APPENDIX C

INSPECTION AND MAINTENANCE (I/M) PROGRAM PERFORMANCE STANDARD MODELING (PSM) FOR THE EXISTING I/M PROGRAM IN THE HOUSTON-GALVESTON-BRAZORIA (HGB) SIX-COUNTY 2015 OZONE NATIONAL AMBIENT AIR QUALITY STANDARD NONATTAINMENT AREA

Houston-Galveston-Brazoria Moderate Area Attainment Demonstration State Implementation Plan Revision for the 2015 Eight-Hour Ozone National Ambient Air Quality Standard

Project Number 2022-022-SIP-NR

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Electronic Attachments[1]:

[1] All four electronic attachments are available at https://www.tceq.texas.gov/downloads/air-quality/sip/ozone/houston/naaqs-2015/hgb-ad-appendix-c-electronic-attachments-1-2-3-4.zip.

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CHAPTER 1: INTRODUCTION

On November 7, 2022, the United States Environmental Protection Agency (EPA) published the final approval of Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Areas Classified as Marginal for the 2015 Ozone National Ambient Air Quality Standard (NAAQS) (87 FR 60897). This rule requires states to provide a demonstration that the existing or proposed inspection and maintenance (I/M) program for a newly designated or reclassified ozone nonattainment area meets the emissions reduction benchmarks specified for the area's ozone NAAQS classification level. The EPA interprets the I/M performance requirement to mean upon designation or reclassification that a proposed or existing I/M program must meet the I/M performance benchmark. These I/M emissions reductions should be realized in the attainment year or program implementation year.

The TCEQ performed the required performance standard modeling analysis of the five counties required to have I/M within the HGB six-county 2015 ozone nonattainment area using the requirements in the EPA guidance document, *Performance Standard Modeling for New and Existing Vehicle Inspection and Maintenance (I/M) Programs Using the MOVES Mobile Source Emissions Model* (EPA-420-B-22-034, October 2022). The TCEQ specifically used the Enhanced Performance Standard that reflects the I/M program design elements as specified in 40 Code of Federal Regulations §51.351(i). The assessment uses a 2023 analysis year, the HGB attainment year under the 2015 ozone NAAQS. The documentation of the PSM assessments is provided in Chapter 2. A summary of the results is provided in Chapter 3.

CHAPTER 2: PERFORMANCE STANDARD MODELING FOR THE EXISTING HGB I/M PROGRAM SCENARIO AND FOR THE EPA ENHANCED PERFORMANCE STANDARD SCENARIO

2.1 MODELING BACKGROUND

The PSM analysis was performed in a manner consistent with all the SIP requirements for the HGB area and the EPA guidance document, *Performance Standard Modeling for New and Existing Vehicle Inspection and Maintenance (I/M) Programs Using the MOVES Mobile Source Emissions Model* (EPA-420-B-22-034, October 2022). This report provides documentation that supports the conclusion that the HGB area I/M program meets the Enhanced Performance Standard. This documentation includes:

- A description of the existing HGB area I/M program that includes the geographic scope, tests performed and inspection frequency, vehicles covered including model years, weight classes, fuel types, etc., and other coverage information such as waiver programs;
- A description of the Enhanced Performance Standard I/M program that includes the geographic scope, tests performed and inspection frequency, vehicles covered including model years, weight classes, fuel types, etc., and other coverage information such as waiver programs;
- A description of the analysis for 2023, which is the attainment year under the HGB area 2015 ozone NAAQS;
- A reference to the emissions model, MOVES3.1, that is used;
- MOVES3.1 Run Specification (RunSpec) files – these files define the scope of the MOVES3.1 run by defining elements such as time period(s), geographical area, source types, etc., included in the modeling;
- MOVES3.1 Input Databases – input databases provide vehicle characteristics, vehicle activity, and other local conditions;
- MOVES3.1 Output Databases – output databases contain the results of the MOVES3.1 analysis;
- Post-processing calculations that demonstrate how the I/M program meets the applicable performance standard in the I/M regulations.[2]

2.2 EXISTING HOUSTON-GALVESTON-BRAZORIA I/M PROGRAM

Texas established a vehicle emissions testing program on January 1, 1995, meeting the EPA's requirements for I/M programs. Enhanced vehicle emissions inspections were implemented in Harris County on May 1, 2002, and in Brazoria, Fort Bend, Galveston, and Montgomery Counties on May 1, 2003. I/M program requirements are codified in 30 Texas Administrative Code (TAC) Section 114, Subchapter C. The design elements of the HGB I/M program as codified in the TAC include:

- Subject Vehicles and Test Frequency: Gasoline vehicles model-year 2 to 24 years old are required to have an annual emissions inspection beginning with the vehicle's second anniversary.
- Inspection Method: Model-year 1996 and newer vehicles are subject to on-board diagnostics (OBD) inspections.

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[2] *Id*

- Timing: Annual test required.
- May 1, 2002: OBD inspections began in Harris County.
- May 1, 2003: OBD inspections began in Brazoria, Fort Bend, Galveston, and Montgomery Counties.
- Testing Network: All inspection stations are required to offer OBD inspections.
- Waivers: Waivers and time extensions are available for eligible vehicle owners.
- Vehicles must successfully pass both the emissions and safety portions of the inspection before receiving a passing vehicle inspection report, which is required in order to renew the vehicle's annual registration and obtain a vehicle registration sticker.

An I/M program is characterized in MOVES3.1 through a table in the input county database file called the *IMCoverageTable*. The MOVES3.1 inputs used in the *IMCoverageTable* for the existing HGB program scenario are consistent with the I/M program as currently in place and approved in the SIP. The input values used to model the HGB I/M program design requirements in MOVES3.1 are discussed in Section 2.5 *I/M Program Parameters for Input County Database Tables (IMCOVERAGETABLE)*.

2.3 MOVES3.1 RUN SPECIFICATION

The 2023 HGB PSM analysis included modeling of two scenarios:

1. Existing HGB program scenario – this scenario represents the I/M program that is covered by the HGB SIP and is consistent with all the 2023 HGB local area parameters, control measures, and the inputs that define the existing HGB I/M program; and
2. Enhanced Performance Standard benchmark scenario – this scenario models the EPA-defined Enhanced Performance Standard benchmark program and is consistent with all the 2023 HGB local area parameters, control measures, and an I/M program with the elements of the required I/M performance standard.

For the 2023 HGB PSM analysis using MOVES3.1, the MOVES3.1 graphical user interface (GUI) was used to develop run specification (RunSpec) files for each of the 10 HGB 2015 ozone PSM scenarios, two I/M program scenarios for five counties. The PSM RunSpec selections are:

- Description Panel: For each of the 10 MOVES3.1 scenarios (two I/M programs and five counties) the description panel was used to document each of the two PSM scenarios for each of the five HGB 2015 ozone counties required to operate an I/M program. Chambers County does not have an I/M program.
- Scale Panel: On-road; County; and Inventory.
- Time Spans Panel: 2023; July; weekday; all hours.
- Geographic Bounds Panel: Five scenarios, for each scenario one of the 2023 PSM HGB 2015 ozone counties was selected, Brazoria, Fort Bend, Galveston, Harris, and Montgomery.
- On-road Vehicle Equipment Panel: All fuel type/source type combinations.
- Road Type Panel: All road types.
- Pollutants and Processes Panel: volatile organic compounds (VOC), nitrogen oxides (NO_X), all the pollutants and emission processes that MOVES3.1 needs to calculate VOC emissions, and with refueling emissions unchecked.

- General Output Panel: Output database specified with naming convention consistent with county, year, and PSM scenario; grams; miles; include distance traveled.
- Output Emissions Detail Panel: 24-Hour Day.
- Create Input Database Panel: existing input county databases (CDBs) are selected, see Section 2.4 *MOVES3.1 INPUT COUNTY DATABASES*; the option to create an input CDB is not used for the HGB 2015 ozone PSM runs.
- Advanced Performance Features Panel: not used for PSM scenarios.

The MOVES3.1 run specification files are provided in Electronic Attachment 2: *MOVES3.1 Run Specification Files for HGB 2015 Ozone NAAQS PSM.*

2.4 MOVES3.1 INPUT COUNTY DATABASES

The input county databases for the 2023 HGB PSM assessment include local activity, local meteorology, and local fuel parameters for each of the five HGB counties within the HGB 2015 ozone nonattainment area that are required to have an I/M program. The TCEQ developed, under contract to the Texas A&M Transportation Institute, MOVES3.1 input county database (CDB) files for each Texas county, for each MOVES3.1 analysis year. The MOVES3.1 input CDBs include local activity information consistent with the analysis year, local meteorological information, local fuel parameters, and existing I/M program parameters. Electronic Attachment 1: *MOVES3 On-Road Trend Emissions Inventories for 1990 and 1999 through 2060* is the Final Project Report and documents development of the county input CDBs used for the 2023 HGB 2015 ozone nonattainment area PSM modeling.

Two sets of input CDBs are required to complete the PSM MOVES3.1 runs: 1) input CDBs with the existing HGB I/M program, and 2) CDBs with the EPA's Enhanced Performance Standard I/M program. Both sets of input CDBs must include the local activity and conditions. MOVES3.1 input CDBs for each HGB county reflecting existing 2023 HGB control programs, local activity, and local conditions are used for the existing HGB I/M PSM scenario. For the benchmark EPA Enhanced Performance Standard PSM MOVES3.1 runs, all tables in the input CDB are the same except for the *IMCoverageTable*. The *IMCoverageTable* is modified for the benchmark runs to be consistent with the Enhanced Performance Standard program provided in the EPA guidance. A summary of the *IMCoverageTable* for each scenario is provided in Section 2.5 *I/M Program Parameters for Input County Database Table (IMCoverageTable).*

The MOVES3.1 input county database files are provided in Electronic Attachment 3: *MOVES3.1 Input County Database Files for HGB 2015 Ozone NAAQS PSM.*

2.5 I/M PROGRAM PARAMETERS FOR INPUT COUNTY DATABASE TABLES (IMCOVERAGETABLE)

I/M programs are characterized in MOVES3.1 through an input called the *IMCoverageTable*. The *IMCoverageTable* consists of 13 parameters, including: *polProcessID*; *stateID*; *countyID*; *yearID*; *sourceTypeID*; *fuelTypeID*; *IMProgramID*; *inspectFreq*; *testStandardsID*; *begModelYearID*; *endModelYearID*; *useIMyn*; and *complianceFactor*. The input parameters for the two 2023 HGB 2015 ozone nonattainment area PSM scenarios are summarized in Table 2-1 and Table 2-2.

Table 2-1: HGB 2023 MOVES3.1 I/M Descriptive Inputs for Existing Program for Brazoria, Fort Bend, Galveston, Harris, and Montgomery Counties for Modeling Year 2023

I/M Program ID	140	160	MOVES3.1
Pollutant Process ID	101, 102, 201, 202, 301, 302	112	MOVES3.1
Source Use Type	21, 31, 32	21, 31, 32	MOVES3.1
Begin Model Year	1999	1999	Annual testing; program specifications
End Model Year	2021	2021	Annual testing; program specifications
Inspect Frequency	1	1	Annual testing; program specifications
Test Standards Description	Exhaust OBD Check	Evaporative Gas Cap and OBD Check	Annual testing; program specifications
Test Standards ID	51	45	MOVES3.1
I/M Compliance	95.00% for source use type 21, 91.31% for source use type 31 and 71.49% for source use type 32	95.00% for source use type 21, 91.31% for source use type 31 and 71.49% for source use type 32	Latest available (2019) HGB I/M Program data for Compliance Rate, Waiver Rate and Failure Rate; and, MOVES3.1 default values for RCCA See Section 2.6

Table 2-2: HGB 2023 MOVES3.1 I/M Descriptive Inputs for EPA's Enhanced Performance Standard Program for Brazoria, Fort Bend, Galveston, Harris, and Montgomery Counties for Modeling Year 2023

I/M Program ID	111	143	151	
Pollutant Process ID	101, 102, 301, 302	112	101, 102, 301, 302	Enhanced Performance Standard Program
Source Use Type	21, 31, 32	21, 31, 32	21, 31, 32	Enhanced Performance Standard Program
Begin Model Year	1968	2001	2001	Enhanced Performance Standard Program
End Model Year	2000	2022	2022	Enhanced Performance Standard Program
Inspect Frequency	1	1	1	Enhanced Performance Standard Program
Test Standards Description	Unloaded Idle Test	Evaporative System OBD Check	Exhaust OBD Check	Enhanced Performance Standard Program

Test Standards ID	11	43	51	MOVES3.1
I/M Compliance	fuelTypeID 1: 95.77% for source use type 21, 92.05%, for source use type 31, and 72.08% for source use type 32; fuelTypeID 5: 95.77% for all source use types	fuelTypeID 1: 95.77% for source use type 21, 92.05%, for source use type 31, and 72.08% for source use type 32; fuelTypeID 5: 95.77% for all source use types	fuelTypeID 1: 95.77% for source use type 21, 92.05%, for source use type 31, and 72.08% for source use type 32; fuelTypeID 5: 95.77% for all source use types	Enhanced Performance Standard Program

2.6 SOURCES OF DATA FOR COMPLIANCE FACTOR CALCULATION

The calculation of the I/M compliance factors is consistent with the definitions, equation, and recommendations in the most recent MOVES3 Technical Guidance, Section 4.9.6, Compliance Factor. The compliance factor entered in MOVES3.1 is calculated as:

$$CF = CR \times (1 - WR \times FR) \times RCCA$$

Where:

CF = Compliance factor
CR = Compliance rate
WR = Waiver rate
FR = Failure rate
RCCA = Regulatory class coverage adjustment

For the existing program in the HGB area the I/M program data used to obtain the failure rate, waiver rate, and compliance rate are from the TCEQ Mobile Source Programs Team based on I/M operating information for the 2019 calendar year, the most recent data available at the time of this assessment. The regulatory class coverage adjustment (RCCA) factors are from Appendix A of the most recent MOVES3 Technical Guidance. The results of the calculations are summarized in Table 2-3: *HGB Existing I/M Program Compliance Factors for MOVES3.1*.

Table 2-3: HGB Existing I/M Program Compliance Factors for MOVES3.1

MOVES3.1 Modeling Parameter	Passenger Car	Passenger Truck	Light Commercial Truck
Compliance Rate (CR)	95.00%	95.00%	95.00%
Waiver Rate (WR)	0.08%	0.08%	0.08%
Failure Rate (FR)	3.59%	3.59%	3.59%
Regulatory Class Coverage Adjustment (RCCA)	100.00%	96.12%	75.26%
MOVES3.1 I/M Compliance Factor	**95.00%**	**91.31%**	**71.49%**

2.7 PROCESSING MODEL OUTPUT FOR THE ENHANCED PERFORMANCE STANDARD ASSESSMENT

Evaluating whether a proposed program meets the Enhanced Performance Standard requires showing that the proposed program grams per mile emission rates for NO_x and VOC emissions are less than the emission rates of the benchmark program plus a 0.02 grams-per-mile buffer rate. To perform this evaluation, the TCEQ converted MOVES3.1 output emissions in grams per day to the equivalent grams per mile rate. The conversion is done using one of the Structured Query Language (SQL) scripts the EPA has provided within MOVES3.1 called *EmissionRates.sql*. The *EmissionRates.sql* script computes emissions in grams per mile based upon the output from the MOVES3.1 runs in grams per day.

After each MOVES3.1 run was completed, to access the *EmissionRates.sql* script, first, an output database was specified in the General Output panel of the MOVES3.1 GUI. Once the output database was specified, an option in the Post Processing menu in MOVES3.1 provides the *EmissionRates.sql* script. The *EmissionRates.sql* script takes information from the *movesactivityoutput* table and the *movesoutput* table in the output database and produces a new table in the output database called *movesrates*. Finally, the *emissionRate* column in the *movesrates* table provides the gram-per-mile rate for each pollutant.

The *EmissionRates.sql* results are included in the output county databases for each scenario. The MOVES3.1 output county database files are provided in Electronic Attachment 4: *MOVES3.1 Output County Database Files for HGB 2015 Ozone NAAQS PSM*. A summary of the PSM results for the HGB 2015 ozone nonattainment area is provided in Chapter 3: *Summary of Results for Performance Standard Modeling*.

CHAPTER 3: SUMMARY OF RESULTS FOR PERFORMANCE STANDARD MODELING

The TCEQ performed MOVES3.1 runs and post-processing for the existing HGB I/M Program and the Enhanced Performance Standard. The assessment uses a 2023 analysis year. The PSM analysis includes each of the five counties in the HGB 2015 ozone nonattainment area in which the HGB I/M program is required to operate. Chambers County does not have an I/M program. All required documentation for the I/M program performance standard benchmark assessment is provided in Chapter 2: *Performance Standard Modeling for the Existing HGB I/M Program Scenario and for the EPA Enhanced Performance Standard Scenario.*

Evaluating whether an existing I/M program meets the Enhanced Performance Standard requires demonstrating that the existing program emission rates for NO_X and VOC do not exceed the benchmark program's emission rates plus a 0.02 grams-per-mile buffer. The analysis demonstrates that the existing HGB area I/M program emissions rates are lower than the performance standard benchmark-plus-buffer emission rates for every county with an I/M program in the HGB 2015 ozone nonattainment area. Therefore, the HGB area I/M program performance requirement is met. Summaries of the HGB 2015 ozone nonattainment area I/M PSM analysis are provided in:

- Table 3-1: *Summary of NO_X Performance Standard Evaluation for HGB 2015 Ozone NAAQS Nonattainment Area Existing I/M Program*; and
- Table 3-2: *Summary of VOC Performance Standard Evaluation for HGB 2015 Ozone NAAQS Nonattainment Area Existing I/M Program.*

Table 3-1: Summary of NO_X Performance Standard Evaluation for HGB 2015 Ozone NAAQS Nonattainment Area Existing I/M Program

County	I/M Program NO_X Emission Rate	I/M NO_X Performance Standard Benchmark	I/M NO_X Performance Standard Benchmark Plus Buffer	Does Existing Program Meet I/M Performance Standard?
Brazoria	0.29	0.29	0.31	Yes
Fort Bend	0.27	0.27	0.29	Yes
Galveston	0.24	0.24	0.26	Yes
Harris	0.26	0.26	0.28	Yes
Montgomery	0.28	0.28	0.30	Yes

Table 3-2: Summary of VOC Performance Standard Evaluation for HGB 2015 Ozone NAAQS Nonattainment Area Existing I/M Program

County	I/M Program VOC Emission Rate	I/M VOC Performance Standard Benchmark	I/M VOC Performance Standard Benchmark Plus Buffer	Does Existing Program Meet I/M Performance Standard?
Brazoria	0.17	0.17	0.19	Yes
Fort Bend	0.19	0.20	0.22	Yes
Galveston	0.17	0.18	0.20	Yes
Harris	0.14	0.14	0.16	Yes

County	I/M Program VOC Emission Rate	I/M VOC Performance Standard Benchmark	I/M VOC Performance Standard Benchmark Plus Buffer	Does Existing Program Meet I/M Performance Standard?
Montgomery	0.16	0.16	0.18	Yes