Addendum to the Request for Redesignation to Attainment for the 2015 Ozone National Ambient Air Quality Standard and Revision to Michigan's State Implementation Plan and Ozone Maintenance Plan for Southeast Michigan Ozone Nonattainment Area

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1. Introduction

This State Implementation Plan (SIP) submittal is an addendum to Michigan's Request for Redesignation to Attainment for the 2015 Ozone National Ambient Air Quality Standard and Revision to Michigan's State Implementation Plan and Ozone Maintenance Plan for Southeast Michigan Ozone Nonattainment Area (Request for Redesignation). The Request for Redesignation was submitted to the United States Environmental Protection Agency (USEPA) on January 3, 2022. The USEPA acted on the Request for Redesignation on May 19, 2023. However, based on events that have occurred since that time, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) requests the USEPA reconsider the Request for Redesignation for the southeast Michigan nonattainment area (NAA). Below is a list of items included in this submittal to supplement the original Request for Redesignation for the USEPA's consideration.

- Southeast Michigan air monitoring data including ozone 8-hour average, design value (DV), and completeness for 2020 through 2025;
- An update to how Michigan is conforming to the federal Clean Air Act (CAA) Section 182(b) requirements;
- A revision of the maintenance year to 2040;
- An updated on-road inventory for the attainment year (2019) and interim year (2035) using MOVES5;
- An updated Motor Vehicle Emission Budget (MVEBs) for 2035 and 2040.

2. Background

On October 1, 2015, the USEPA promulgated a revised National Ambient Air Quality Standard (NAAQS) for ozone (the 2015 ozone NAAQS). The 2015 ozone NAAQS was revised to an 8-hour standard of 0.070 parts per million (throughout this document, the 2015 ozone NAAQS will be expressed as 70 parts per billion [ppb]).

The USEPA made initial attainment/unclassifiable designations for the 2015 ozone NAAQS for the State of Michigan on November 16, 2017 (82 *Federal Register* [FR] 54232), and made corrections to those designations on October 16, 2018 (83 FR 52157). On June 4, 2018 (83 FR 25776) the USEPA made the final designations and classifications for Michigan, including designating the following seven southeast Michigan counties as marginal nonattainment, effective August 3, 2018: Wayne, Oakland, Macomb, Washtenaw, St. Clair, Livingston, and Monroe (southeast Michigan).

The southeast Michigan counties were designated marginal nonattainment based on air monitoring data from the 2014 through 2016 ozone seasons. Monitors with a 3-year DV for 2014-2016 above 70 ppb were Port Huron (26-147-0005) 73 ppb, New Haven (26-099-0009) 72 ppb, and Detroit East 7 Mile (26-163-0019) 72 ppb.

Section 107(d)(3)(E) of the CAA allows states to request the redesignation of NAAs to attainment provided certain criteria are met. In addition, Title 40 of the Code of Federal

Regulations (CFR), Part 51, Requirements for Preparation, Adoption, and Submittal of Implementation Plans, contains requirements for SIP revisions.

On January 3, 2022, EGLE submitted a SIP revision request to the USEPA entitled, *Request for Redesignation to Attainment for the 2015 Ozone National Ambient Air Quality Standard and Revision to Michigan's State Implementation Plan and Ozone Maintenance Plan for Southeast Michigan Ozone Nonattainment Area* (2022 Redesignation Request). Southeast Michigan failed to attain the 2015 ozone NAAQS by August 3, 2021, and therefore was reclassified to moderate nonattainment on March 1, 2023 (88 FR 6633). On May 19, 2023, (88 FR 32594) the USEPA finalized a clean data determination and redesignated southeast Michigan to attainment of the 2015 ozone NAAQS (88 FR 32584 and 88 FR 32594).

On July 17, 2023, the Sierra Club filed a petition for review of the USEPA's redesignation of southeast Michigan for the 2015 ozone NAAQS. On December 5, 2025, the U.S. Court of Appeals for the Sixth Circuit provided its opinion, which became effective on February 24, 2026, returning the 7-county area of southeast Michigan to "moderate nonattainment" designation.

As stated above, Section 107(d)(3)(E) of the federal CAA allows states to request the redesignation of NAAs to attainment provided certain criteria are met. The State of Michigan, through EGLE, is asking the USEPA to reconsider EGLE's 2022 Redesignation Request and is providing this addendum to demonstrate the area continues to meet the requirements for redesignation, including the ongoing attainment of the 2015 ozone NAAQS. Therefore, EGLE requests the USEPA make a determination that the southeast Michigan area continues to attain the 2015 ozone NAAQS and formally redesignate the area from nonattainment to attainment. EGLE also requests the USEPA approve the CAA Section 175A maintenance plan and emissions inventories included in this document as a revision to the Michigan SIP. In addition, EGLE requests approval of the MVEB for the southeast Michigan counties, included in this document for the duration of the maintenance period.

3. CAA Section 107(d)(3)(E) – Continued Attainment of the NAAQS

3.1 Attainment of the NAAQS

CAA Section 107(d)(3)(E)(i) requires three complete, consecutive calendar years of quality-assured air quality monitoring data to demonstrate attainment. This section addresses monitoring updates extending the data covered in EGLE's previously submitted 2022 Redesignation Request. The data extension in this section addresses the years 2020 through 2025 and meets the consecutive year requirement. Quality assurance is addressed more thoroughly in Subsection 3.2 below.

Ozone monitoring data were collected at the seven ozone monitoring sites within the southeast Michigan NAA for the consecutive years of 2020 through 2025. Table 1 provides the highest four daily maximum 8-hour average values collected in 2020

through 2025 for all seven sites, along with the 2022 through 2025 DVs. These values were obtained during the ozone season, which runs March 1 through October 31 in Michigan each year. Table 1 also lists the percentage of days (% Days) during the ozone season that data was obtained from these sites, demonstrating completeness.

Table 1 includes adjusted values for the Detroit – East 7 Mile site resulting from the Exceptional Event (EE) demonstration submittal that EGLE submitted in January of 2023, which has been concurred on by the USEPA at the time of this submittal. This EE demonstration excluded daily maximum 8-hour average ozone concentrations on June 24 and June 25, 2022, due to demonstrated impacts from wildfire smoke entering the region from Canada. This resulted in a lowering of the 2022 4th high daily maximum 8-hour average utilized to calculate the 2023 and 2024 DVs.

Table 1. Southeast Michigan Air Monitoring Sites, Ozone 8-Hour Average, DV, and Completeness for 2020 Through 2025.

Site Name	Site ID	Year	% Days	1st High	2nd High	3rd High	4th High	2020-2022 DV	2021-2023 DV	2022-2024 DV	2023-2025 DV
Allen Park	26-163-0001	2020	93	73	71	70	70	70	70	71	69
		2021	95	73	71	70	69				
		2022	99	75	72	72	71				
		2023	84	82	79	73	72				
		2024	85	76	75	72	70				
		2025	89	88	67	67	67				
Detroit-E. 7 Mile	26-163-0019	2020	97	76	75	74	73	69	71	71	72
		2021	99	71	71	70	69				
		2022	94	75	71	70	67				
		2023	98	86	85	80	79				
		2024	99	72	71	69	68				
		2025	98	88	73	71	70				
New Haven	26-099-0009	2020	100	78	76	75	74	69	68	69	69
		2021	99	75	74	73	68				
		2022	99	78	70	69	66				
		2023	98	81	80	79	72				
		2024	100	75	74	71	70				
		2025	96	78	69	69	66				
Oak Park	26-125-0001	2020	98	78	77	76	74	69	69	69	71
		2021	98	71	70	69	68				
		2022	99	70	68	67	65				
		2023	95	89	79	78	75				
		2024	100	71	69	69	69				
		2025	98	92	78	71	70				
Port Huron	26-147-0005	2020	100	72	70	70	69	69	70	69	71
		2021	99	82	76	73	72				
		2022	98	80	77	69	66				
		2023	98	80	79	75	74				
		2024	96	72	71	70	68				
		2025	99	84	76	73	72				

Site Name	Site ID	Year	% Days	1st High	2nd High	3rd High	4th High	2020-2022 DV	2021-2023 DV	2022-2024 DV	2023-2025 DV
Warren	26-099-1003	2020	100	77	71	70	70	68	69	69	70
		2021	99	71	68	68	67				
		2022	99	73	70	68	68				
		2023	95	84	79	76	73				
		2024	99	70	68	67	67				
		2025	97	92	74	71	70				
Ypsilanti	26-161-0009	2020	99	74	76	72	72	68	68	68	69
		2021	99	70	68	66	66				
		2022	99	71	68	68	67				
		2023	98	87	79	77	73				
		2024	99	66	64	64	64				
		2025	89	80	73	71	70				

At the time that this document was created, four monitoring sites had DVs above the 70 ppb 2015 ozone NAAQS, however the air quality in southeast Michigan had been impacted by smoke entering the region from wildfires in Canada during 2023 and 2025. Due to this influence, EGLE has completed additional EE demonstrations for southeast Michigan. In February 2026, EGLE submitted to the USEPA an EE demonstration regarding impacts to the Allen Park and Detroit – East 7 Mile monitoring sites. Additionally, another EE demonstration submittal for the Oak Park and Port Huron monitoring sites was developed, and at the time of creation of this document was released for public comment. EGLE will consider and address any comments received regarding the pending EE demonstration and, if appropriate, intends to submit it to the USEPA in April of 2026.

If the USEPA concurs with the EE demonstrations, the data from the Allen Park, Detroit – East 7 Mile, Oak Park, and Port Huron monitoring sites for the impacted days will be excluded from ozone season calculations for southeast Michigan 2023 through 2025 DVs. With the exclusion of the data the DVs will be at or below the 2015 ozone NAAQS and EGLE will continue to pursue redesignation.

Table 2 presents the 2021 through 2025 4th high daily maximum 8-hour average ozone concentrations and the DVs prior to and after EE concurrence by the USEPA. The table highlights and bolds the 4th high daily maximum 8-hour averages that will be changed following concurrence of the associated EE demonstration. Following the USEPA's concurrence of these EE dates, the southeast Michigan NAA will be eligible for redesignation to attainment of the 2015 ozone NAAQS.

Table 2. 2021 through 2025 4th high daily maximum 8-hour average ozone concentrations and the 2023 to 2025 DVs for the Allen Park, Detroit-E 7 Mile, Oak Park, and Port Huron monitors prior to and after EE concurrence.

Site Name	Site ID	2021 4th High	2022 4th High	2023 4th High	2024 4th High	2025 4th High	2023 DV	2024 DV	2025 DV	EE Status
Allen Park	26-163-0001	69	71	72	70	67	70	71	69	Prior to EE concurrence
		69	71	**69**	70	67	69	70	68	After EE concurrence
Detroit-E. 7 Mile	26-163-0019	69	67	79	68	70	71	71	72	Prior to EE concurrence
		69	67	**71**	68	70	69	68	69	After EE concurrence
Oak Park	26-125-0001	68	65	75	69	70	69	69	71	Prior to EE concurrence
		68	65	**73**	69	**69**	68	69	70	After EE concurrence
Port Huron	26-147-0005	72	66	74	68	72	70	69	71	Prior to EE concurrence
		72	66	**71**	68	**69**	69	68	69	After EE concurrence

According to 40 CFR, Part 50, National Primary and Secondary Ambient Air Quality Standards, Appendix I, the requirement for three complete, consecutive calendar years of data is met if the "daily maximum 8-hour average concentrations are available for at least 90 percent, on average, of the days during the designated ozone monitoring season, with a minimum data completeness in any one year of at least 75 percent of the designated sampling days." For the most recent three complete, consecutive calendar years, 2023 through 2025, the southeast Michigan monitors have a current DV in the range of 69 ppb to 72 ppb and upon the USEPA concurrence of EE demonstrations will have DVs in the range of 68 ppb to 70 ppb. The southeast Michigan monitoring sites also have a yearly completeness over 84 percent, and an average completeness over 95 percent. These completeness values align with the requirements under 40 CFR, Part 50, Appendix I. Upon the USEPA's concurrence of the related EE demonstrations, the 2022 through 2025 DVs will be at or below the 2015 ozone NAAQS of 70 ppb,

demonstrating the monitoring data is attaining the NAAQS for the southeast Michigan NAA.

3.2 Quality-assured Data

CAA Section 107(d)(3)(E)(i) requires that the ambient air quality data was collected and quality-assured in accordance with 40 CFR, Part 58, Ambient Air Quality Surveillance, and recorded in the Air Quality System.

EGLE has quality-assured all ozone data for 2020 through 2025 shown in Tables 1 and 2. EGLE submits annual data certification letters to the USEPA Region 5, certifying the completeness criteria under 40 CFR, Part 50 and the quality assurance criteria under 40 CFR, Section 58.10. Certification letters for the 2025 statewide ozone data were submitted to the USEPA on November 21, 2025, and March 12, 2026, and are available upon request.

4. CAA Section 182(b) Requirements

4.1. Applicable Requirement Under Section 182(b)

CAA Section 182(b)(1) states for moderate NAAs, “by no later than 3 years after the date of the enactment of the CAA Amendments… the State shall submit a revision to the applicable implementation plan to provide for volatile organic compound emission reductions, within 6 years after the date…, of at least 15 percent from the baseline emissions, accounting for any growth in emissions… Such plan shall provide for such specific annual reductions in emissions of volatile organic compounds and oxides of nitrogen as necessary to attain the national primary ambient air quality standard for ozone by the attainment date applicable under this Act.”

As mentioned previously, the USEPA finalized a clean data determination on May 19, 2023 (88 FR 32594). As a result of the clean data determination, based on exclusion of event-influenced data, the USEPA suspended the requirements for the area to submit attainment demonstrations and associated Reasonably Available Control Measures, Reasonable Further Progress (RFP) plans, contingency measures for failure to attain or make reasonable progress, and other planning SIPs related to attainment of the 2015 ozone NAAQS, for as long as the area continues to attain the 2015 ozone NAAQS. Based on the USEPA’s May 1995 Clean Data Policy, the May 19, 2023, clean data determination, and the continuation of attainment of the 2015 ozone NAAQS, certain SIP elements, including the attainment demonstration and RFP, have been suspended by the USEPA.

4.2. Reasonably Available Control Technology (RACT)

Pursuant to CAA Sections 172, 182(b), and 182(f), states are required to implement RACT in the NAA for major sources and all sources in specified categories established through Control Techniques Guidelines for the applicable criteria pollutant and its

precursors (volatile organic compounds [VOC] and nitrogen oxides [NOx]). The USEPA defines RACT as the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. A source generally consists of several units that emit pollutants.

Historically, EGLE developed VOC RACT rules for past NAAs while developing attainment plans for the 1979, 1997, and 2015 ozone NAAQS. Michigan didn't have NAAs for the 2008 ozone standard. It should be noted that many sources that would be subject to VOC RACT under the 2015 ozone NAAQS have implemented VOC controls as required by the Michigan Air Pollution Control Rules adopted to meet VOC RACT requirements under the 1979 ozone NAAQS. EGLE is actively working with the USEPA to determine specific requirements and the due dates for RACT requirements.

4.3. Motor Vehicle Inspection and Maintenance

CAA Section 182(b)(4) requires states with moderate (or higher) ozone NAAs to implement a basic vehicle inspection and maintenance (I/M) program to identify and repair high-emitting vehicles. Vehicle I/M programs are requirements set forth by the 1990 amendments to the CAA for ozone and carbon monoxide NAAs based on certain criteria, including population, geographic area, and air quality status. The CAA identifies two levels of I/M programs, basic and enhanced, to be implemented based on urbanized population thresholds and NAAQS designation level. Basic I/M programs require light-duty cars to be tested and Enhanced I/M programs require both light-duty cars and trucks to be inspected.

Although Michigan is not currently required to operate a vehicle I/M program, an I/M program was previously established in the Detroit-Ann Arbor NAA from 1986 to 1995, under CAA requirements included prior to the 1990 amendments. The Automotive Emission Test program operated in Wayne, Oakland, and Macomb counties.

When the Detroit-Ann Arbor NAA was designated moderate nonattainment for the 1979 1-hour ozone NAAQS and due to the CAA amendments of 1990, EGLE was required to incorporate a contingency provision within the CAA Section 175A maintenance plan for implementation of a basic I/M program. The I/M contingency provision needed to include a commitment, legislative authority, and an enforceable schedule for adoption and implementation of the program. Public Act (PA) 232 of 1993, established a motor vehicle emissions testing program in southeast Michigan. This Act was subsequently repealed, and its provisions were incorporated into the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451 as part of Michigan's environmental regulatory authority and framework.

EGLE submitted the elements (described above) necessary to establish basic I/M as a contingency measure in the CAA Section 175A maintenance plan as provided for by the revisions to the national I/M rule. EGLE subsequently submitted a redesignation package to the USEPA in November 1993 for the 1979 1-hour ozone NAAQS. The

USEPA granted redesignation to attainment/maintenance in March 1995, and the I/M program upgrade became a contingency provision that could be implemented if there were future violations of the standard (60 FR 1735).

Although an I/M program has not been triggered since being included as a contingency provision, Michigan's PA 166 of 1996 and Part 65, Motor Vehicle Emissions Testing for Southeast Michigan, of the NREPA, contain authorities and regulations for a motor vehicle I/M emissions testing program for southeast Michigan, specifically Wayne, Oakland, and Macomb counties. As set forth in CAA Section 182(b)(4), the deadline for implementing the vehicle I/M requirements has not yet occurred. EGLE is actively working with the USEPA to determine specific requirements and the due dates for such requirements related to a vehicle I/M program.

4.4. General Offset Requirement

CAA Section 182(b)(5) requires the general nonattainment new source review (NNSR) permit offset ratio for ozone precursors set at 1.15 to 1. Michigan currently has sufficient SIP-approved (May 12, 2021, 86 FR 25954) NNSR permitting rules that address the emission offset requirement of 1.15 to 1 as Michigan Rule 336.2908(6)(a)(ii).

Documentation was submitted on January 24, 2023, certifying Michigan's existing NNSR meets the requirements of 40 CFR, 51.165. It was proposed for direct final approval on June 9, 2023, (88 FR 37766).

4.5. Not Applicable Requirements Under Section 182(b)

CAA Section 182(b)(3) – Gasoline Vapor Recovery

States are not required to implement Stage II programs in their SIPs per 77 FR 28772.

5. CAA Section 172(c)(3) Requirements

CAA Section 172(c)(3) requires each plan to "include a comprehensive, accurate, current inventory of actual emissions from all sources of the relevant pollutant or pollutants in such area..." The USEPA Guidance states "[f]or O_3 nonattainment areas, the inventory should be based on actual *typical summer day* emissions of O_3 precursors...during the attainment year." EGLE submits the following inventory to comply with this requirement.

EGLE has updated the on-road attainment inventory for 2019, additionally, the NOx and VOC emissions totals for 2019 have been updated to reflect this revision. For on-road emissions, as stated in the Southeast Michigan Council of Governments (SEMCOG) analysis (Attachment A), SEMCOG used the MOVES5 model to generate July weekday on-road emissions for 2019. Tables 3 and 4 display the updated emissions inventory for the southeast Michigan area. This inventory shows a decrease in all inventory

emissions categories throughout southeast Michigan from 2014 through 2019 and a total emission decrease for both NOx and VOC.

Table 3. Southeast Michigan NOx Emissions Inventory for 2014 and 2019 (tons/ozone season day).

Emission Category	2014	2019
On-road	192.70	112.60
Nonroad	60.26	22.51
Point	166.86	97.01
Nonpoint	36.69	27.98
Total NOx Emissions	456.51	260.10

Table 4. Southeast Michigan VOC Emissions Inventory for 2014 and 2019 (tons/ozone season day).

Emission Category	2014	2019
On-road	83.20	55.40
Nonroad	69.63	30.46
Point	32.24	13.74
Nonpoint	149.93	134.77
Total VOC Emissions	335.00	234.37

6. CAA Section 175A Maintenance Plan

CAA Section 107(d)(3)(E) requires a fully approved CAA Section 175A maintenance plan for a redesignation to attainment. CAA Section 175A of the CAA and the USEPA Guidance contain the following requirements for maintenance plans with which EGLE demonstrates compliance. According to the USEPA Guidance, a state may submit both the redesignation request and the maintenance plan at the same time. EGLE submits the following revisions to the maintenance plan for approval for the southeast Michigan nonattainment area.

6.1. Maintenance for 10 Years

CAA Section 175A(a) requires that the maintenance plan must provide for maintenance of the NAAQS for at least 10 years after the redesignation. The USEPA Guidance states, “the State should project emissions for the 10-year period following redesignation...for the purpose of showing that emissions will not increase over the attainment inventory...The projected inventory should consider future growth, including population and industry, should be consistent with the attainment inventory, and should document data inputs and assumptions.”

In this submittal EGLE is utilizing the 2019 and 2035 inventory from the January 3, 2022, SIP submittal, with appropriate revisions. Additionally, EGLE has updated the maintenance year from 2035 to 2040. As mentioned in Section 5, EGLE updated the on-road attainment inventory for 2019, therefore the NOx and VOC emissions totals for 2019 have been updated to reflect this revision. To follow the USEPA guidance, on-road inventories for 2035 and 2040 were calculated by SEMCOG using MOVES5 (Attachment A). The inputs and assumptions for those projections are detailed in that analysis and are based on July weekday emissions.

The nonroad, nonpoint, and point inventory projections for 2040 were derived from the USEPA National Emissions Inventory Collaborative 2016v2 modeling platform data by calculating a linear interpolation between the modeling platform's analytic year inventories of 2016 and 2032, consistent with accepted protocols. This process created a rate of change of NOx and VOC emissions. The linear interpolation rate was then applied to the previously developed 2035 inventory and extrapolated out five years to derive 2040. Additional information can be provided upon request.

To obtain the inventories, the annual totals of NOx and VOC for each emission category were summed to annual totals for each of the seven counties in southeast Michigan. Then, a conversion factor was created to convert the annual totals to a tons per ozone season day value for both NOx and VOC for each county. The conversion factor is a ratio or fraction. It was generated by taking the July pollutant category emissions and dividing them by the annual total category emissions (on a per county basis for both NOx and VOC). July was chosen as the standard southeast Michigan typical ozone season month after evaluating the summer months for ozone season production.

Tables 5 and 6 demonstrate southeast Michigan's maintenance of the 2015 ozone NAAQS through continued decreasing emissions across emissions inventory categories through 2040. Table 6 shows a slight increase in point VOC emissions through 2040 but with an overall decrease in VOC emissions throughout the southeast Michigan area.

Table 5. Southeast Michigan Counties NOx Emissions Inventory Projections (tons/ozone season day).

Emission Category	2019	2035	2040
On-road	112.60	25.60	17.80
Nonroad	22.51	15.17	11.81
Point	97.01	76.44	67.33
Nonpoint	27.98	25.84	25.32
Total NOx Emissions	260.10	143.05	122.26

Table 6. Southeast Michigan Counties VOC Emissions Inventory Projections (tons/ozone season day).

Emission Category	2019	2035	2040
On-road	55.40	27.90	22.50
Nonroad	30.46	26.56	24.91
Point	13.74	14.12	14.36
Nonpoint	134.77	133.11	132.60
Total VOC Emissions	234.37	201.69	194.37

7. CAA Section 110 and Part D Requirements

CAA Section 107(d)(3)(E) requires a determination that all CAA Section 110 and Part D requirements have been met for an area to be redesignated to attainment. The USEPA Guidance states, “For the purposes of redesignation, a State must meet all requirements of Section 110 and Part D that were applicable prior to submittal of the complete redesignation request.” The USEPA Guidance suggests the only Section 110 requirements at issue are those in Section 110(a)(2). Section 110(a)(2) lists the infrastructure SIP requirements. Part D lists the general requirements for nonattainment areas. These requirements, except those of Section 176 within Part D of the CAA, were adequately addressed in the January 3, 2022, Request for Redesignation.

7.1. Conformity Requirements

The USEPA Guidance states the state must “…show that its SIP provisions are consistent with section 176(c)(4) conformity requirements. The redesignation request should include conformity procedures if the State already has these procedures in place.”

Section 176(c) of the CAA requires states to establish criteria and procedures to ensure federally supported or funded activities, including highway projects, conform to the air quality planning goals in the applicable SIPs.

7.2. Transportation Conformity Requirements and Motor Vehicle Emission Budgets

Transportation conformity under CAA Section 176(c) is the requirement to determine conformity for transportation plans, programs, and projects developed, funded, or approved under Title 23 of the United States Code and the Federal Transit Act. Conformity to a SIP means transportation activities will not produce new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS.

EGLE has updated the projected emission reductions associated with the new interim and maintenance years, 2035 and 2040, respectively.

Tables 5 through 8 list the emissions from all sectors along with the projected emissions for 2035 and 2040. Tables 7 and 8 demonstrate the projected decrease in emissions from 2019 through 2040. To obtain the safety margin, a percentage of the projected total emission decrease was added to the on-road sector for southeast Michigan. For 2035 a sixty-five percent safety margin was chosen for both NOx and VOCs because it remained below the total emission reductions for all sectors and the total MVEB remained below the 2019 on-road emissions for NOx and VOCs for 2035. For 2040, a sixty percent safety margin was chosen for both NOx and VOCs because it remained below the total emission reductions for all sectors and the total MVEB remained below the 2019 on-road emissions for NOx and VOCs for 2040. Tables 7 and 8 detail the total projected emission decrease used in the first step to create the safety margin. Table 9 details the safety margin and resulting motor vehicle emissions budget for southeast Michigan. Currently the MVEB set forth in Table 9 is being reviewed by the Inter-agency work group (IAWG) for concurrence. EGLE anticipates concurrence with the MVEB and will include a narrative on the response from the IAWG after public comment.

Table 7. Projected NOx Emission Reductions for Southeast Michigan NAA (tons/summer day).

Emission Category	2019 Emissions	2035 Projected Emissions	Projected 2035 Emissions Reductions	2040 Projected Emissions	Projected 2040 Emissions Reductions
On-road	112.60	25.60	87.00	17.80	94.80
Nonroad	22.51	15.17	7.34	11.81	10.70
Point	97.01	76.44	20.57	67.33	29.68
Nonpoint	27.98	25.84	2.14	25.32	2.66
Total NOx Emissions	260.10	143.05	117.05	122.26	137.84

Table 8. Projected VOC Emission Reductions for Southeast Michigan NAA (tons/summer day).

Emission Category	2019 Emissions	2035 Projected Emissions	Projected 2035 Emissions Reductions	2040 Projected Emissions	Projected 2040 Emissions Reductions
On-road	55.40	27.90	27.50	22.50	32.90
Nonroad	30.46	26.56	3.90	24.91	5.55
Point	13.74	14.12	-0.38	14.36	-0.62
Nonpoint	134.77	133.11	1.66	132.60	2.17
Total VOC Emissions	234.37	201.69	32.68	194.37	40.00

Table 9. Motor Vehicle Emissions Budget for Southeast Michigan NAA (tons/summer day).

Pollutant	2035 Projected On-road Emissions	65% Safety Margin	2035 Total MVEB	2040 Projected On-road Emissions	60% Safety Margin	2040 Total MVEB
NOx	25.60	76.08	101.68	17.80	82.71	100.51
VOCs	27.90	21.24	49.14	22.50	24.00	46.50

8. Title 40 Code of Federal Regulations, Part 51, Appendix V Requirements

40 CFR, Part 51, Appendix V, contains requirements EGLE must follow to revise the SIP. The applicable requirements and EGLE's fulfillment of them are as follows:

8.1. A Formal Request

Appendix V requires all SIP submittals contain a formal letter of submittal from the Governor or the Governor's designee requesting USEPA approval of the SIP revision.

A letter dated July 3, 2019, from Governor Gretchen Whitmer to the USEPA, Region 5 delegates authority from the Governor to EGLE's Director to make any SIP submittal, request, or application under the CAA. This letter was submitted to the USEPA on July 30, 2019, for inclusion in the Michigan SIP and is available upon request. This delegation of authority and the cover letter included with this SIP submittal to the USEPA satisfies the formal request requirement.

8.2. Necessary Legal Authority

Appendix V requires states to submit evidence that the state has the necessary legal authority under state law to adopt and implement the requested SIP revision.

Part 55, Air Pollution Control, of the NREPA, and Executive Reorganization Order 2011-1 provide EGLE with the legal authority under state law to implement and enforce the provisions of the Michigan SIP. A copy has been submitted to the USEPA through previous SIP submittals and is available upon request.

8.3. Sufficient Public Notice

Appendix V requires the State of Michigan to submit evidence that public notice was given of the proposed change consistent with procedures approved by the USEPA, including the date of publication of such notice.

The notice of this SIP revision and an opportunity for public comment and request for a hearing is provided in Attachment B.

8.4. Valid Public Hearing

Appendix V requires the state submits a certification that a public hearing, if held, was held in accordance with the information provided in the public notice and the state's Administrative Procedures Act.

According to the public notice in Attachment B, EGLE provided an opportunity for a public hearing upon request. As stated in the public notice, requests for a public hearing needed to be submitted to the AQD by April 8, 2026.

8.5. Public Comments

Appendix V requires the state to compile any public comments and the state's responses to them in the SIP submittal. This section will be updated after the public comment period.

9. Conclusion

This addendum supports the January 3, 2022, Request for Redesignation SIP submittal and documents that the southeast Michigan ozone NAA is attaining the 2015 ozone NAAQS. The State of Michigan hereby requests the USEPA reconsider the January 3, 2022, Request for Redesignation SIP submittal and that the southeast Michigan ozone nonattainment area be redesignated to attainment, simultaneously with the USEPA's approval of the maintenance plan provisions contained herein. In addition, EGLE requests the USEPA's approval that this maintenance plan satisfies the requirements of CAA Section 175A(b) for subsequent plan revisions required for areas redesignated for the 2015 ozone NAAQS.

Attachment A. Ozone On-road Emissions for the Seven Counties of Southeast Michigan (Livingston, Monroe, Macomb, Oakland, St. Clair, Washtenaw, and Wayne), March 17, 2026

Ozone On-road Emissions
for
The Seven Counties of Southeast Michigan

(Livingston, Monroe, Macomb, Oakland, St. Clair, Washtenaw, and Wayne)

March 17, 2026

Prepared by the
Southeast Michigan Council of Governments (SEMCOG)
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1. Introduction

This report describes the process used to estimate the on-road mobile emissions for the seven counties of Southeast Michigan: Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne, as part of a redesignation of attainment request for the 2015 ozone National Ambient Air Quality Standard (NAAQS) by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) to the US Environment Protection Agency (EPA).

2. Geographical Area

The seven counties listed above are designated as nonattainment areas for the 2015 ozone NAAQS. Their boundaries align with those of the Southeast Michigan Council of Governments (SEMCOG) metropolitan planning organization (MPO). Throughout this report, these counties are collectively referred to as the SEMCOG region

3. Attainment Status

The SEMCOG region was originally designated nonattainment for the 1997 ozone NAAQS of 0.08 ppm. Following the successful implementation of Michigan's State Implementation Plan (SIP), the region was re-designated to maintenance status in 2009. In 2012, the SEMCOG region was designated as attainment for the 2008 ozone NAAQS of 0.075 ppm.

On August 3, 2018, the EPA designated the SEMCOG region as nonattainment for the strengthened 2015 ozone NAAQS of 0.070 ppm. Since the 1997 ozone NAAQS has been revoked, transportation conformity requirements under the Clean Air Act apply to the 2015 ozone non-attainment area. These requirements ensure that federally funded or approved highway and transit projects conform to the air quality goals established in the state's SIP. Up to this date, SEMCOG has conducted ozone conformity analysis for the entire SEMCOG region and has continued to demonstrate conformity.

4. Emission Analysis Overview

The vehicle emission estimates presented in this analysis are based on the methodology developed and used for transportation conformity analysis for the seven counties of SEMCOG region. This methodology has been reviewed and accepted by the FHWA and the EPA. To conduct conformity analysis, emissions from all vehicles operating on Southeast Michigan's roadway network are estimated using a set of interconnected computer models. These models evaluate how emissions are expected to change over time based on:

- Anticipated growth in the region, including changes in population, employment, and travel activity; and
- The implementation of regionally significant transportation projects that modify roadway capacity (e.g., constructing new roads, adding or reducing the number of traffic lanes on existing roads). The impact of major transit projects is also incorporated.

4.1 Analysis Years

Emissions were estimated for analysis years 2019, 2035, and 2040. *The Air Quality Conformity Analysis for the SEMCOG region Nonattainment Area* dated December 10, 2025, served as the primary source of input data for all three analysis years.

4.2 MOVES Run Specifications

EPA's latest Motor Vehicle Emission Simulator (MOVE5) was used to conduct on-road emission analysis. Due to the extensive travel interactions among the seven counties in the SEMCOG region, emissions for all seven counties were modeled as a single area within MOVES. The County-level run specification was applied, with Wayne County selected to represent the characteristics of the full SEMCOG region where MOVES default data were used.

Although Wayne County served as the geographic representative for MOVES default inputs, all local input data were developed to reflect actual transportation activity across all seven SEMCOG counties. The meteorological condition representative of the ten highest-ozone days was applied to the month of July to estimate ozone emissions for a typical high-ozone summer weekday.

4.3 On-road Emission Summary

The on-road emission estimates were generated using EPA's MOVES5 model, incorporating locally developed datasets prepared for the conformity analysis of SEMCOG's 2050 RTP. *Table 1* summarizes typical summer weekday emissions of the two primary ozone precursors - volatile organic compounds (VOC) and nitrogen oxides (NO_x), for each of the three analysis years. These emissions values were derived from the MOVES outputs representing July weekday conditions.

Table 1: Ozone On-road Emissions

Analysis Year	Summer Weekday Emissions (US short tons)		Regional Summer Weekday VMT (millions)
	VOC	NO_x	
2019	55.4	112.6	142.7
2035	27.9	25.6	150.7
2040	22.5	17.8	152.3

The methodology used to develop the key modeling inputs that supports these emission estimates is described in the following sections.

5. Description of Key Modeling Inputs

This section describes the key inputs used in this emission analysis, including the local travel activity data, vehicle fleet characteristics, and the temperature applied to represent typical high-ozone conditions.

5.1 Local Travel Data Inputs

Local travel data were developed using SEMCOG's Travel Demand Forecast Model (TDFM), along with other regional datasets. These datasets include demographic forecasts, roadway characteristics, and travel activity metrics that support the estimation of vehicle miles traveled (VMT), vehicle hours traveled (VHT), speed distributions, and other MOVES inputs. This subsection provides an overview of the demographic data used to support the TDFM and the methods used to generate the travel activity inputs applied in MOVES.

5.1.1 Demographic Data

The demographic inputs for SEMCOG's TDFM are based on the agency's 2050 Regional Development Forecast (RDF), adopted in March 2023. The RDF provides region-wide projections

of population, households, and employment through 2050. A three-step process was used to develop this forecast for the inputs to the TDFM.

a) Regional forecast totals of population, households and jobs were generated from the REMI (Regional Economic Models, Inc.) model. The model forecasts Southeast Michigan's ability to attract and retain population and jobs relative to all other parts of the United States. Regional totals were developed for all forecast years from the 2020 base year to 2050.

b) The regional totals were then used to develop a small-area forecast that disaggregates regional population, households and jobs into 1.8 million land parcels using the UrbanSim model. UrbanSim is a computer simulation model for planning and analysis of urban development. It incorporates the interaction between land use, transportation, and public policy. In doing so, it puts future population and jobs into the most desirable land parcels f, and models residential and nonresidential developments as demand arises.

c) Land parcels from the small-area forecast were aggregated to traffic analysis zones (TAZs) for use in SEMCOG's travel demand forecasting model.

5.1.2 SEMCOG's Travel Demand Forecasting Model (TDFM)

Vehicle miles of travel (VMT) forecasts for the on-road emissions inventory were developed using version E8 of SEMCOG's TDFM for both passenger travel and commercial vehicle travel.

E8 – passenger travel model components were inherited from E7, which was implemented in 2018 using SEMCOG's 2015 travel survey and recalibrated in 2022 with the transit ridership numbers from SEMCOG's 2019 onboard transit survey. It utilizes the standard trip-based modeling process (trip generation, trip distribution and mode choice) to model the passenger travel demand. The program is run on the platform of TransCAD.

E8 - commercial vehicle (CV) travel model components were implemented in 2021 using SEMCOG's 2017 commercial vehicle survey and other observed truck data. The CV model runs with the script language of R and includes three model components, described below at high-level.

a) The Firm Synthesis Model, which develops a list of business establishment locations and processes zonal land use data used to generate truck trip demand in later steps of the CV model.
b) The Long-Distance Truck Model, which estimates long-haul freight truck travel to and from the region, as well as external to external truck travel through the region.
c) The Commercial Vehicle Touring Model (CVTM), which estimates demand for local deliveries and the provision of services by non-freight carrying trucks. The tours and trips simulated to serve this demand, when combined with the travel from the long-distance truck model, means that the CV model simulates all truck movements within, to, from, and through the region.

The last step of SEMCOG's TDFM is traffic assignment, which runs in TransCAD and assigns zone-to-zone passenger and commercial vehicle trips to the E8 model road network by time period and vehicle type.

The E8 model base year (referred to as E8-LA20) incorporated datasets from both 2019 and 2020. Specifically, 2020 household and population data together with 2019 employment data were used as model inputs. The model was estimated with pre-COVID regional travel patterns and validated against the 2019 VMT reported through the HPMS program. As a result, the travel behavior changes associated with Covid-19 were not reflected in this version of the E8 model.

Regional travel forecasts were developed in five-year increments from the 2019/2020 base year through the horizon year of SEMCOG's 2050 RTP. The latest model networks include projects from SEMCOG's 2050 RTP and the 2026–2029 Transportation Improvement Program (TIP), amended on the Dec. 10, 2025 conformity analysis. The 2035 model (E8-LD35) network reflects the completion of several major regional projects, such as the new Gordie Howe International Bridge (GHIB), the conversion of I-375 into a new at-grade boulevard, and the implementation of Advanced Traffic Management (ATM) lanes on US-23 and I-96. The 2040 model (E8-LD40) network further incorporates partial completion of the I-94 Modernization Project.

Detailed documentation on the model is contained in a separate SEMCOG document that is available upon request.

5.1.5 Mapping TDFM Functional Classes to MOVES Road Types

To incorporate TDFM outputs into MOVES, the roadway functional classifications used in SEMCOG's model must be reconciled with the four MOVES road types used for on-road emission modeling: Urban Restricted, Urban Unrestricted, Rural Restricted and Rural Unrestricted. In MOVES, "restricted" road types refer to limited-access facilities, which in the SEMCOG region include all freeway segments. All other motorized roadway facilities are categorized as "unrestricted". The TDFM also includes several special functional classes that are not part of the regular roadway network (e.g. walk only, external zone connectors, transit-only links). These are not included in SEMCOG's emissions modeling.

Table 2: Mapping of TDFM Functional Classes and Area Types to MOVES Road Types

<table>
<tr><th rowspan="2">SEMCOG TDFM
Functional Class</th><th colspan="5">SEMCOG TDFM Area Type</th></tr>
<tr><th>Urban Business</th><th>Urban Fringe</th><th>Urban</th><th>Suburban</th><th>Rural</th></tr>
<tr><td>1 - Interstate Freeway</td><td colspan="4" rowspan="2">4 – MOVES Urban Restricted Road Type</td><td rowspan="2">2 – MOVES Rural Restricted Road Type</td></tr>
<tr><td>2 - Other Freeway</td></tr>
<tr><td>3 - Principal Arterial</td><td colspan="4" rowspan="6">5 – MOVES Urban Unrestricted Road Type</td><td rowspan="6">3 – MOVES Rural Unrestricted Road Type</td></tr>
<tr><td>4 - Minor Arterial</td></tr>
<tr><td>5/6 - Collector</td></tr>
<tr><td>7 - Local</td></tr>
<tr><td>9 - Uncertified Road</td></tr>
<tr><td>99 - Centroid connector (local road surrogate)</td></tr>
<tr><td>81 - 94 Transit Use Only</td><td colspan="5" rowspan="3">Non-road or outside region. Not used in MOVES</td></tr>
<tr><td>90 - External</td></tr>
<tr><td>96 - Walk Only</td></tr>
</table>

As TDFM functional classes do not distinguish between urban and rural facilities, the TDFM "Area Type" variable is used as a surrogate. The TDFM defines five area types (urban business, urban fringe, urban, suburban and rural) and assigns one to each roadway link based on the density of households, population and employment in the traffic analysis zone in which the link resides.

Table 2 shows how each area type and functional class in SEMCOG's TDFM is mapped to the four road types used in MOVES.

5.1.4 Vehicle Miles Traveled (VMT)

MOVES provides an option to input annual VMT by the six FHWA Highway Performance Monitoring System (HPMS) vehicle classes, with the passenger cars (HPMS 20) and other 4-tire/2-axle vehicles (HPMS 30) combined into a single category, HPMS 25.

- HPMS10 – Motorcycle
- HPMS25 - Passenger car and Other 4-tire, 2-axle vehicles
- HPMS40 – Bus
- HPMS50 - Single unit truck
- HPMS60 - Combination truck

Local VMT inputs for MOVES were derived from SEMCOG's TDFM. While the model produces average weekday VMT forecasts, it does not disaggregate VMT by individual MOVES vehicle types. Therefore, additional processing steps are necessary to convert TDFM outputs into the format required for MOVES.

a) HPMS Normalization

In accordance with EPA and FHWA guidance, SEMCOG TDFM VMT was normalized to match HPMS VMT at county and road-type level. Normalization factors were developed by dividing the 2019 HPMS VMT by the 2020 model VMT estimated from E8-LA20. *Table 3* shows the resulting factors. These factors were applied to TDFM VMT in all forecast years.

Table 3: HPMS Normalization Factors

County	Road Type	
	Restricted	Unrestricted
Livingston	1.14164	0.98447
Macomb	0.86251	1.06446
Monroe	0.96648	1.06906
Oakland	0.88927	0.97795
St Clair	1.03914	1.39949
Washtenaw	1.05165	0.92587
Wayne	0.93895	1.23753

b) Average Weekday VMTs

Since the E8 model base year was calibrated and normalized to the 2019 HPMS VMT totals, the normalized VMT outputs from the TDFM base year (E8-LA20) were used as the VMT inputs for the 2019 analysis year. Similarly, VMT inputs for the 2035 and 2040 analysis years were taken from TDFM E8-LD35 and E8-LD40, respectively.

Table 4 presents the normalized regional VMT from SEMCOG's TDFM for all three analysis years: 2019, 2035 and 2040.

Table 4: Average Weekday Vehicle Miles Traveled (VMT)

MOVES Road Type	2019 (E8-LA20)	2035 (E8-LD35)	2040 (E8-LD40)
Rural Restricted	9,536,693	10,106,226	10,279,950
Rural Unrestricted	12,964,462	14,013,146	14,239,467
Urban Restricted	39,725,909	42,273,246	42,834,705
Urban Unrestricted	71,612,188	74,949,076	75,515,318
Region Total	133,839,252	141,341,694	142,869,440

c) Distribution of VMT Among HPMS Vehicle Types

Two sets of VMT distribution factors (one for restricted roadways and one for unrestricted roadways) were developed to allocate total VMT of an analysis year among five vehicle classes described earlier in this section.

Because scheduled traffic count collection in 2020 was suspended due to COVID-19 impacts, no updated count data were available for developing new distribution factors. As a result, the VMT distribution factors originally developed using the 2015 traffic counts for SEMCOG's 2045 RTP were carried forward for use in the 2050 RTP. These factors, derived from the 2015 count dataset, are presented in *Table 5*.

Table 5: VMT Distribution Factors by HPMS Vehicle Type

HPMS Vehicle Type	Restricted	Unrestricted
H10 – Motorcycle	0.00276	0.00589
H25 - Passenger Car and Other 4-tire, 2-axle vehicles	0.89201	0.90783
H40 – Bus	0.00166	0.00442
H50 - Single-Unit Truck	0.01931	0.05772
H60 - Combination Truck	0.08426	0.02414

d) Conversion of Average Weekday VMT to Annual VMT

Monthly and weekend adjustment factors were developed using 2014-2016 traffic count data from the 35 PTR stations in Southeast Michigan. Monthly adjustment factors for motorcycles were developed separately due to their significant difference from other vehicle types. Weekend adjustment factors were also developed for each of the five vehicle types to account for the significant variations observed between vehicle classes. These adjustment factors (shown in *Table 6*), along with the HPMS-normalized weekday VMT by vehicle type, were then entered into EPA's AADVMT converter of "*moves5-aadvmt-converter-tool-2024-11.xls"* to compute the annual VMT, as well as the monthly and daily VMT fractions needed for MOVES5.

Table 6: Monthly and Weekend Adjustment Factors

Month	Monthly Adjustment Factors		Weekend Adjustment Factors				
	Motorcycle	Others	H10	H25	H40	H50	H60
Jan	0.61591	0.84277	0.74004	0.76880	0.50814	0.31258	0.34568
Feb	0.64898	0.89507	0.72627	0.74810	0.53906	0.28693	0.32378
Mar	0.70943	0.97283	0.78072	0.80027	0.56487	0.28654	0.32074
Apr	0.86564	1.01831	1.06431	0.80995	0.56013	0.30115	0.30696
May	1.18817	1.03520	1.00755	0.82747	0.51042	0.31796	0.31331
Jun	1.39409	1.08036	1.09094	0.82842	0.53217	0.34252	0.32225
Jul	1.47548	1.06434	1.04333	0.83058	0.61693	0.34956	0.31060
Aug	1.42116	1.07990	1.07714	0.85262	0.61017	0.36666	0.32662
Sep	1.29399	1.04244	1.02136	0.85271	0.61270	0.36014	0.32851
Oct	0.95050	1.04384	0.84475	0.82973	0.63029	0.33629	0.33077
Nov	0.78996	0.98673	0.72377	0.79581	0.61643	0.32037	0.34036
Dec	0.64280	0.93822	0.77974	0.78883	0.52432	0.31239	0.34840

Table 7: Weekday Hourly Fractions for Restricted Road Types

HOUR	H10	H25	H40	H50	H60	Total
1	0.00901	0.00853	0.01300	0.00685	0.01929	0.00941
2	0.00506	0.00508	0.01077	0.00607	0.01775	0.00618
3	0.00495	0.00412	0.01079	0.00671	0.01748	0.00531
4	0.00572	0.00487	0.01220	0.00855	0.01974	0.00621
5	0.01331	0.01094	0.01839	0.01323	0.02500	0.01218
6	0.03873	0.02914	0.02854	0.02445	0.03304	0.02940
7	0.05610	0.05634	0.04263	0.05114	0.04400	0.05518
8	0.05897	0.07031	0.05985	0.06570	0.04968	0.06843
9	0.05187	0.06151	0.06112	0.07814	0.05658	0.06139
10	0.04527	0.04812	0.06610	0.07654	0.06325	0.04996
11	0.04491	0.04411	0.06347	0.07401	0.06555	0.04653
12	0.04792	0.04569	0.05739	0.07388	0.06606	0.04798
13	0.05076	0.04846	0.06006	0.07350	0.06413	0.05029
14	0.05422	0.05120	0.06267	0.07587	0.06291	0.05269
15	0.06414	0.06073	0.06700	0.07750	0.06062	0.06107
16	0.07425	0.07509	0.06726	0.07268	0.05566	0.07339
17	0.07592	0.08344	0.05918	0.06113	0.04929	0.08007
18	0.07156	0.08323	0.05087	0.04636	0.04353	0.07909
19	0.06320	0.06326	0.04795	0.03500	0.04076	0.06079
20	0.04912	0.04401	0.03725	0.02398	0.03570	0.04292
21	0.03837	0.03466	0.02944	0.01737	0.03160	0.03407
22	0.03307	0.02891	0.03085	0.01314	0.02904	0.02863
23	0.02533	0.02233	0.02336	0.01009	0.02620	0.02243
24	0.01823	0.01591	0.01989	0.00810	0.02316	0.01638

5.1.5 Hourly VMT Fractions

Two data sources were used to develop the hourly VMT fractions required for MOVES:

- 2015 SEMCOG screen line traffic counts - These counts include classification information but were only collected on weekdays.
- 2015 PTR count data within the SEMCOG region - These data include both weekdays and weekends. All PTR stations are located on freeways and only a limited number provide vehicle classification data.

Using these datasets, SEMCOG developed weekday hourly VMT fractions for each of five HPMS vehicle types, differentiated by restricted (*Table 7*) and unrestricted (*Table 8*) MOVES road types.

For weekends, however, the available count data was not sufficiently robust to produce reliable factors by either road type or vehicle class. As a result, a single unified set of hourly VMT factors was developed for weekend days, as shown in *Table 9*.

Table 8: Weekday Hourly Fractions for Unrestricted Road Types

Hour	H10	H25	H40	H50	H60	Total
1	0.00536	0.00794	0.00434	0.00529	0.01420	0.00791
2	0.00371	0.00543	0.00249	0.00395	0.01364	0.00552
3	0.00416	0.00527	0.00357	0.00407	0.01379	0.00539
4	0.00426	0.00685	0.00344	0.00528	0.01637	0.00696
5	0.00865	0.01299	0.00744	0.00917	0.02186	0.01294
6	0.01924	0.02808	0.01596	0.02223	0.03012	0.02769
7	0.03800	0.04830	0.06490	0.04586	0.04488	0.04809
8	0.06079	0.06905	0.09539	0.06604	0.06031	0.06873
9	0.05785	0.06046	0.09259	0.07022	0.06781	0.06133
10	0.04103	0.04541	0.06258	0.06268	0.06417	0.04691
11	0.04297	0.04380	0.05978	0.06083	0.06390	0.04533
12	0.04714	0.04747	0.06159	0.06332	0.06677	0.04891
13	0.05924	0.05097	0.05531	0.06543	0.06308	0.05216
14	0.06083	0.05242	0.06116	0.06275	0.06378	0.05338
15	0.07287	0.06154	0.08679	0.06809	0.06259	0.06213
16	0.08846	0.07415	0.09969	0.07556	0.06072	0.07411
17	0.10167	0.08174	0.08279	0.07774	0.05772	0.08105
18	0.09847	0.08327	0.04963	0.07190	0.05491	0.08187
19	0.07032	0.06446	0.03165	0.05387	0.04189	0.06319
20	0.04197	0.04739	0.01901	0.03639	0.03149	0.04621
21	0.03187	0.03906	0.01488	0.02833	0.02705	0.03800
22	0.01966	0.02956	0.01118	0.01918	0.02313	0.02866
23	0.01337	0.02062	0.00735	0.01304	0.01861	0.02003
24	0.00810	0.01378	0.00649	0.00879	0.01722	0.01351

Table 9: Weekend Hourly Fractions for Restricted/Unrestricted Road Types

HOUR	H10	H25	H40	H50	H60	Total
1	0.01635	0.01781	0.03310	0.01946	0.03316	0.01839
2	0.01066	0.01119	0.02323	0.01586	0.02873	0.01187
3	0.00790	0.00841	0.01984	0.01526	0.02595	0.00911
4	0.00579	0.00642	0.01708	0.01556	0.02498	0.00718
5	0.00749	0.00823	0.01755	0.01712	0.02806	0.00902
6	0.01279	0.01332	0.02291	0.02249	0.03179	0.01407
7	0.01867	0.02010	0.03379	0.03690	0.03798	0.02089
8	0.02291	0.02624	0.05137	0.05046	0.04349	0.02708
9	0.03282	0.03478	0.05412	0.06060	0.04905	0.03552
10	0.04456	0.04581	0.05471	0.06376	0.05285	0.04622
11	0.05503	0.05565	0.05689	0.06525	0.05602	0.05574
12	0.06466	0.06392	0.05137	0.06709	0.05710	0.06369
13	0.07084	0.06986	0.05404	0.06761	0.05578	0.06932
14	0.07520	0.07230	0.04839	0.06710	0.05434	0.07159
15	0.07703	0.07398	0.04786	0.06348	0.05153	0.07307
16	0.08072	0.07576	0.05201	0.06053	0.04996	0.07469
17	0.07736	0.07454	0.05285	0.05702	0.04782	0.07342
18	0.07136	0.07088	0.05550	0.05255	0.04620	0.06982
19	0.06338	0.06289	0.05654	0.04594	0.04549	0.06211
20	0.05482	0.05373	0.04961	0.03817	0.04285	0.05321
21	0.04560	0.04517	0.03900	0.03143	0.03990	0.04486
22	0.03578	0.03735	0.04079	0.02575	0.03628	0.03722
23	0.02814	0.02989	0.03471	0.02164	0.03196	0.02990
24	0.02016	0.02177	0.03273	0.01898	0.02874	0.02201

5.1.6 Road Type Distribution

Several steps were undertaken to develop the VMT road type distribution factors for each HPMS vehicle class. First, the 2019 HPMS VMT numbers were grouped into four MOVES road types (Urban Restricted, Urban Unrestricted, Rural Restricted and Rural Unrestricted). Next, the VMT associated with each MOVES road type was allocated across the five HPMS vehicle classes using the vehicle-type distribution factors developed earlier (*Table 5*). The final VMT road-type distribution factors (shown in

Table 10) were then calculated by dividing the VMT for each MOVES road type and each HPMS vehicle type by the total VMT of each HPMS vehicle class.

Table 10: Road Type Distribution

HPMS Vehicle Type	MOVES Road Type			
	Rural Restricted	Rural Unrestricted	Urban Restricted	Urban Unrestricted
H10 - Motorcycle	0.020290	0.048728	0.193794	0.737189
H25 - Passenger Car or Other 4-tire, 2-axle vehicles	0.034454	0.039461	0.329089	0.596996
H40 - Bus	0.017007	0.050876	0.162438	0.769680
H50 - Single-Unit Truck	0.015430	0.051907	0.147378	0.785285
H60 - Combination Truck	0.063482	0.020471	0.606346	0.309700

5.1.7 Vehicle Hours Traveled (VHT) and Average Speed Distributions

MOVES determines operating mode distributions based on the allocation of vehicle hours traveled (VHT) across average-speed bins. To develop the local average-speed distribution, SEMCOG used congested speeds and VHT outputs from the TDFM to calculate the proportion of VHT falling within each MOVES speed bin. The average-speed distributions for the 2019, 2035, and 2040 analysis years were derived from the speed outputs of TDFM E8-LA20, E8-LD35, and E8-LD40, respectively. *Table 11* presents the VHT totals of the three analysis years reported by the TDFM.

Table 11: Average Weekday Vehicle Hours Traveled (VHT)

MOVES Road Type	2019 (E8-LA20)	2035 (E8-LD35)	2040 (E8-LD40)
Rural Restricted	143,133	155,182	159,420
Rural Unrestricted	457,551	509,650	521,494
Urban Restricted	803,342	884,184	901,022
Urban Unrestricted	2,881,632	3,114,552	3,153,659
Region Total	4,285,658	4,663,568	4,735,595

MOVES requires users to input hourly speed distributions by road type and vehicle class. While SEMCOG's TDFM does not provide hourly speeds, it does produce speeds for five model time periods:

- AM peak, simulating the hours of 6:30 - 9:00 a.m.
- Mid-day, simulating the hours of 9:00 a.m. - 2:30 p.m.
- PM peak, simulating the hours of 2:30 - 6:30 p.m.
- Evening, simulating the hours of 6:30 p.m. - 10:00 p.m.
- Night, simulating the hours of 10 p.m. – 6:30 a.m.

For MOVES, separate speed distributions were developed for each of these time periods and then applied to all hours within that period. This was done as follows:

- For each time period, the directional congested speed of each roadway link was assigned to one of MOVES 16 speed bins.
- The associated directional VHTs on the links were then aggregated by speed bin and MOVES road type.
- Then, for each road type, the VHT fraction in each speed bin was computed.

For each analysis year, the average speed distributions were developed. As no local data is currently available to differentiate speeds between vehicle classes, the same speed distributions were applied to all vehicle types.

5.2 Local Vehicle Data Inputs

5.2.1 Vehicle Population

Vehicle population inputs for the 2019 analysis year were developed using 2019 vehicle registration datasets obtained from the Michigan Department of State (DOS). The data fields of body style, plate type and use type were used to determine the MOVES source type for each vehicle. *Table 12* summarizes the mapping of each combination of these data fields to the appropriate MOVES source type. When DOS data lacked sufficient detail for certain vehicle categories, MOVES default distributions for Southeast Michigan counties were used to supplement the assignment. As noted in the table, vehicle populations for transit buses (M42) and school buses (M43) in the base year were derived from 2018/2019 bus fleet data obtained from the Michigan Department of Transportation (MDOT) and Michigan Department of Education (MDOE).

Table 12: Mapping of Michigan DOS Body Styles to MOVES Vehicle Types

MOVES Vehicle Type	Michigan DOS Body Style
M11 – Motorcycle	Motorcycle
M21 – Passenger Car	2-door, 4-door, Convertible
M31 – Passenger Truck	Non-Commercial Station Wagon/Pick-up/Van
M32 – Light Commercial Truck	Ambulance, Hearse, Panel, Commercial Station Wagon/Pick-up/Van
M41 – Other Bus	Bus population from DOS registration database
M42 – Transit Bus	DOS data not used. Instead, MDOT 2018/2019 transit bus fleet data of SEMCOG region was used.
M43 – School Bus	DOS data not used. Instead, MDOE 2018/2019 school bus fleet data of SEMCOG region was used.
M51 – Refuse Truck	Dump Truck, Mixer, utility, Wrecker, Stake, Tank (Apportioned this data to M51, M52 and M53 vehicle types using split factors from MOVES4 default run.)
M52 – Single-unit Short-haul Truck	
M53 – Single–unit Long-haul Truck	
M54 – Motor Home	Motor Home
M61 & M62 – Combination Truck	DOS data not used. Instead, National default numbers of SEMCOG region were used.

Following the methodology described earlier, the 2023 vehicle population was developed from the 2023 Michigan DOS vehicle registration dataset and used as the base for projecting future-year vehicle populations. Growth rates for 2035 and 2040 relative to 2023 were calculated using regional population, household, and employment forecasts from SEMCOG's 2050 Regional Development Forecasts (RDF). These growth factors were then uniformly applied to the 2023 vehicle population to produce vehicle population estimates for the 2035 and 2040 analysis years for all MOVES source types except M61 and M62. Due to lacking sufficient information of combination trucks available at the time of the development, a MOVES default-scale run was used to obtain the combination truck populations of SEMCOG region for each analysis year. *Table 13: Regional Vehicle Population and Growth Factors* presents both the resulting growth factors and vehicle population estimates for these analysis years.

Table 13: Regional Vehicle Population and Growth Factors

MOVES Source Type	Actual Veh Pop	Base Year Veh Pop	Forecast Year	
	2019	2023	2035	2040
M11	95,752	95,284	99,386	100,304
M21	1,394,877	1,094,594	1,141,720	1,152,261
M31	2,053,397	2,305,329	2,404,580	2,426,783
M32	96,743	105,801	110,356	111,375
M41	3090	2842	2,964	2,992
M42	4209	4209	4,390	4,431
M43	1031	1031	1,075	1,085
M51	165	180	188	190
M52	24,153	26,419	27,556	27,810
M53	1,079	1,180	1,231	1,243
M54	10,277	10,381	10,828	10,928
M61	20,460	20,684	23,662	24,268
M62	12,324	12,459	14,253	14,618
Regional Total	**3,705,233**	**3,667,934**	**3,842,189**	**3,878,288**
Growth Factor	N.A.	1.000000	1.043053	1.052684

Detailed documentation on the development of SEMCOG's vehicle population data is contained in a separate SEMCOG mobile emissions model development memo, which is available upon request.

5.2.2 Vehicle Age Distribution

Similar to the development of vehicle population inputs, the 2019 and 2023 Michigan DOS vehicle registration datasets were used to develop the vehicle age distributions required for MOVES. The DOS body-style field was used to assign each vehicle to one of the six HPMS vehicle types (see *Table 14*). After assigning HPMS vehicle types, the data were aggregated by model year and grouped into the appropriate age categories. The age distribution from age 0 through 30+ were then calculated for each HPMS vehicle type.

Using the 2023 base year dataset, future-year age distributions were projected using EPA's age projection tool ("*moves4-age-distribution-projection-tool-2023-08*.xls"). Because these age distributions were originally developed in MOVES4 format, the MOVES5 built-in conversion tool was subsequently used to convert them into MOVES5-compatible format. During this process, age fractions for ages 30-40 were estimated based on the developed fractions at age 30.

For Single–unit Long-haul Truck (M-53) and combination trucks (M61 & M62), the default MOVES5 age distribution was used for each analysis year.

Table 14: Mapping of Michigan DOS Body Styles to HPMS Vehicle Types

HPMS Vehicle Type	Michigan DOS Body Style
H10 – Motorcycle	Motorcycle
H20 – Passenger Car	2-door; 4-door; Convertible
H30 – Other 4-tire, 2-axle vehicles	Station Wagon; Pick-up/Van; Ambulance; Hearse; Panel;
H40 – Bus	Bus
H50 – Single-unit Short Truck	Dump Truck; Mixer; Utility; Wrecker; Stake; Tank, Motor Home
M53, M61 and M62 – Long-haul/Combination Truck	MOVES 5 Default Data

5.2.3 Alternate Vehicle and Fuel Technology (AVFT)

The vehicle fuel-engine fractions of the AVFT table were developed using the fuel-code information from the 2023 Michigan DOS vehicle registration dataset, supplemented with the 2018/2019 school/transit bus fleet data. Each vehicle record was assigned to one of five MOVES fuel types based on its reported fuel-code (see *Table 15*). Vehicles sharing the same MOVES fuel type were then counted by MOVES source type and model year. Fuel-engine fractions were calculated for model years 1993 through 2023 for the following vehicle source types or source-type groups: 21, 31, 32, 41 & 42 & 43, 51 & 52 & 53, and 54.

Using the dataset constructed for vehicle model years 1993-2023, fuel-engine fractions for all analysis years were projected by EPA's AVFT tool included with MOVES5.

Table 15: Mapping of DOS Fuel Codes to MOVES Fuel Types

MOVES Fuel Type	DOS Fuel Code
1-Gasoline	Convertible
	Electric & Gas Hybrid
	Flexible
	Gas
	Gas & Oil Mix
2-Diesel Fuel	Diesel
	Electric & Diesel Hybrid
3-Compressed Natural Gas	Butane
	Comp Nat Gas
	Liq Nat Gas
	Propane
5-Ethanol (E85)	Alcohol
	Ethanol
9-Electricity	Electric
	FEV
	PHEV

5.3. Local Meteorological Inputs

5.3.1 Temperature Data for Ozone Modeling

For the ozone analysis, the objective is to simulate the on-road emissions that are likely to occur on days when meteorological conditions that are conducive to high ozone formation (i.e., hot summer days). Emission inventory data from 2019 to 2021 was used to develop the ozone SIP and redesignation submittal for the SEMCOG region. To represent typical high-ozone conditions, the maximum summer temperature input for MOVES was calculated as the average of daily maximum temperatures recorded on the 10 highest-ozone days across these three years. Likewise, the minimum summer temperature was calculated at the average of the daily minimum temperatures on these same days. This yielded a maximum temperature of 88.7°F and a minimum temperature of 63.7°F, which were then converted into the hourly temperature inputs for MOVES. These temperature numbers, along with the default relative humidity data provided in MOVES5, were assigned to the month of July to simulate a typical summer day for ozone emission modeling.

Attachment B. Public Participation Process Documentation