformity Tests: 2012 SIP Maintenance Plan tests

Analysis Years: 2022 PM_{2.5} Budget year
2030 Interim year
2040 Interim year
2045 AMATS/ERPC Plan horizon year
2050 NOACA Plan horizon year

PM_{2.5} Test	2022 Budget	2022 Emissions	2030 Budget	2030 Emissions	2040 Emissions
Direct PM _{2.5}	406.79	243.93	270.57	192.28	162.50
NO _x	9,432.04	7,093.52	4,907.54	3,721.28	2,561.28

For additional detail on these topics, visit the following U.S.EPA websites:

<http://www.epa.gov/air/ozonepollution/> (general ozone information)

<http://www.epa.gov/ttn/naaqs/ozone/ozonetech/> (technical ozone information)

<http://www.epa.gov/air/particlepollution/fastfacts.html> (fast facts on particulate matter)

<http://www.epa.gov/air/particlepollution/basic.html> (general particulate matter information)

http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html (technical particulate matter information)

15. Final Fine Particles Conformity Determination

Based upon the process and procedures described above, the Cleveland/Akron/Lorain area has re-established conformity for the long-range range transportation plans and TIPs in that area with the fine particles NAAQs. The conformity determination analyses for these documents were conducted consistent with the *Criteria and Procedures for Determining Conformity to State or Federal Implementation Plans of Transportation Plans, Programs and Projects Funded or Approved Under Title 23 U.S.C. or the Federal Transit Act*, 40 CFR Parts 51 and 93, issued November 24, 1993 and the *Ohio State Transportation Conformity Rules, Ohio Administration Code Part 3745-101-01 through 20*, issued August 21, 1995, and subsequent amendments thereof. **Accordingly, the State of Ohio requests U.S. DOT conformity determinations for the referenced analyses.**

Attachment 1: NOACA, AMATS, and Erie Regional Planning Commission Governing Board Resolutions

Attachment 2: Interagency Consultation