

APPENDIX J

**PRELIMINARY MOVES²⁰¹⁴ SUPPLEMENT AND
ATTACHMENT A**

**PRELIMINARY MOVES2014 SUPPLEMENT AND
ATTACHMENT A**

This appendix provides additional technical detail regarding Motor Vehicle Emission Simulator (MOVES) 2014 model-based on-road mobile emissions estimates, which were made available after the Houston-Galveston-Brazoria (HGB) Redesignation Substitute (RS) State Implementation Plan (SIP) Revision was approved for proposal by the commission; the proposed SIP revision was developed using the MOVES2010b on-road model.

**ON-ROAD EMISSIONS INVENTORY SUPPLEMENT TO
THE PROPOSED HOUSTON-GALVESTON-BRAZORIA
AREA REDESIGNATION SUBSTITUTE FOR THE ONE-
HOUR OZONE NATIONAL AMBIENT AIR QUALITY
STANDARD STATE IMPLEMENTATION PLAN REVISION**

This supplement provides additional technical detail regarding Motor Vehicle Emission Simulator (MOVES) 2014 model-based on-road mobile emissions estimates for the HGB nonattainment area.

1. BACKGROUND

This supplement provides additional technical detail regarding Motor Vehicle Emission Simulator (MOVES) 2014 model-based on-road mobile emissions estimates that became available after the Houston-Galveston-Brazoria (HGB) Redesignation Substitute (RS) State Implementation Plan (SIP) Revision for the One-Hour Ozone National Ambient Air Quality Standard (Non-Rule Project No. 2014-011-SIP-NR) was approved for proposal by the commission on November 19, 2014. The proposed SIP revision was developed using the MOVES2010b on-road model. The Texas Commission on Environmental Quality (TCEQ) is taking comment from December 5, 2014 through January 9, 2015 on the proposed HGB RS SIP revision, including using MOVES2014-based on-road emissions inventories in lieu of the MOVES2010b inventories for the adopted version of the HGB RS SIP revision.

The United States Environmental Protection Agency (EPA) officially released the MOVES2014 version of the model as a replacement to MOVES2010b for SIP applications in the October 7, 2014 issue of the *Federal Register* (70 FR 60343). The TCEQ is working with the Texas Transportation Institute (TTI) to develop 2011, 2014, 2017, 2020, 2023, and 2026 on-road emissions inventories using MOVES2014 for the HGB area, which may replace the current inventories and control reductions referenced in the proposal version of this SIP revision. The planning assumptions, fleet characteristics, and vehicle miles traveled (VMT) estimates may also be updated to incorporate the latest available information.

If MOVES2014 inventories are used, it is expected that the final emissions figures and maintenance results would be different than those reported in the proposed HGB RS SIP revision. Instead of relying solely on the use of MOVES2010b inventories for the proposed SIP revision, the TCEQ performed a preliminary analysis based on approximate MOVES2014-based on-road emissions inventories in this supplement to the proposed HGB RS SIP revision for consideration during the public comment period.

2. PRELIMINARY MOVES2014-BASED ON-ROAD MOBILE SOURCE EMISSIONS INVENTORIES, CONTROL STRATEGIES, AND CONTROL STRATEGY REDUCTIONS

An expedited method was used to obtain preliminary MOVES2014 emissions estimates in order to assess the degree of changes expected in the on-road inventories. The method and results are discussed section-by-section below.

2.1 Preliminary MOVES2014-Based On-Road Mobile Sources Emissions Inventory Development

The MOVES2010b and preliminary MOVES2014 inventories were developed using the latest available data, the most current planning assumptions, and the same total VMT. For the MOVES2010b SIP-quality emissions estimates, an hourly-link method was used in conjunction with emissions rates to develop inventories. Instead of using an hourly-link method, the preliminary MOVES2014 emissions estimates were calculated by running MOVES2014 in inventory mode without post-processing. The inventory-mode method will produce information valid for planning purposes; however, the resulting values may not be used to set motor vehicle emissions budgets because the emissions differences due to subtle changes in the transportation network assessed with a link-based method will not be captured with the inventory-mode method.

A summary of the on-road mobile source VMT used to develop both the MOVES2010b and the preliminary MOVES2014 nitrogen oxides (NO_x) and volatile organic compounds (VOC) emissions is presented in Table 2-1: *HGB VMT (miles per average summer day)*. The preliminary MOVES2014-based HGB 2011, 2014, 2017, 2020, 2023, and 2026 on-road mobile source emissions inventories (EIs) for NO_x and VOC are summarized in Table 2-2: *Preliminary MOVES2014-Based HGB Average Summer Weekday NO_x and VOC Emissions for On-Road Mobile Sources (tons per day)*.

Documentation of the development of the preliminary MOVES2014-based on-road mobile source emissions is provided in Attachment A: *Preliminary MOVES2014-Based On-Road Inventories in Support of the Area Redesignation Substitute for the One-Hour Ozone National Ambient Air Quality Standard State Implementation Plan Revision*.

Table 2-1: HGB VMT (miles per average summer day)

Description	2011	2014	2017	2020	2023	2026
Vehicle Miles Traveled	150,968,794	144,916,411	151,890,390	159,509,450	167,539,317	176,004,008

Table 2-2: Preliminary MOVES2014-Based HGB Average Summer Weekday NO_x and VOC Emissions for On-Road Mobile Sources (tons per day)

Pollutant	2011	2014	2017	2020	2023	2026
NO _x	217.88	154.87	97.86	72.40	57.81	47.86
VOC	88.17	65.82	48.84	40.61	35.78	30.89

2.2 Preliminary MOVES2014-Based On-Road Mobile Source Control Strategies

The preliminary MOVES2014 on-road mobile EIs were developed using emissions factors that incorporate the same control strategies as the proposed HGB RS SIP revision except Tier 3 of the Federal Motor Vehicle Control Program (FMVCP) is included and the Texas Low Emissions Diesel (TxLED) program is not included. The Tier 3 FMVCP rule, which was finalized in March 2014, will begin implementation in 2017 and is included in the MOVES2014 model but not in the MOVES2010b model. Since the expedited methodology used for the preliminary analyses does not include post-processing assessments, the effects due to TxLED are not included in the preliminary emissions estimates.

The controls that were modeled using MOVES2014 include: pre-1990 FMVCP, fleet turnover to Tier 1 of the FMVCP, fleet turnover to Tier 2 of the FMVCP, the 2007 heavy duty diesel FMVCP, summer reformulated gasoline (RFG), the HGB vehicle inspection and maintenance (I/M) program, and the HGB anti-tampering program. A summary of the on-road mobile source control strategies for the HGB area are presented in Table 2-3: *HGB On-Road Mobile Control Strategies Summary*.

Table 2-3: HGB On-Road Mobile Control Strategies Summary

Control Program Description	Year Control Program Started	Control Scenario Notes
Pre-1990 FMVCP	Pre-1990	Included for 2011, 2014, 2017, 2020, 2023, and 2026
Anti-Tampering Program	1986	Included for 2011, 2014, 2017, 2020, 2023, and 2026

Control Program Description	Year Control Program Started	Control Scenario Notes
1992 Federal Controls on Gasoline Volatility	1992	Maximum Reid Vapor Pressure of 7.8 pounds per square inch Included for 2011, 2014, 2017, 2020, 2023, and 2026
Tier 1 FMVCP	1994	Included for 2011, 2014, 2017, 2020, 2023, and 2026
RFG Phase 1	1995 for Phase One	Superseded by RFG Phase 2
I/M Program	1997	Included for 2011, 2014, 2017, 2020, 2023, and 2026
RFG Phase 2	2000 for Phase Two	Included for 2011, 2014, 2017, 2020, 2023, and 2026
National Low Emission Vehicle Program	2001	Included for 2011, 2014, 2017, 2020, 2023, and 2026
Tier 2 FMVCP	2004	Phase in 2004 to 2009 Included for 2011, 2014, 2017, 2020, 2023, and 2026
TxLED	2006	Low aromatic hydrocarbon and high cetane number to control NO _x Included in the MOVES2010b proposal estimates Not included in preliminary MOVES 2014 estimates Included in the final MOVES2014 estimates
Federal Low-Sulfur Highway Diesel	2006	15 parts per million maximum sulfur content Included for 2011, 2014, 2017, 2020, 2023, and 2026
2007 Heavy Duty FMVCP	2007	Phase in 2007 to 2010 Included for 2011, 2014, 2017, 2020, 2023, and 2026
Tier 3 FMVCP	2017	Tier 3 rule not final until March 2014 Not included in MOVES2010b SIP EIs Included in the MOVES2014 EIs

2.3 Preliminary MOVES2014-Based On-Road Mobile Source Control Strategy Reductions

Due in part to including the effects of Tier 3 FMVCP, preliminary MOVES2014 emissions estimates indicate an even greater decrease in on-road emissions for the HGB future milestone years when compared with MOVES2010b. Using the same increase in VMT as the MOVES2010b assessments, the preliminary MOVES2014 emissions estimates show a 169.87 tons per day (tpd) decrease in NO_x and a 57.31 tpd decrease in VOC between the base year of 2011 and the 2026 horizon year.

A summary of the preliminary MOVES2014 emissions change from the 2011 base year to each milestone year and the horizon year are summarized in Table 2-4: *Preliminary MOVES2014 Estimated Reductions from 2011 Baseline Due to FMVCP, I/M, and RFG (tons per day)*. A summary of the preliminary MOVES2014-based percent change in NO_x and VOC from the 2011 base year to each milestone year and the horizon year are summarized in Table 2-5: *Preliminary MOVES2014-Estimated Percent Reductions from 2011 Baseline Due to FMVCP, I/M, and RFG*.

Table 2-4: Preliminary MOVES2014-Estimated Reductions from 2011 Baseline Due to FMVCP, I/M, and RFG (tons per day)

Inventory Year	NO _x	VOC
2011	0	0
2014	-63.03	-22.36
2017	-119.76	-39.31
2020	-145.27	-47.56
2023	-159.89	-52.41
2026	-169.87	-57.31

Table 2-5: Preliminary MOVES2014-Estimated Percent Reductions from 2011 Baseline Due to FMVCP, I/M, and RFG

Inventory Year	NO _x	VOC
2011	0.0	0.0
2014	-29.00	-25.40
2017	-55.11	-44.65
2020	-66.84	-54.03
2023	-73.57	-59.53
2026	-78.16	-65.10

3. EMISSIONS SUMMARY UPDATED WITH PRELIMINARY MOVES2014-BASED ON-ROAD EMISSIONS INVENTORIES

The preliminary MOVES2014-based on-road emissions estimates for the 2011 baseline year, the 2026 horizon year, and the intervening milestone years (2014, 2017, 2020, and 2023) are presented in the table below, along with the summary emissions for the other source categories for the HGB area. Except for updates to the mobile source category, no other source category updates have been made to the values presented in the proposed HGB RS SIP revision.

The resulting emissions summaries by ozone precursor are shown in Table 3-1: *HGB NO_x Emissions by Source Category with Preliminary MOVES2014 On-road Emissions (tons per day)* and Table 3-2: *HGB VOC Emissions by Source Category with Preliminary MOVES2014 On-road Emissions (tons per day)*.

Table 3-1: HGB NO_x Emissions by Source Category with Preliminary MOVES2014 On-Road Emissions (tons per day)

Category	2011	2014	2017	2020	2023	2026
Point Sources	108.48	126.31	126.82	127.01	127.20	127.39
Area Sources	21.15	22.19	22.90	23.28	23.17	23.23
Preliminary MOVES2014 On-Road Mobile Sources	217.88	154.87	97.86	72.4	57.81	47.86
Non-Road Mobile Sources	121.11	106.99	94.99	83.70	75.54	68.98
Total	468.62	410.36	342.57	306.39	283.72	267.46

Table 3-2: HGB VOC Emissions by Source Category with Preliminary MOVES2014 On-Road Emissions (tons per day)

Category	2011	2014	2017	2020	2023	2026
Point Sources	96.11	100.81	102.86	103.29	103.71	104.12
Area Sources	308.74	321.92	332.43	339.67	342.58	346.13
Preliminary MOVES2014 On-Road Mobile Sources	88.17	65.82	48.84	40.61	35.78	30.89
Non-Road Mobile Sources	49.92	38.33	33.34	30.86	30.11	30.02
Total	542.94	526.88	517.47	514.43	512.18	511.16

4. MAINTENANCE DEMONSTRATION CONCLUSION UPDATED WITH PRELIMINARY MOVES2014-BASED RESULTS

The proposed HGB RS SIP revision narrative indicates a decrease of 176.40 tpd in combined NO_x and VOC emissions between 2011 and 2026 for the HGB area based upon EI summaries that include MOVES2010b on-road EIs. This net change includes a projected 18.49 tpd decrease in VOC and a 157.91 tpd decrease in NO_x.

Using preliminary MOVES2014-based on-road emissions inventory estimates, trend analysis indicates an overall decrease of 232.94 tpd in combined NO_x and VOC emissions for the HGB area between the maintenance base and horizon years of 2011 and 2026. This net change includes a projected 31.78 tpd decrease in VOC and a 201.16 tpd decrease in NO_x. Therefore, using MOVES2014 in the adopted version of the HGB RS SIP revision would not be anticipated to negatively affect the maintenance demonstration.

Based on this trend analysis, the HGB area is projected to show continued attainment of the one-hour ozone standard through 2026.

5. SUMMARY

The TCEQ is taking comment on using the MOVES2014 on-road emission inventories in the adopted version of the HGB Redesignation Substitute State Implementation Plan Revision for the One-Hour Ozone National Ambient Air Quality Standard (Non-Rule Project No. 2014-011-SIP-NR). The MOVES2014 model includes the effects of Tier 3 and other updates that make it the most robust tool to assess future year on-road mobile source emissions estimates. Based on the analysis provided in this supplement, the TCEQ anticipates that the use of on-road mobile emissions inventories developed using the EPA's MOVES2014 would not change the conclusion included in the proposed HGB RS that the area demonstrates maintenance from the 2011 base year to the 2026 horizon year. In fact, the TCEQ anticipates that the use of MOVES2014 in the adopted SIP revision would yield even greater reductions in both NO_x and VOC.

6. REFERENCES

EPA, 2005. *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations*, EPA-454/R-05-001, Issued By: Emissions Inventory Group, Emissions, Monitoring and Analysis Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. August 2005.

EPA, 2014. *Policy Guidance on the Use of MOVES2014 and Subsequent Minor Revisions for State Implementation Plan Development, Transportation Conformity, and Other Purposes*, EPA-420-B-14-008, Issued by: Transportation and Regional Programs Division, Office of Transportation and Air Quality, U.S. Environmental Protection Agency, July 2014.

EPA, 2014. *Motor Vehicle Emission Simulator (MOVES), User Guide for MOVES2014*, EPA420-B-14-055, Assessment and Standards Division, Office of Transportation and Air Quality. July 2014.

7. ATTACHMENTS

Attachment A: *Preliminary MOVES2014-Based On-Road Inventories in Support of the Area Redesignation Substitute for the One-Hour Ozone National Ambient Air Quality Standard State Implementation Plan Revision.*

ATTACHMENT A

Preliminary MOVES2014-Based On-Road Inventories in Support of
the Area Redesignation Substitute for the One-Hour Ozone National
Ambient Air Quality Standard State Implementation Plan Revision

Houston-Galveston-Brazoria Eight County One-Hour Ozone NAAQS
Air Quality Area
Analysis Years 2011, 2014, 2017, 2020, 2023, and 2026

November 2014

1. INTRODUCTION

The Texas Commission on Environmental Quality (TCEQ) has proposed a redesignation substitute (RS) State Implementation Plan (SIP) revision for the Houston-Galveston-Brazoria (HGB) one-hour ozone air quality planning area. The HGB RS SIP revision will be used to demonstrate that ozone precursor emissions, nitrogen oxides (NO_x) and volatile organic compounds (VOC) will be at or below the levels achieved for the attainment year, the base year for the RS demonstration, and for at least ten years beyond the attainment year. The HGB one-hour ozone RS base year is 2011. The horizon year is 2026 and provides a ten year window plus time to process the SIP documents. Four intermediate years used to track the trend between the base and horizon years are 2014, 2017, 2020, and 2023.

The United States Environmental Protection Agency (EPA) officially released the Motor Vehicle Emission Simulator (MOVES) 2014 version of the model as a replacement to MOVES2010b for SIP applications on October 7, 2014 (70 FR 60343). During the period of time that the HGB RS SIP revision was developed for proposal, it was not feasible to include MOVES2014-based on-road emission inventories. The TCEQ is working with the Texas Transportation Institute (TTI) to develop 2011, 2014, 2017, 2020, 2023, and 2026 on-road emission inventories using MOVES2014 for the HGB area, which may replace the current inventories and control reductions referenced in the proposed HGB RS SIP revision. The planning assumptions, fleet characteristics and vehicle miles traveled (VMT) estimates may also be updated to incorporate the latest available information at the time the inventories are developed. If MOVES2014 inventories are used, it is expected that the final emissions figures and maintenance results would be different than those reported in the HGB RS SIP revision proposal. Instead of relying solely on the use of MOVES2010b inventories for the SIP proposal, the TCEQ has elected to perform a preliminary analysis based on approximate MOVES2014-based on-road emissions inventories in the addendum to the HGB RS SIP revision proposal. This report documents the development of the preliminary MOVES2014-based on-road mobile inventories.

2. MODELING APPROACH

The MOVES2014 model can be run in inventory mode or emissions rates mode. When link based inventories are developed, MOVES2014 is run in emissions rate mode and the calculation of emissions is done outside the model by multiplying the emissions rates by corresponding activity parameters. For the preliminary MOVES2014-based analysis, the model was run in inventory mode. For the inventory mode runs, aggregated VMT values, equal to the total VMT used for the SIP quality analysis done by TTI, were put into MOVES formats and uploaded to the MOVES county database files (CDB). The aggregated VMT method will produce results similar, but not identical to, the post processed link VMT method. A summary of the MOVES2014 parameters used for the preliminary MOVES2014 assessments is provided in Table 1: *Summary of Local Input Parameters for the HGB Preliminary MOVES2014 Assessments*.

Table 1: Summary of Local Input Parameters for the HGB Preliminary MOVES2014 Assessments

Parameter Description	Value	Additional Information
County	Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties	Same for preliminary and SIP quality methods

Parameter Description	Value	Additional Information
Calendar Year	2011, 2014, 2017, 2020, 2023, and 2026	Same for preliminary and SIP quality methods
Month	July	Same for preliminary and SIP quality methods
VMT	HGB travel demand model based estimates for each analysis year	Aggregated by MOVES Source Use Type for preliminary assessments; MOVES emissions rates applied to link level VMT for SIP quality method
Source Use Type Populations	2011 registration data used for 2011 Projected values using most recently available data year used for future years	Same values used for both preliminary and SIP quality assessments Uploaded to MOVES2014 CDBs for preliminary method Applied to corresponding MOVES emissions rates post process for SIP quality method (Between the HGB RS SIP proposal and adoption the most recently available year of registration data will change from 2013 to 2014)
Inspection and Maintenance (I/M) Program	HGB I/M program for five county program area	Same for preliminary and SIP quality methods
Fuel Programs	Reformulated Gasoline (RFG) Phase 2 all counties	Same for preliminary and SIP quality methods
Temperatures and Humidity	2011 average summer	Same for preliminary and SIP quality methods
MOVES2014 Rate of Progress Toggle Switch	Toggle not activated	Same for preliminary and SIP quality methods
Speeds	Average speeds	Preliminary method: Aggregated speed distributions in MOVES2014 CDBs; SIP quality method: Hourly MOVES emissions rates determined for each roadway link based upon link speed for each hour of the day

For major metropolitan areas, VMT is estimated using travel demand models (TDM). The local council of governments has primary responsibility for running the TDM and developing VMT estimates for their area. The TDM VMT output provides information for each roadway link in the local roadway network. For a large metropolitan area, the roadway network may contain 10,000 to 40,000 links. The VMT establishes the traffic volume on each link, which can be used to calculate the link speed. Speed is a primary input for determining emission rates.

The link file output from the TDM, in addition to link VMT, also includes a roadway categorization for each link. The VMT can be summed using the roadway type categories to produce a summary file with total VMT for each roadway category. The corresponding link

speeds can be averaged using a VMT weighted method to produce an average speed for each roadway type. The VMT and speeds developed by the TTI and used in the development of the link-based, MOVES2010b inventory estimates were summarized and averaged by road type to calculate road type based values. The VMT summaries and average speeds were developed for each HGB one-hour RS analysis year and processed into MOVES2014 input formats. A summary of the VMT used to develop the preliminary MOVES2014 NO_x and VOC emissions levels, the same total VMT as used for the TTI MOVES2010b inventories in the HGB RS SIP proposal, are presented in Table 2: *HGB VMT for Preliminary MOVES2014 Assessments (miles per average summer day)*.

Table 2: HGB VMT for Preliminary MOVES2014 Assessments (miles per average summer day)

Description	2011	2014	2017	2020	2023	2026
Vehicle Miles Traveled	150,968,794	144,916,411	151,890,390	159,509,450	167,539,317	176,004,008

For the preliminary MOVES2014 analyses, the model was run with inputs reflecting all HGB on-road controls except Texas low emission diesel (TxLED). MOVES does not allow for the assessment of TxLED. Since the expedited methodology used for the preliminary analyses does not include post-processing assessments, the effects due to TxLED are not included in the preliminary emissions estimates. A description of the control strategies modeled is provided in Table 3: *HGB Preliminary MOVES2014 On-road Mobile Control Strategies Summary*.

Table 3: HGB Preliminary MOVES2014 On-road Mobile Control Strategies Summary

Control Program Description	Year Control Program Started	Control Scenario Notes
Pre-1990 Federal Motor Vehicle Control Program (FMVCP)	Pre-1990	Included
HGB Anti-Tampering Program	1986	Included
1992 Federal Controls on Gasoline Volatility	1992	Maximum Reid Vapor Pressure of 7.8 pounds per square inch Superseded by RFG Phase 2
Tier 1 FMVCP	1994	Included
RFG Phase 1	1995 for Phase One	Superseded by RFG Phase 2
HGB I/M Program	1997	Included
RFG Phase 2	2000 for Phase Two	Included
National Low Emission Vehicle (NLEV) Program	2001	Included
Tier 2 FMVCP	2004	Phase in 2004 to 2009
TxLED	2006	Not included in preliminary MOVES 2014 estimates
Federal Low-Sulfur Highway Diesel	2006	15 parts per million maximum sulfur content Included

Control Program Description	Year Control Program Started	Control Scenario Notes
2007 Heavy Duty FMVCP	2007	Phase in 2007 to 2010 Included
Tier 3 FMVCP	2017	Included

3. MOVES2014 PRELIMINARY EMISSIONS ESTIMATES

The MOVES model was executed for each HGB RS analysis year. The emissions summaries for each analysis year are provided Table 4: *Summary of Uncontrolled and Post-Control Emissions and RFP Control Reductions*. All MOVES2014 county databases, run specification files and output files are available in electronic format upon request from the TCEQ Emissions Assessment Section.

Table 4: Preliminary MOVES2014-Based HGB Average Summer Weekday NO_x and VOC Emissions for On-road Mobile Sources (tons per day)

Pollutant	2011	2014	2017	2020	2023	2026
NO _x	217.88	154.87	97.86	72.40	57.81	47.86
VOC	88.17	65.82	48.84	40.61	35.78	30.89

4. REFERENCES FOR GUIDANCE DOCUMENTS

EPA, 2005. *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations*, EPA-454/R-05-001, Issued By: Emissions Inventory Group, Emissions, Monitoring and Analysis Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Research Triangle Park, NC 27711, August 2005.

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