North Central Texas
Council of Governments
Transportation Department

DALLAS-FORT WORTH
DIESEL FRACTION STUDY

Sponsored by the
Texas Commission On
Environmental Quality

August 2005

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ABSTRACT

TITLE: Dallas-Fort Worth Diesel Fraction Study

DATE: August 2005

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SUBJECT: Diesel Fraction Study for Dallas-Fort Worth Region representing Rural, Urban and Perimeter County Characteristics

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ABSTRACT: The purpose of this document is to report emission sensitivity of the diesel fraction and vehicle age distribution for diesel vehicle classes in MOBILE modeling. The document addresses how to reduce the variation in emissions by including interaction between the counties that account for commuter flow and regional distribution of heavy-duty vehicle travel.

DIESEL FRACTION STUDY

BACKGROUND

The Texas Commission on Environmental Quality (TCEQ) works with local planning agencies and the Texas Department of Transportation (TxDOT) to establish on-road mobile source emission inventories. An on-road emission inventory is one category of emission inventories necessary to develop a State Implementation Plan (SIP) for nonattainment areas. Nonattainment areas are regions that do not meet National Ambient Air Quality Standards (NAAQS) set by the United States Environmental Protection Agency (EPA).

TCEQ, the State's environmental agency, is responsible for developing a SIP that demonstrates how a nonattainment area will best achieve the air quality standards. As on-road mobile is a key part of the SIP, transportation agencies should provide the latest and most accurate transportation data available that best represents local area travel and vehicle characteristics, as SIPs place limits on on-road mobile emissions. These on-road mobile emission limits are termed motor vehicle emission budgets (MVEBs) and have a direct impact on transportation planning.

The North Central Texas Council of Governments (NCTCOG) serves as the Metropolitan Planning Organization for transportation in the Dallas-Fort Worth (DFW) area and is responsible for developing and maintaining on-road mobile source emission inventories for the DFW nonattainment area. NCTCOG uses a four-step travel demand model process in TransCAD software to forecast regional vehicle activity and MOBILE6.2.03 (EPA MOBILE Emission Factor Model) with Texas Transportation Institute (TTI) post-processing application (Texas Mobile Source Emission Software) to estimate mobile source emissions within the region.

NCTCOG used EPA's MOBILE6 Model to calculate regional emission factors by vehicle class for three criteria pollutants: Hydrocarbon (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx). When available, local input data is supplied to better estimate local emissions. If no local data is available, MOBILE6 applies a national average default value. The national average default value may not reflect the unique characteristics of the counties within the DFW nonattainment area. Therefore, applying local data is preferred to produce the desired region specific results to better represent the local area.

INTRODUCTION

MOBILE6 provides more advanced modeling scenarios than previous MOBILE versions used within the region, for example, with expanded vehicle classification types to 28 vehicle types from 8 vehicle types in MOBILE5. In an effort to limit the use of national defaults in emission modeling, NCTCOG applies local input data related to meteorological conditions, vehicle fleet age distribution, vehicle activity related input, and State programs to name a few. Some of the MOBILE model data inputs are more sensitive than others when developing final emission factors. Care must be taken when collecting and applying local data to best represent the local area appropriately. One set of local data that is available annually is vehicle registration data. Vehicle registration data is used to develop vehicle age distributions and diesel fractions that feed into MOBILE6 as input values. A variation in any one of these input values has an effect on the final emission factors that can range up to a 20 to 30 percent change in emission results. This significant change in vehicle emission results can have a direct effect on transportation planning.

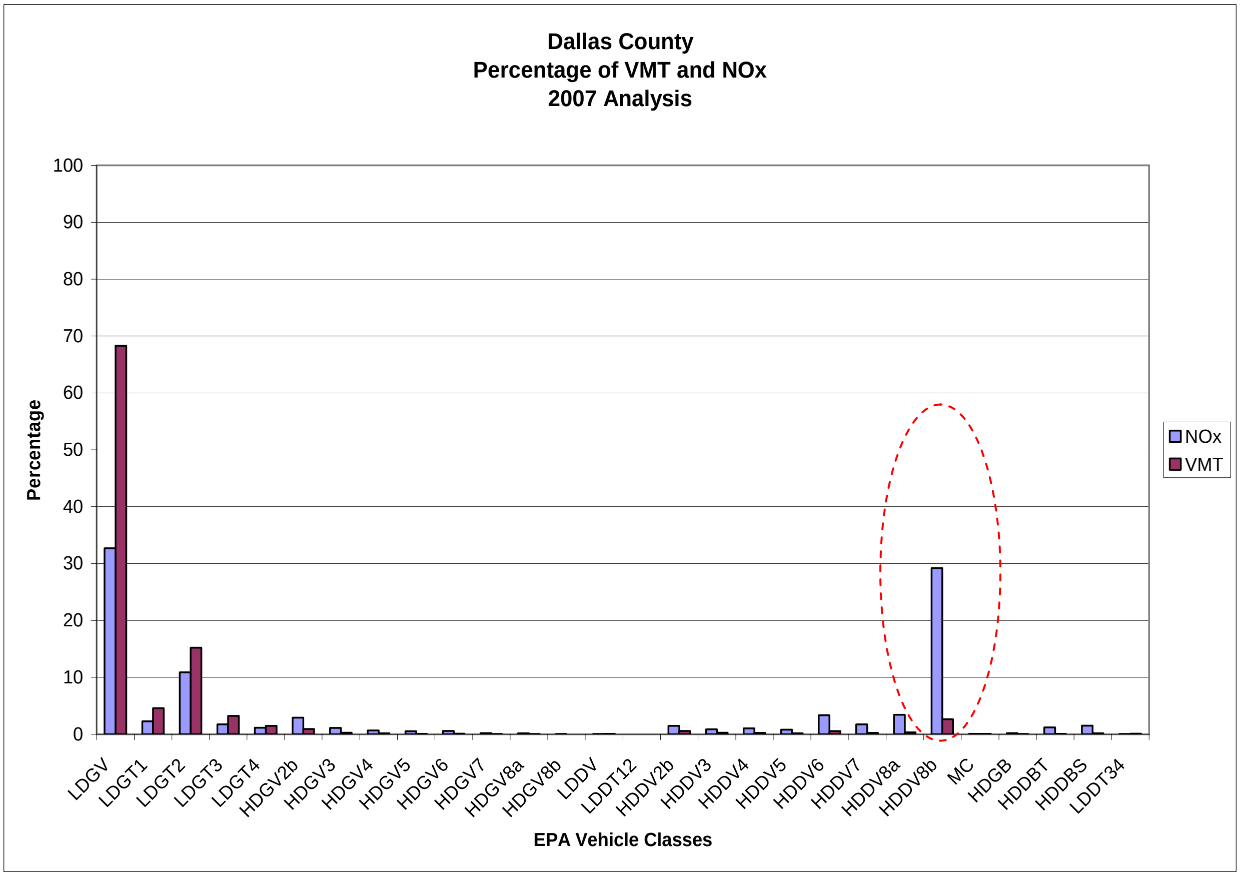
NCTCOG selected Dallas County to help demonstrate the significant variation in emission results based on changes in vehicle registration data used in MOBILE. Also, with the increasing number of vehicle types to 28 classes, some of these 28 vehicle classes have a small number of registered vehicles within the county that can significantly impact emissions of a particular vehicle class. Dallas County was selected because of its regional representation and for its major contribution of vehicle emissions to the region.

Exhibit 1 depicts that the two highest NOx contributors in Dallas County are light-duty gasoline vehicles (LDGV) and heavy-duty diesel vehicle class 8b (HDDV8b) emissions out of EPA's 28 vehicle classes recorded. The graph shows vehicle miles traveled (VMT) for light-duty gasoline vehicles at 68.3 percent and the total contribution of NOx emission at 32.7 percent. The graph also shows the VMT for heavy-duty diesel vehicle class 8b (HDDV8b) at 2.6 percent and the total contribution of NOx emission at 29.2 percent. Dallas County is a good representation of the other regional urban counties in North Central Texas for this comparison of vehicle classes.

These two vehicle classes help establish outer limits. First, as shown in Exhibit 1, the light-duty gasoline class has the lowest NOx to VMT ratio of approximately 1:2. This depicts that the percentage of NOx emitted in this class is half of the vehicle activity percentage in this vehicle class. Therefore, a low regional NOx emission factor for LDGV in Dallas County. Second, the heavy-duty diesel vehicle class has the highest NOx to VMT ratio of approximately 11:1. This depicts that the percentage on NOx emitted is from HDDV8b class is about eleven times greater than the VMT percentage of this vehicle class. The high regional NOx emission factor for HDDV8b can cause significant fluctuations in regional NOx emissions due to slight variations in modeling assumptions. For example, slight variations in the emission factors caused by diesel fraction or vehicle age distribution can greatly impact regional emission percentages. This modeled emission variation can be unreasonable compared to the regional emissions emitted.

EXHIBIT 1

COMPARISON OF VEHICLE MILES TRAVELED (VMT) VERSUS NOx EMISSIONS



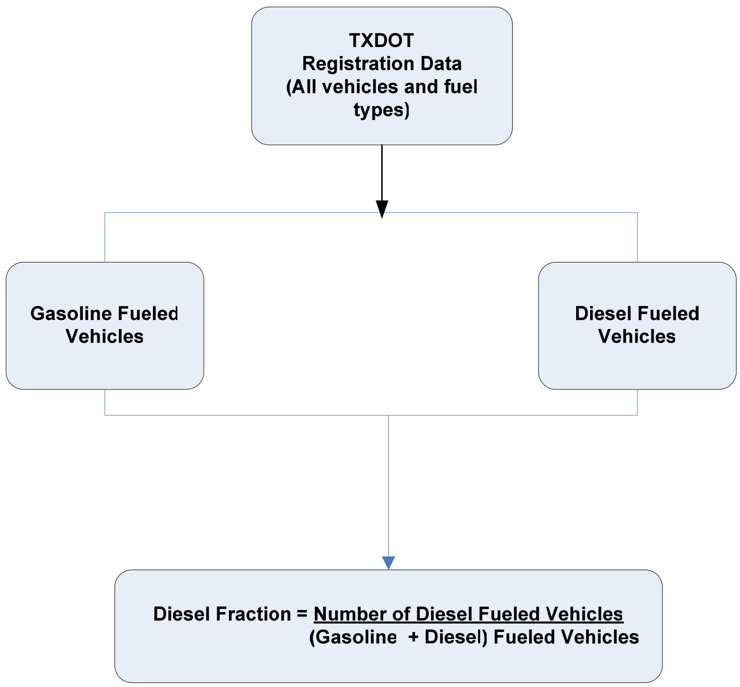
In this study, NCTCOG will identify ways to reduce variations in modeled emission factors by incorporating demographic traffic characteristics specific to the region in calculating diesel fractions and age distribution. HDDV8b will be the vehicle class of concentration in this study, as a low total number of registered vehicles in this class by county may lead to significant variations in emission levels.

DIESEL FRACTION CALCULATION

A diesel fraction is the percentage of diesel vehicles in a particular vehicle class. TxDOT vehicle registration data is used to calculate registration distribution by vehicle age and class. Vehicle registration data is further disaggregated into either gasoline or diesel fuel vehicle type to calculate the percentage of diesel vehicles in each year by class which is known as diesel fraction as shown in Exhibit 2. Diesel fractions should be consistent with the vehicle registration data. Emission factors for each vehicle class for gasoline and diesel vehicles are calculated based on registration and diesel fraction.

EXHIBIT 2

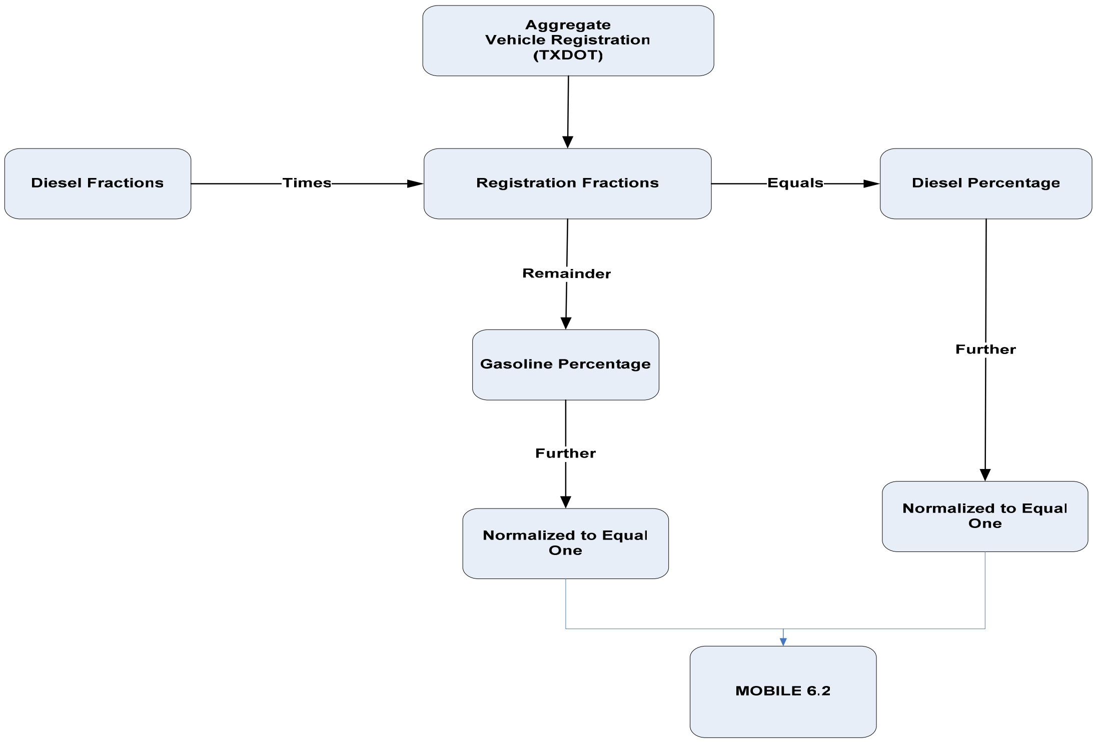
DIESEL FRACTION CALCULATION



Emission factors are sensitive to changes in the diesel fraction; any change made to diesel fraction directly impacts the gasoline fraction as shown in Exhibit 3. A variation in diesel fractions year by year is carried through the calculation process and may lead to significant changes in the overall emission reported. Examples of these emission impacts are shown later in the report.

EXHIBIT 3

DIESEL FRACTION DISTRIBUTION PROCESS



DIESEL FRACTION DISTRIBUTION EFFECTS

The distribution effects of diesel fractions have a significant impact on emission levels. This is because diesel emission factors are the weighted average of diesel fractions over a 25-year period. Typically, older modeled vehicles have higher emission factors; therefore emit greater amounts of emission per equal distance traveled. Small changes in diesel fractions can significantly alter the diesel vehicle age distribution. MOBILE6 normalizes diesel fractions and gasoline fractions to equal one. If there are only a few diesel vehicles of the heavy-duty class registered in a county for a certain model year, then the diesel fraction will be distributed between those years and normalized to one which does not accurately reflect diesel activity in that county. Furthermore, the emission factors will be weighted by those few years, which produce emission factors based on too few vehicles as shown in Exhibits 4 and 5.

EXHIBIT 4

EXAMPLE OF FIVE YEAR WEIGHTED EMISSION FACTOR

Model Year	NOx	Diesel Percentage	Emission Factor (EF)
2003	9.09	0.20	1.82
2004	7.58	0.20	1.52
2005	7.47	0.20	1.50
2006	7.35	0.20	1.47
2007	3.88	0.20	0.78
Weighted Emission Factor			**7.08**

EXHIBIT 5

TWO YEAR WEIGHTED EMISSION FACTOR

Model Year	NOx	Diesel Percentage	Emission Factor (EF)
2003	9.09	0.50	4.54
2004	7.58	0.50	3.79
2005	7.47	0.00	0.00
2006	7.35	0.00	0.00
2007	3.88	0.00	0.00
Weighted Emission Factor			**8.34**

From the two examples in Exhibits 4 and 5, you can see that a change in age distribution can change the emission factor by 18 percent. In other words, we can say that inconsistent diesel fractions of a certain vehicle class may result in high or low emission factors. This emission factor represents the vehicle class and is multiplied by the VMT resulting in erroneous emissions. Also, there are vehicles traveling from other counties, regions, and states that influence the emissions in a county. Therefore, the outside influence of these vehicles is reviewed in this study.

METHODOLOGY

County-to-County Worker Flow

Vehicles registered in one county may often travel to another county for work or pleasure. A majority of the modeled trips are work related. The nine nonattainment counties of the DFW region are grouped into urban counties (Dallas and Tarrant), rural counties (Collin and Denton) and perimeter counties (Ellis, Johnson, Kaufman, Parker, and Rockwall). Since Dallas and Tarrant are urban counties, surrounding county residents commute to work in Dallas and Tarrant Counties in large percentages. Therefore, it would not be realistic to consider vehicles registered only in Dallas County for modeling purposes. EPA has 28 vehicle classes, generally Light-Duty Vehicles (LDV) shown in Exhibit 6, used daily to travel to work, and so NCTCOG has applied percentages based on Census 2000 county-to-county worker flow as shown in Exhibit 7. For a better understanding, Exhibit 8 is provided, where residents of different counties travel to Dallas County for work. Counties bordering the nine nonattainment counties of DFW contribute a small percentage of workflow. Therefore, it is assumed that vehicle influx will be equal to outflux from these counties. The full 28-vehicle classification list is available in Appendix A.

EXHIBIT 6

MOBILE6 VEHICLE CLASSIFICATION

Abbreviation	Description
LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, greater than 5,751 lbs. ALVW)
LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
LDDT12	Light-Duty Diesel Trucks 1and 2 (0-6,000 lbs. GVWR)
HDGB	Gasoline Buses (School, Transit and Urban)
HDDBT	Diesel Transit and Urban Buses
HDDBS	Diesel School Buses
LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

Source: U.S. EPA, OTAQ, MOBILE6.2 User's Guide (August 2003).

EXHIBIT 7

COUNTY-TO-COUNTY WORKER FLOW (CENSUS 2000)

County of Work

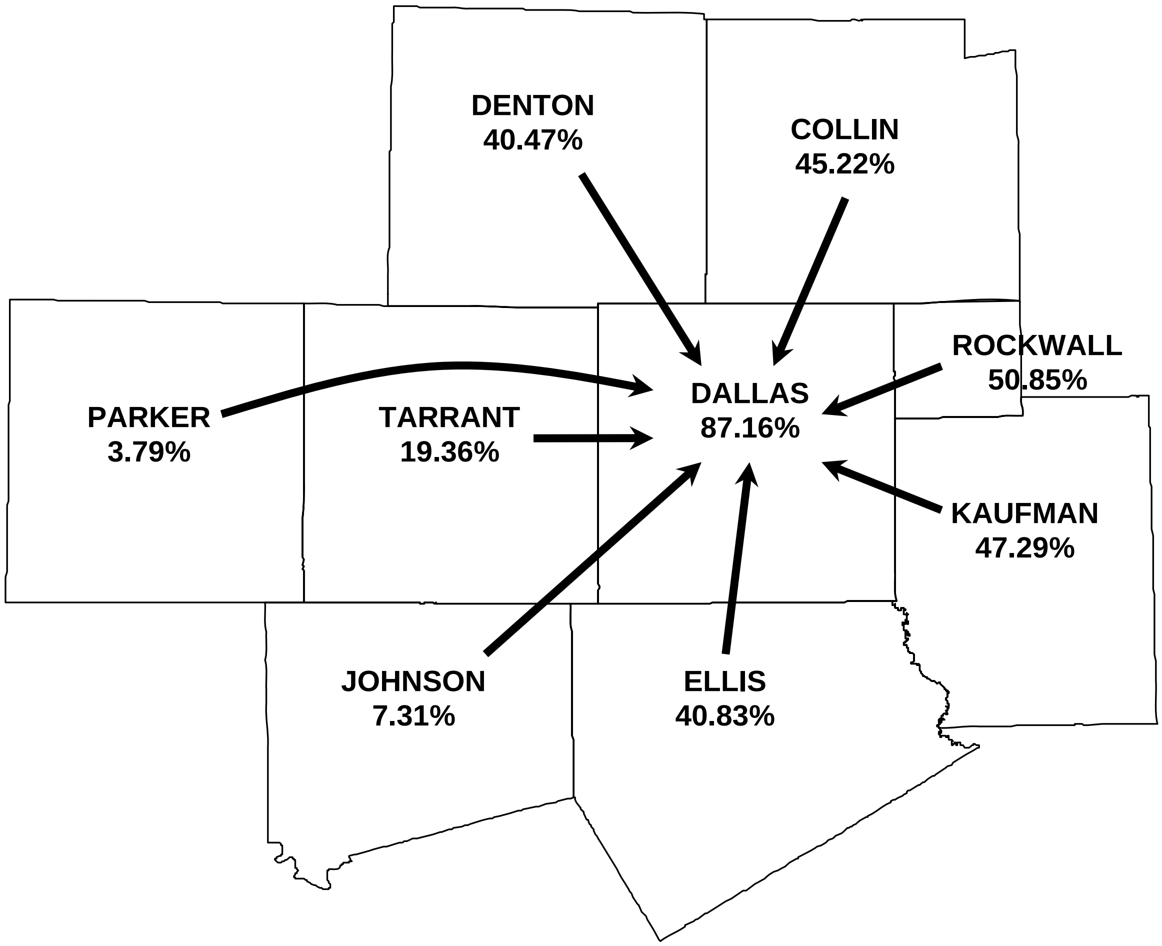
County of Residence

County	Collin	Dallas*	Denton	Ellis	Johnson	Kaufman	Parker	Rockwall	Tarrant	Others	Total
Collin	48.66%	45.22%	1.97%	0.04%	0.02%	0.09%	0.06%	0.30%	1.32%	2.32%	**100.00%**
Dallas	4.62%	87.16%	1.28%	0.33%	0.06%	0.27%	0.04%	0.33%	4.47%	1.44%	**100.00%**
Denton	6.32%	40.47%	43.96%	0.08%	0.03%	0.04%	0.07%	0.03%	6.71%	2.29%	**100.00%**
Ellis	1.11%	40.83%	0.26%	48.59%	0.88%	0.20%	0.02%	0.06%	5.27%	2.78%	**100.00%**
Johnson	0.33%	7.31%	0.54%	2.23%	42.37%	0.05%	0.53%	0.03%	43.44%	3.17%	**100.00%**
Kaufman	1.79%	47.29%	0.53%	0.56%	0.03%	42.75%	0.03%	1.08%	1.74%	4.20%	**100.00%**
Parker	0.27%	3.79%	0.79%	0.14%	0.40%	0.00%	40.64%	0.00%	48.72%	5.25%	**100.00%**
Rockwall	6.51%	50.85%	0.58%	0.12%	0.18%	1.94%	0.00%	33.91%	1.31%	4.60%	**100.00%**
Tarrant	0.53%	19.36%	1.32%	0.24%	0.56%	0.03%	0.36%	0.02%	75.98%	1.60%	**100.00%**

* Dallas County workforce contains 45.22% workers from Collin County, 87.16% of workers from Dallas County, and so on.

EXHIBIT 8

RESIDENTS OF OTHER COUNTIES TRAVELING TO DALLAS COUNTY FOR WORK



Modeled Interaction (TransCAD)

The heavy-duty vehicles category includes all heavy-duty diesel vehicle (HDDV) classes and heavy-duty gasoline vehicle (HDGV) classes. The travel behavior of heavy-duty vehicles (HDV) is different than that of LDV. There are no distinct percentages of county-to-county interaction for HDV, so NCTCOG used the TransCAD-based travel demand model output to derive a percentage of interaction. Truck origin-destination (O-D) matrix was used to estimate the aggregate trips made between counties. Truck interaction percentages were developed from the modeled aggregate trips as shown in Exhibit 9. Furthermore, these percentages were applied to truck registration data to account for the truck interaction.

EXHIBIT 9

TRUCK INTERACTION FROM DALLAS-FORT WORTH TRAVEL DEMAND MODEL ORIGIN-DESTINATION MATRIX

Destination County

County	Collin	Dallas*	Denton	Ellis	Johnson	Kaufman	Parker	Rockwall	Tarrant
Collin	40.28%	41.70%	8.59%	2.27%	0.14%	0.35%	0.15%	1.19%	5.31%
Dallas	8.54%	65.83%	4.72%	2.83%	0.40%	2.24%	0.52%	1.63%	13.29%
Denton	9.50%	25.48%	43.42%	1.50%	1.61%	1.64%	1.04%	0.25%	15.55%
Ellis	5.84%	35.51%	3.49%	31.69%	2.42%	4.23%	1.24%	5.77%	9.81%
Johnson	0.48%	6.67%	4.92%	3.18%	50.02%	0.55%	2.45%	0.07%	31.66%
Kaufman	1.55%	48.58%	6.59%	7.29%	0.72%	14.67%	8.01%	1.00%	11.60%
Parker	0.75%	12.53%	4.66%	2.38%	3.57%	8.90%	8.70%	1.24%	57.28%
Rockwall	5.46%	36.60%	1.02%	10.29%	0.09%	1.03%	1.15%	38.90%	5.46%
Tarrant	1.77%	21.58%	4.67%	1.27%	3.11%	0.87%	3.86%	0.40%	62.48%

* Dallas County truck trips contains 41.70% trips from Collin County, 65.83% of trips from Dallas County, and so on

Regional Data

The majority of travel for LDV is home-based work trips (HWB). HDV tend to travel in several different counties in a day depending upon the stops and nature of the work such as deliveries. In these cases it would not be reasonable to account for HDV interaction between one county and another. Instead, NCTCOG summed the HDV classes for all nine nonattainment counties to obtain a region-specific diesel fraction and age distribution. This diesel fraction is then applied for all counties included in summation.

Statewide Data

HDV data for EPA vehicle classes HDDV8a and HDDV8b for all 254 counties was summed to provide a statewide diesel fraction, since HDV travel across counties, regions, and even states. The travel of HDDV8b is mainly on freeways and is responsible for a significant portion of emissions in the DFW region.

DATA AND TOOLS USED

The data for this study include:

- TxDOT 2004 vehicle registration data. This was used to construct age distribution and diesel fraction.
- NCTCOG 2007 Transportation network. This was used to develop vehicle activity data, weekday trip lengths, and AM-peak, PM-peak, Off-peak VMT mix.
- Inspection and Maintenance (I/M) and Anti-Tampering Program (ATP) specific to county (provided by TCEQ).
- EPA defaults were used for the MOBILE inputs where local data was not available.
- Zeroes in diesel fraction for the HDDV8b class was forced to 0.95 (TCEQ technical recommendation).

The tools used for this study include:

- EPA MOBILE6.2.03. This was used to calculate emission factors. This version was released in November 2003.

- Texas Mobile Source Emissions software developed by TTI. This is used to estimate total emissions.

- Dallas-Fort Worth Regional Travel Model (DFWRTM) was used to model vehicle activity. TransCAD software was used for the DFWRTM.

- TxDOT 2003 Highway Performance Monitoring System (HPMS). This data was used for perimeter counties. 2003 HPMS data was not available at the time of this study.

MODELED SCENARIOS

NCTCOG wanted to analyze the effect of commuter interaction for LDV and DFWRTM interaction for HDV for counties that represented urban, rural, and perimeter characteristics. To reduce and easily replicate the effort, NCTCOG considered Dallas County for the urban counties; Collin County for rural counties; and Kaufman County for perimeter counties instead of an individual analysis of each of the nine nonattainment counties. Model Scenario description is given in Exhibit 10.

Appendix B contains the diesel fractions used for the Base Case and all other scenarios. To support the diesel fractions, Appendix C contains the registration distribution used in conjunction with the diesel fractions. When looking at the Scenario Descriptions in Exhibit 10, both Appendix B and C can be used to see the differences between scenarios.

EXHIBIT 10

SCENARIO DESCRIPTION

	LDV	HDV 2b-7	HDV 8a and 8b
SCENARIO-1 (Base Case)	Commuter worker flow interaction between four core counties and five perimeter counties with no commuter workflow interaction applied.	TxDOT nine counties summed without undergoing any changes by interaction.	TxDOT nine counties summed without undergoing any changes by interaction.
SCENARIO-2	From Census 2000, commuter worker flow interaction for all nine counties was applied.	From TransCAD, origin-destination trips were calculated for heavy-duty trucks to identify a HDV interaction and percentages were applied for all nine counties. After applying the percentages we summed nine counties according to vehicle class.	From TransCAD, origin-destination trips were calculated for heavy-duty trucks and the percentages were applied for all nine counties. After applying the percentages we summed nine counties according to vehicle class.
SCENARIO-3a	From Census 2000, commuter worker flow interaction for all nine counties was applied.	From TransCAD, origin-destination trips were calculated for heavy-duty trucks and the percentages were applied for all nine counties. After applying the percentages we considered county-specific data.	From TransCAD, origin-destination trips were calculated for heavy-duty trucks and the percentages were applied for all nine counties. After applying the percentages we considered countywide data.
SCENARIO-4	From Census 2000, commuter worker flow interaction for all nine counties was applied.	TxDOT county-specific registration data was used directly without undergoing any changes by HDV interaction.	TxDOT countywide registration data was used directly without undergoing any changes by interaction.
SCENARIO-5	From Census 2000, commuter worker flow interaction for all nine counties was applied.	From TransCAD, origin-destination trips were calculated for heavy-duty trucks and the percentages were applied for all nine counties. After applying the percentages we considered county-specific data.	TxDOT was used for this class statewide.
SCENARIO-6	From Census 2000, commuter worker flow interaction for all nine counties was applied.	TxDOT nine counties summed without undergoing any changes by interaction.	TxDOT nine counties summed without undergoing any changes by interaction.

Note: all scenarios were performed using 2004 TxDOT vehicle registration data and a 2007 transportation network.

RESULTS AND OBSERVATIONS

Modeled Scenario-4 utilized TxDOT county-specific vehicle age distribution and diesel fraction without any commuter or DFWRTM interaction. The NOx emissions for rural county and urban county modeled in Scenario-4 decreased by 0.64 tons/day and 0.73 tons/day compared to Base Case (Scenario-1) respectively as shown in Exhibits 11 and 12. Perimeter County NOx emissions increased by 5.1 tons/day as shown in Exhibit 13. NCTCOG also used county specific vehicle age distribution and diesel fraction after applying HDV percentages based on DFWRTM in Scenario-3, which produced much better results when compared to Scenario-4.

EXHIBIT 11

RURAL COUNTY NOx EMISSIONS FROM MODELED SCENARIOS

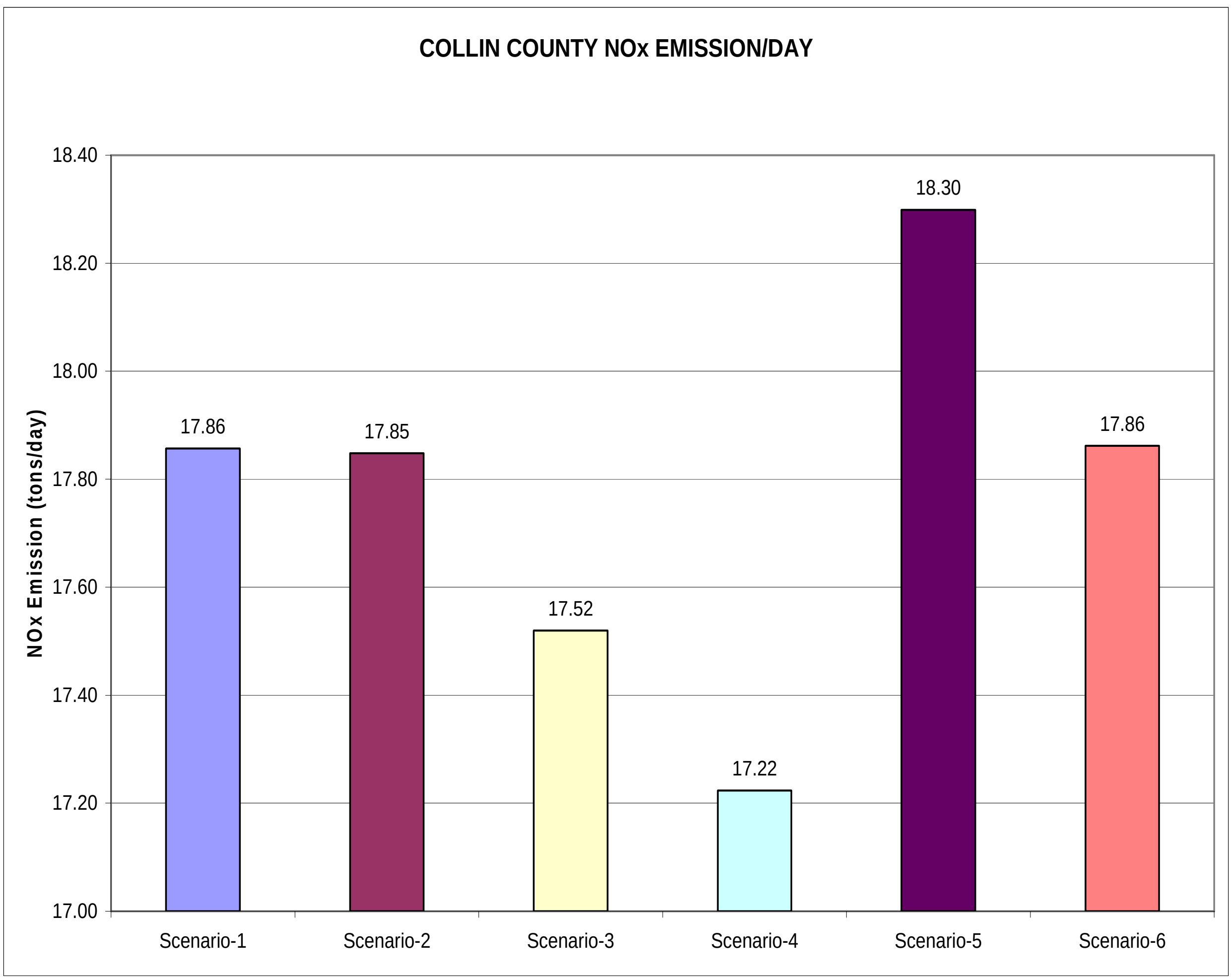


EXHIBIT 12

URBAN COUNTY NOx EMISSIONS FROM MODELED SCENARIOS

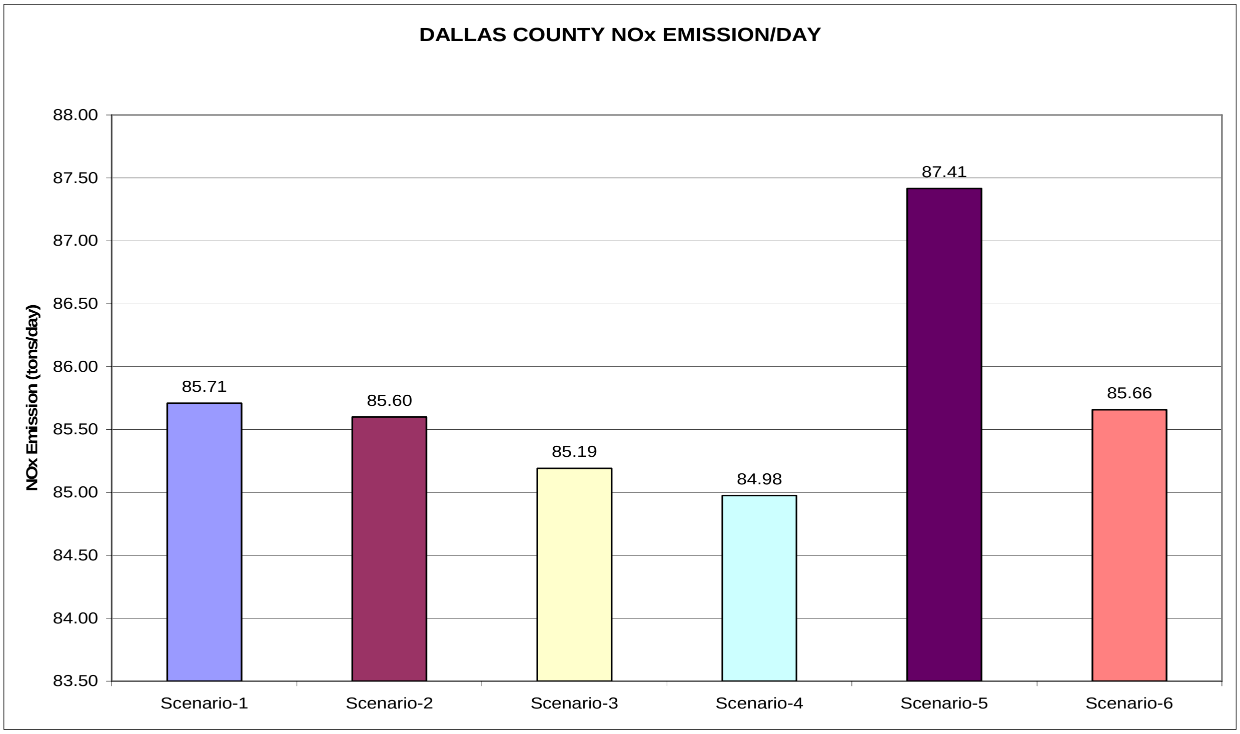
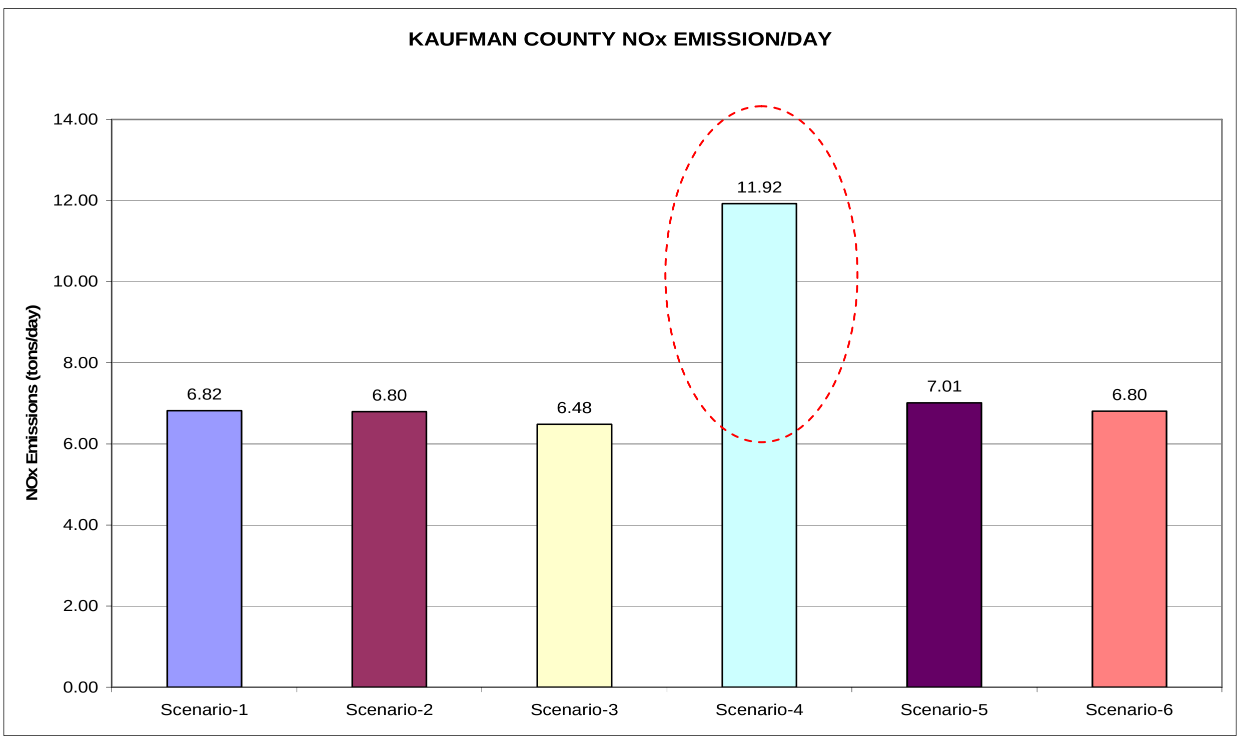


EXHIBIT 13

PERIMETER COUNTY NOx EMISSIONS FROM MODELED SCENARIOS



NCTCOG explored more to find the cause of high variations in the NOx emissions between Scenarios 4 and the Base Case. HDV portion was analyzed first and it was concluded from Exhibits 14, 15, and 16 that HDDV8b class was responsible for high variation in the NOx emissions. HDDV8b class was analyzed in detail for all the counties and it was identified that a total 5.1 tons/day increase in NOx emission for the Perimeter County in Scenario-4 HDDV8b contribution was 5.08 tons/day, as shown circled in Exhibit 17.

EXHIBIT 14

RURAL HDDV NOx EMISSIONS FROM MODELED SCENARIOS

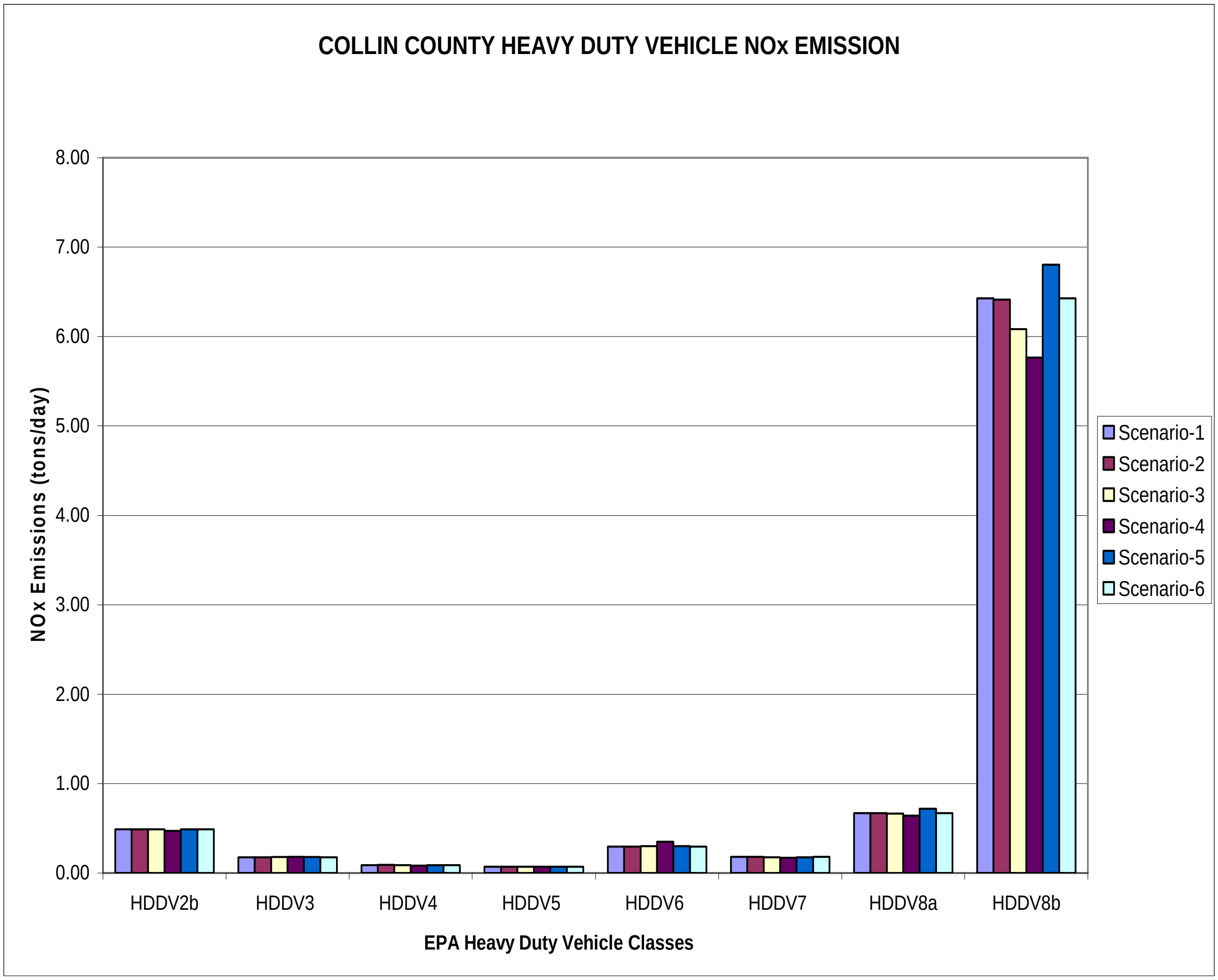


EXHIBIT 15

URBAN HDDV NOx EMISSIONS FROM MODELED SCENARIOS

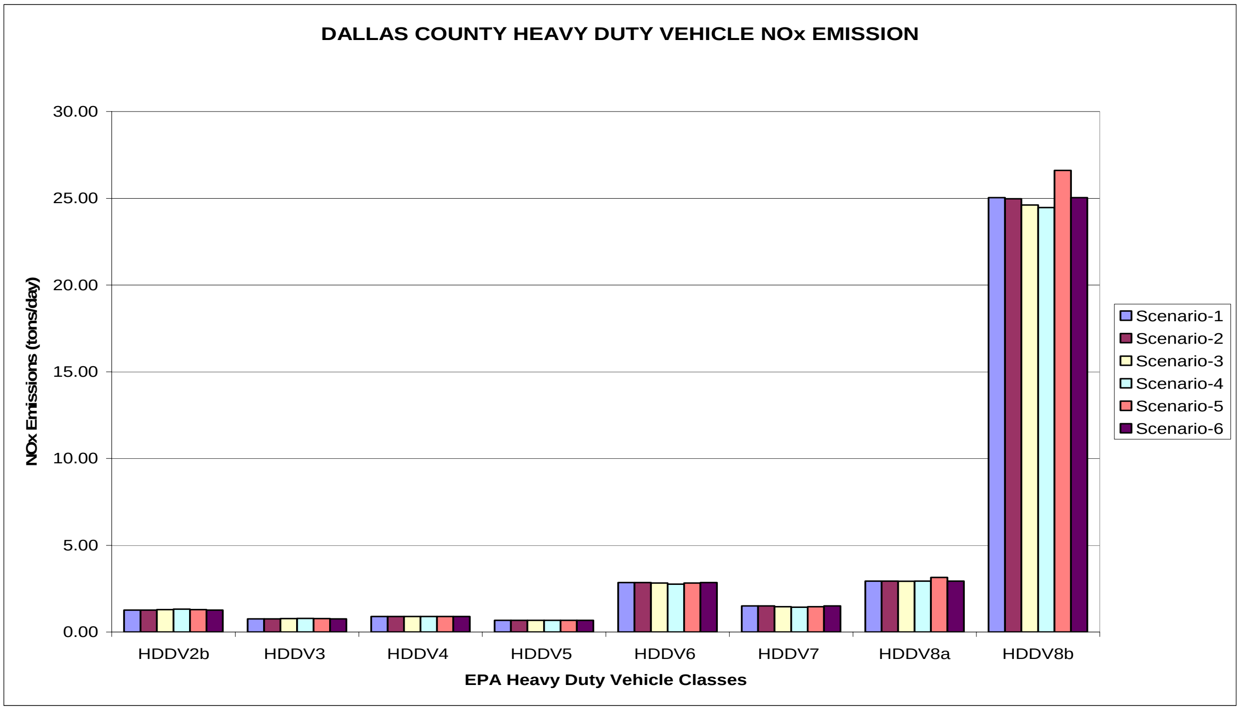


EXHIBIT 16

PERIMETER HDDV NOx EMISSIONS FROM MODELED SCENARIOS

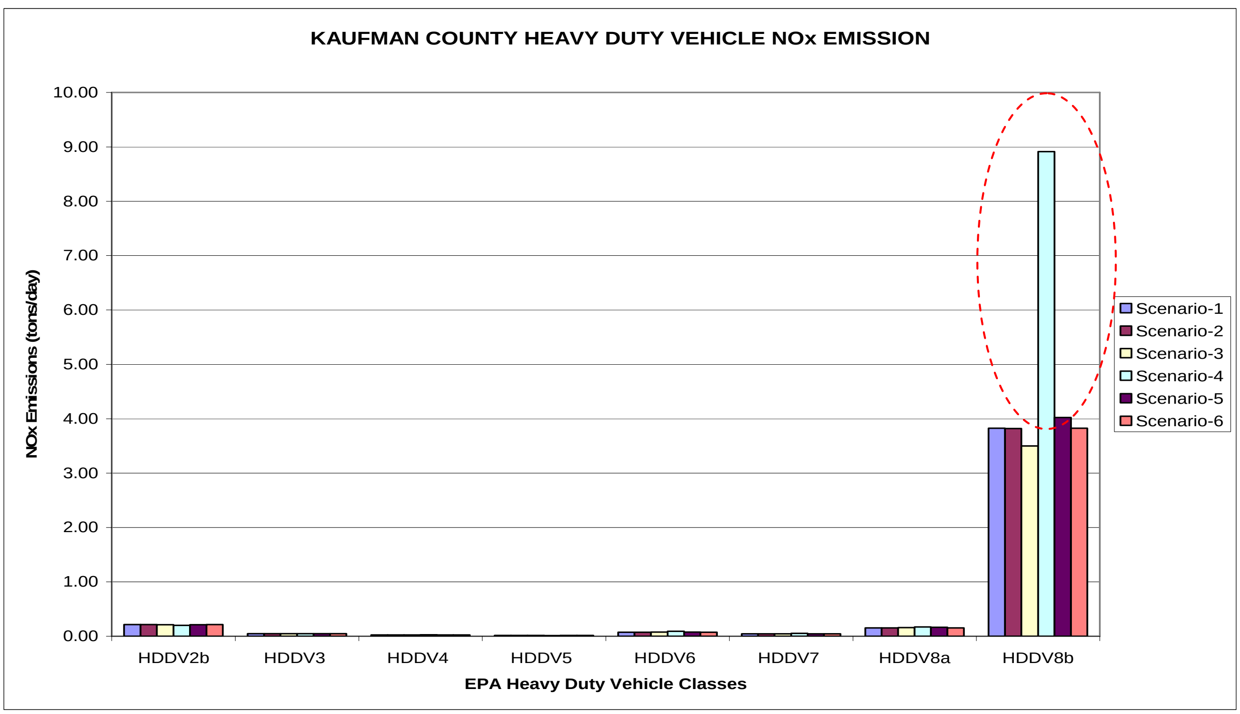
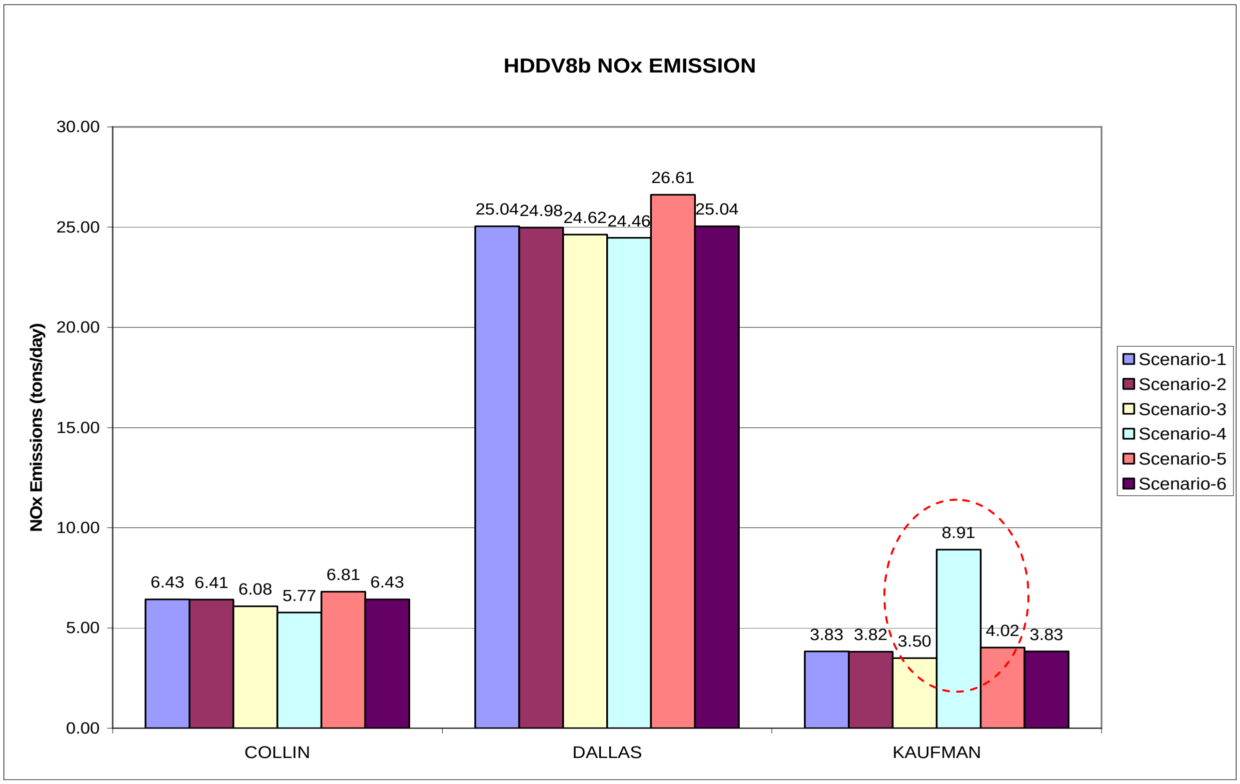


EXHIBIT 17

HDDV8B NOx EMISSIONS FROM MODELED SCENARIOS



NCTCOG also looked at daily emission factors for all the scenarios and found that heavy-duty gasoline vehicle class 8b (HDGV8b) NOx emissions for Rural County was high in Scenario-4 as shown in Exhibit 18, but still total emission for Rural County in Scenario-4 was not affected because VMT mix percentage for HDGV8b class was much less. Urban County did not show high variations in the daily emission factors as shown in Exhibit 19. Perimeter County as expected had a very high daily emission factor for HDDV8b class for Scenario-4, which is evident from Exhibit 20, and this vehicle class also had good VMT mix percentage, which produced high emissions. HDGV8b class also showed an increase in NOx emission factor but did not produce high emissions because of low VMT mix percentage.

EXHIBIT 18

RURAL COUNTY MOBILE6.2 NOx EMISSION FACTORS FOR MODELED SCENARIOS

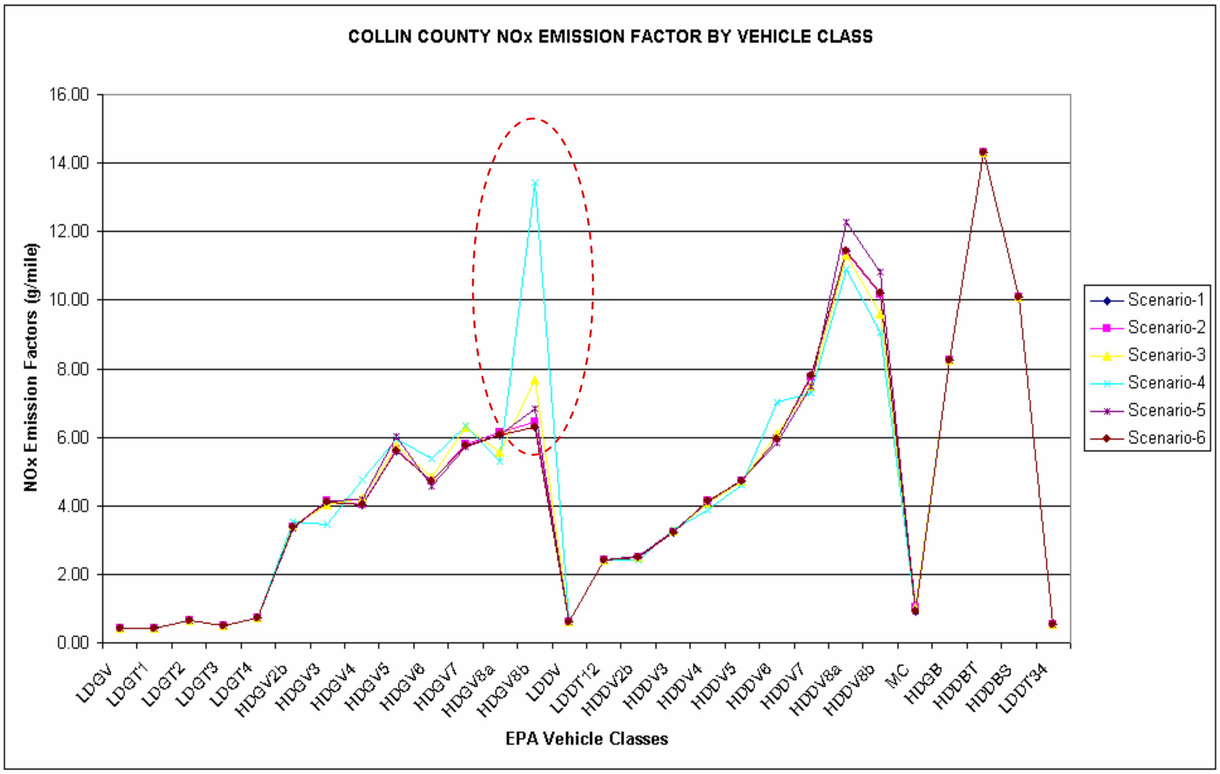


EXHIBIT 19

URBAN COUNTY MOBILE6.2 NOx EMISSION FACTORS FOR MODELED SCENARIOS

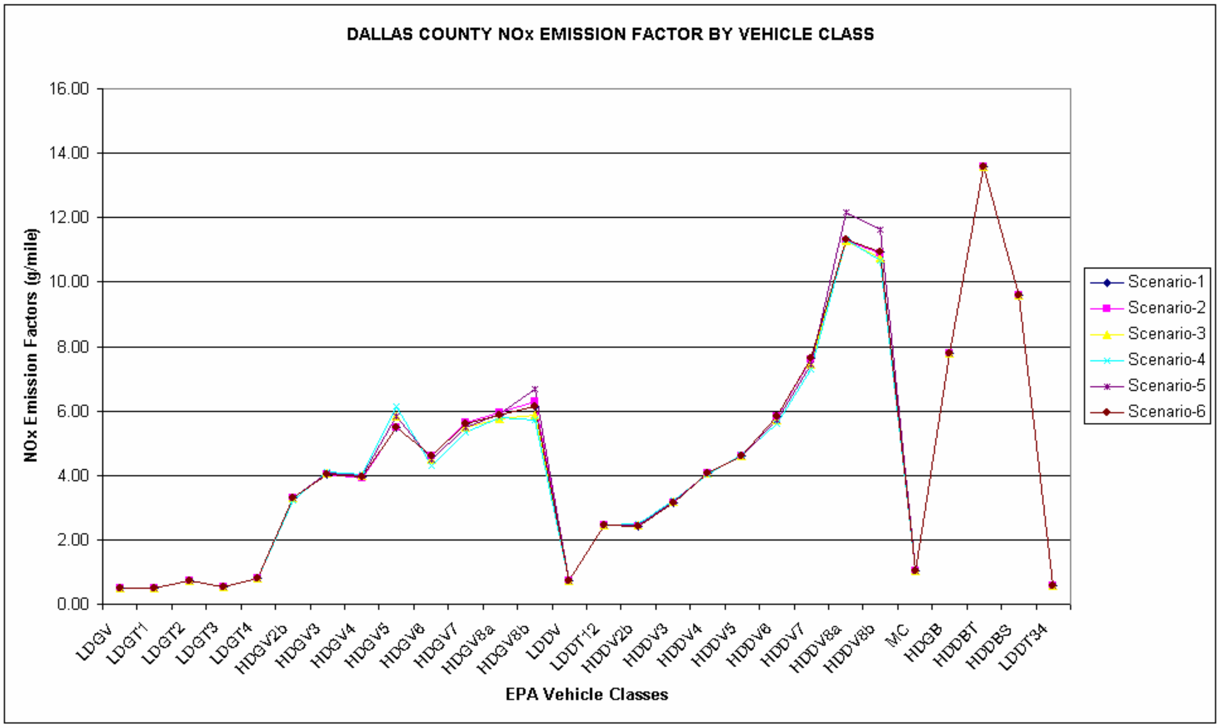
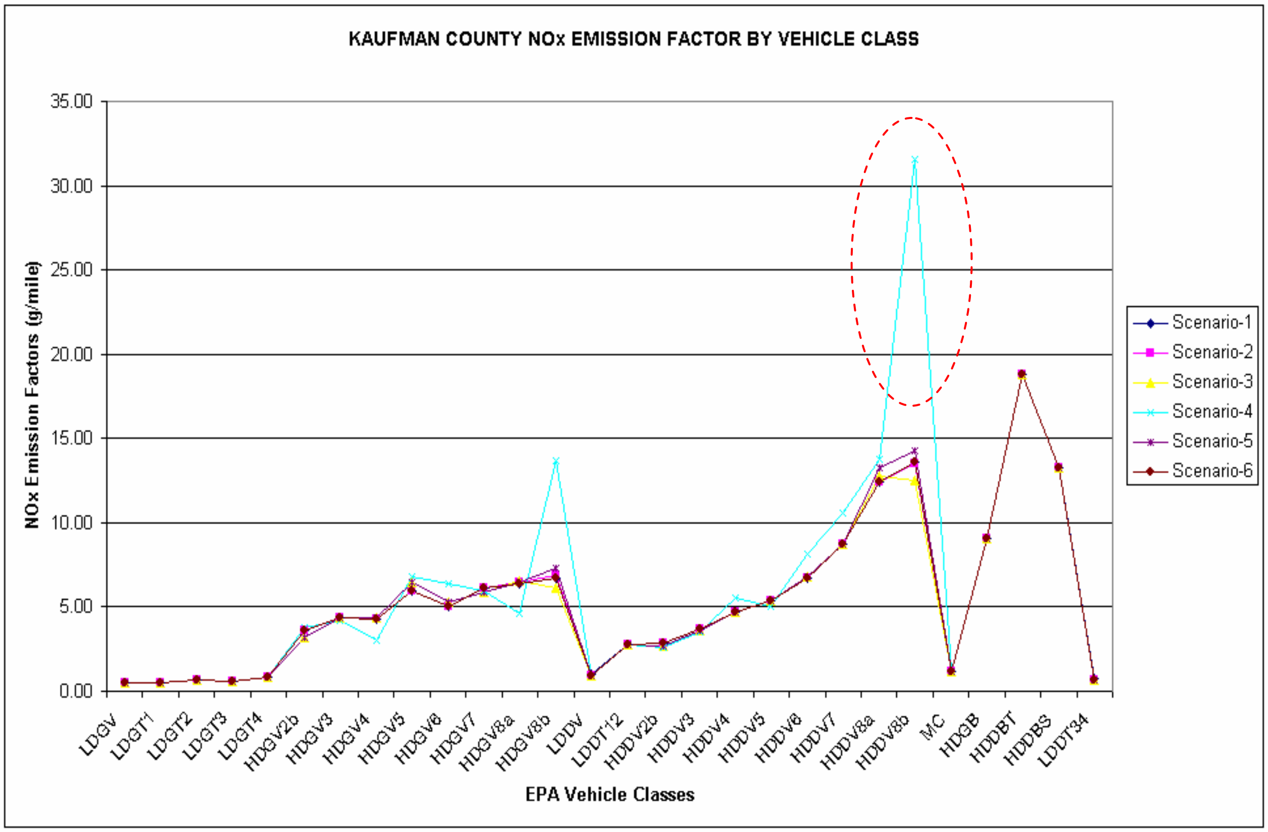


EXHIBIT 20

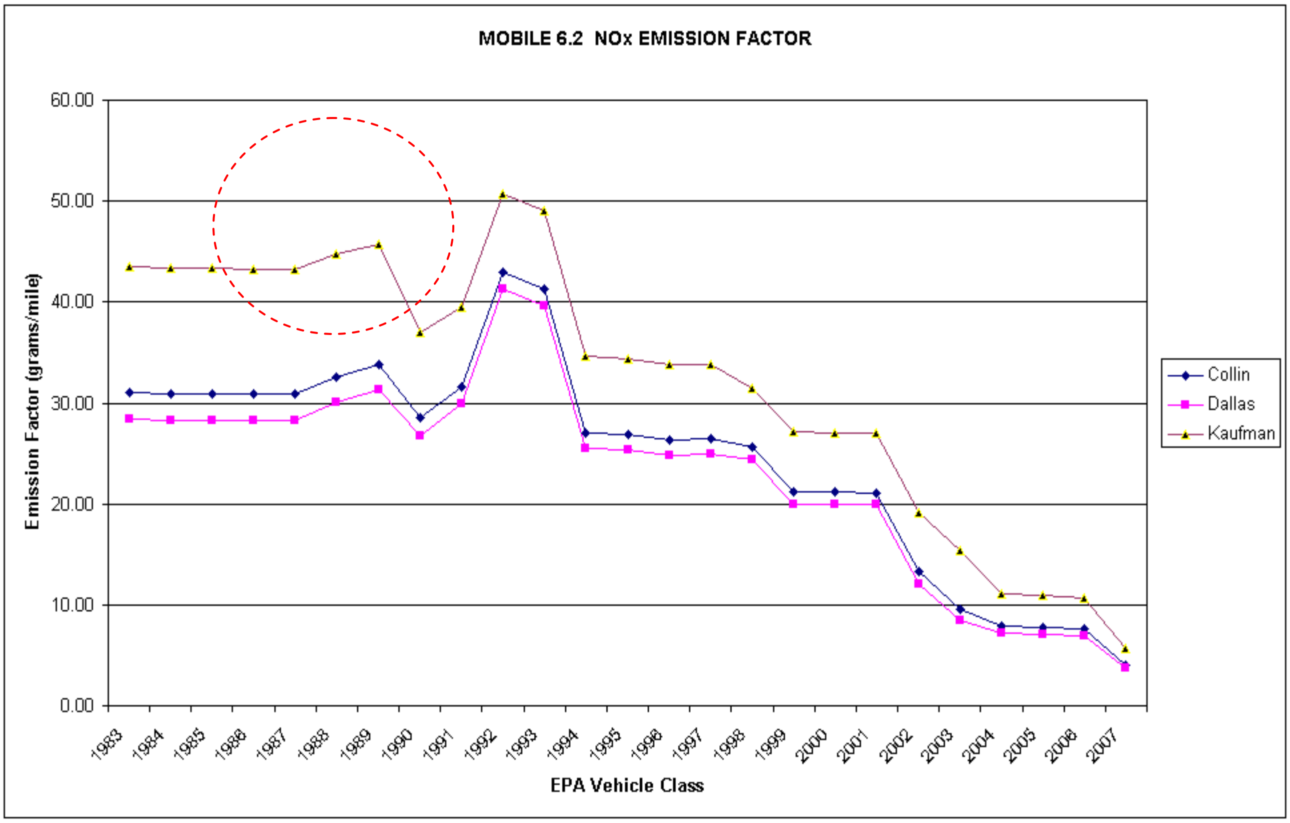
PERIMETER COUNTY MOBILE6.2 NOx EMISSION FACTORS FOR MODELED SCENARIOS



NCTCOG found that only two vehicles were registered in HDDV8b class in years 1986 and 1987 for Perimeter County. The resulting daily emission factor is the normalized weighted average of emission factors of year 1986 and 1987. Emission factors by years for NOx for all the counties are shown in Exhibit 21.

EXHIBIT 21

MOBILE6.2 NOx EMISSION FACTORS



When VOC emissions were analyzed, it was found that there was no substantial increase in the emissions for all the Scenarios. From Exhibits 22, 23, and 24 it was found that Scenario-4 VOC emissions increased by 0.03, 0.07 and 0.15 tons/day for Rural, Urban and Perimeter Counties respectively when compared to Base Case.

EXHIBIT 22

RURAL COUNTY VOC EMISSIONS FROM MODELED SCENARIOS

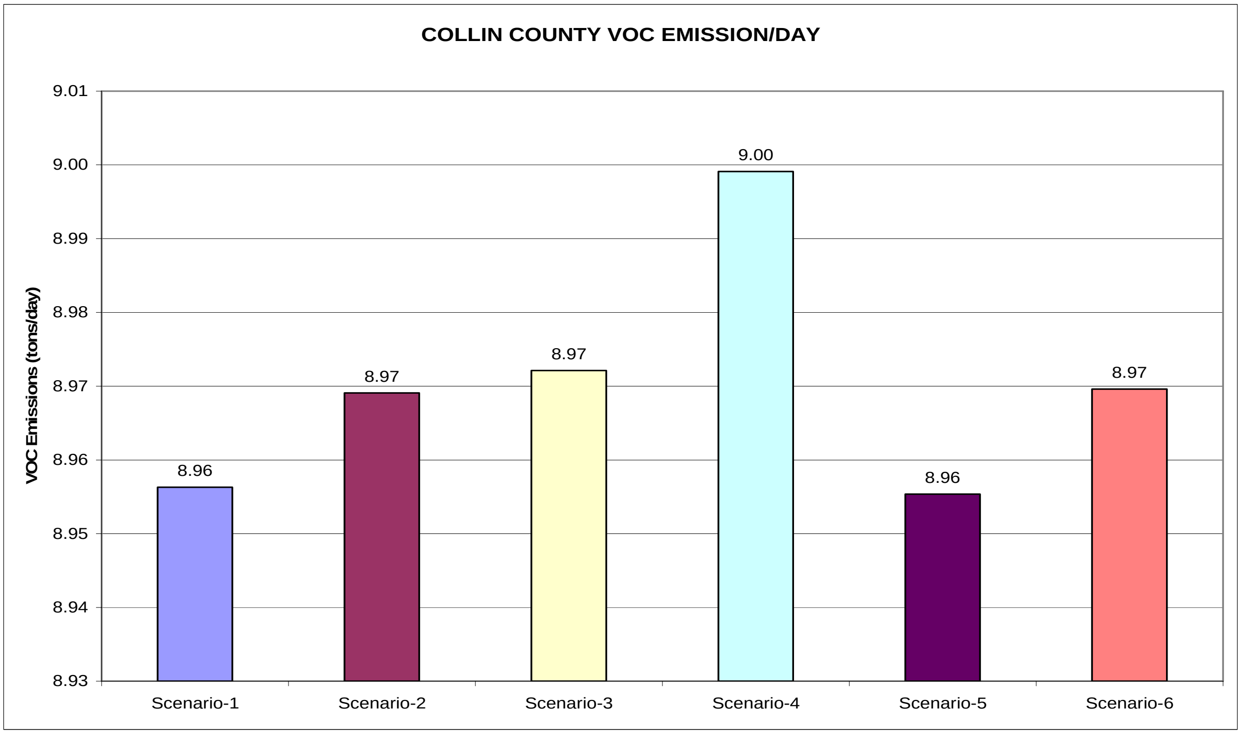
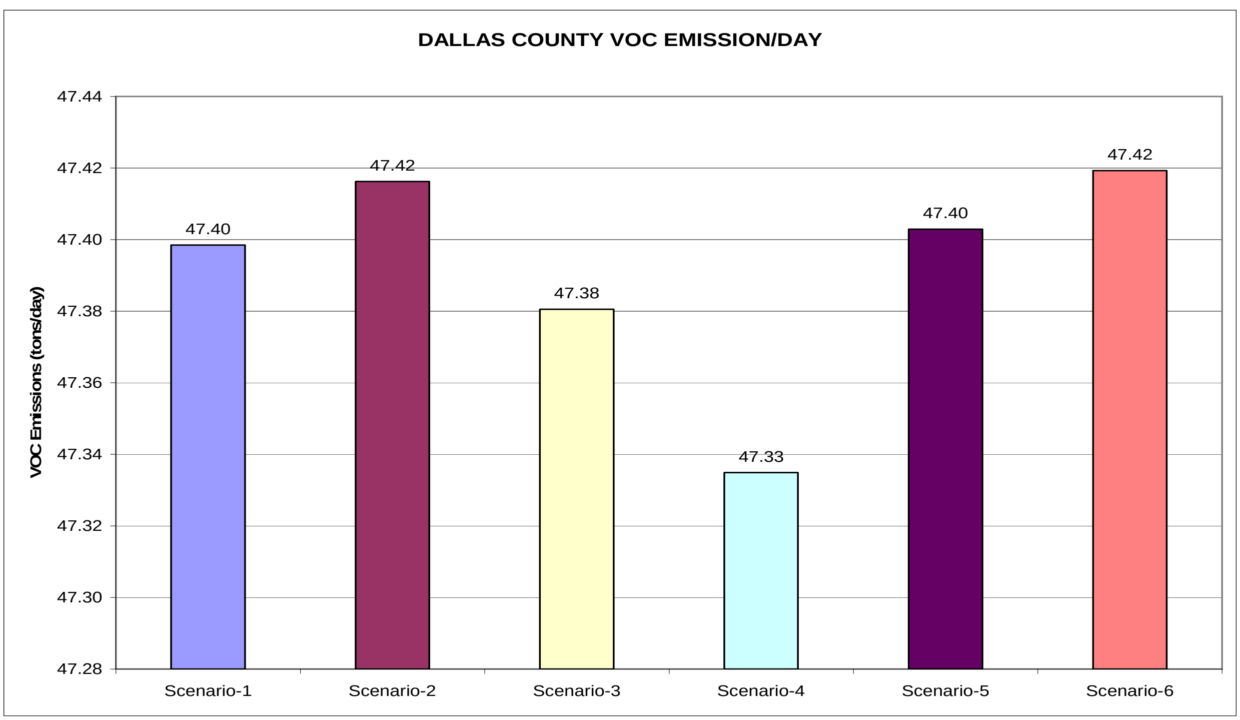


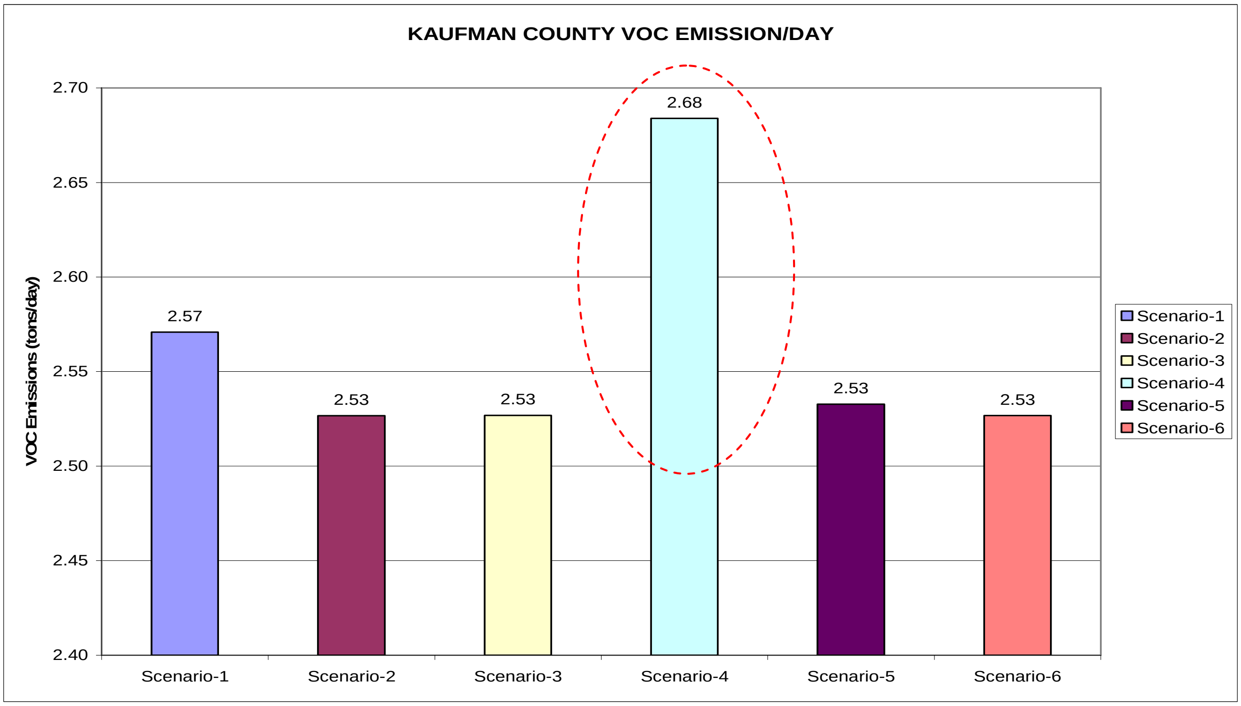
EXHIBIT 23

URBAN COUNTY VOC EMISSIONS FROM MODELED SCENARIOS



<u>**EXHIBIT 24**</u>

PERIMETER COUNTY VOC EMISSIONS FROM MODELED SCENARIOS



Exhibits 25, 26, and 27 were analyzed to see any variation in VOC emissions for HDV. It was concluded that there were no considerable changes for rural and perimeter counties in all the scenarios. However, there was a 0.14 tons/day variation compared to base case in HDDV8b class as shown in Exhibit 28.

EXHIBIT 25

RURAL COUNTY HDDV VOC EMISSIONS FROM MODELED SCENARIOS

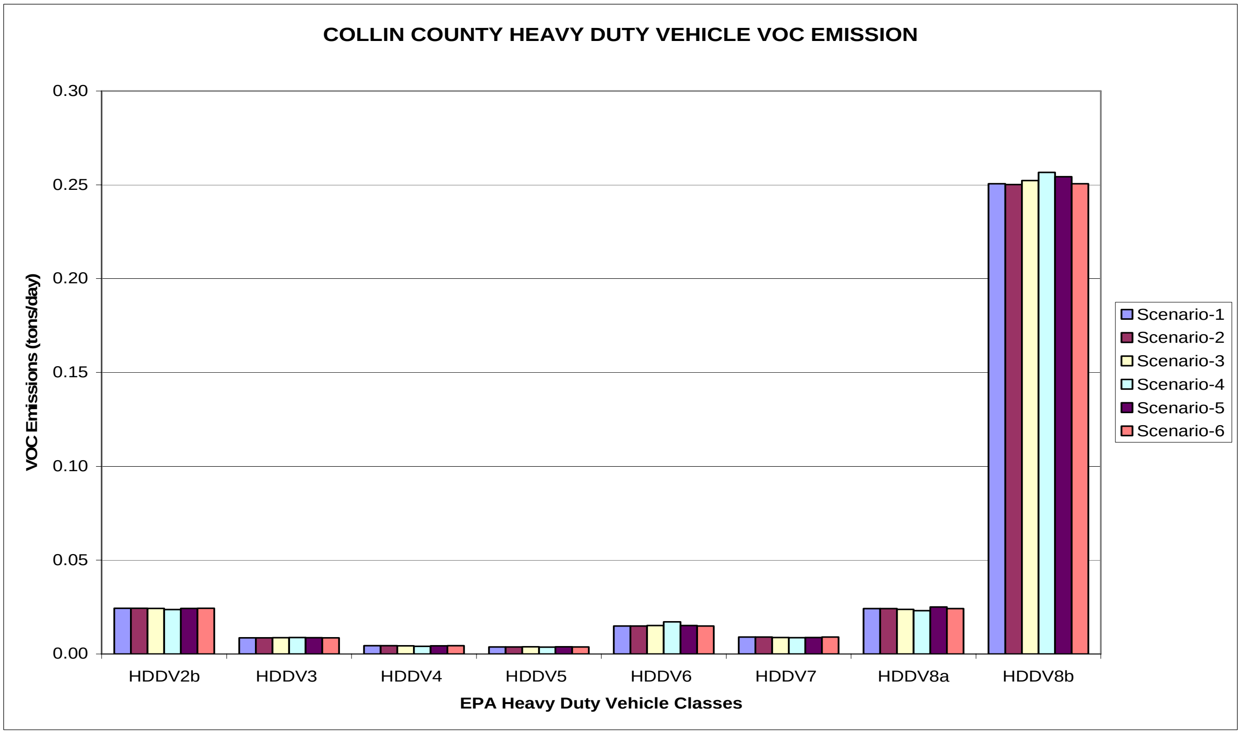


EXHIBIT 26

URBAN COUNTY HDDV VOC EMISSIONS FROM MODELED SCENARIOS

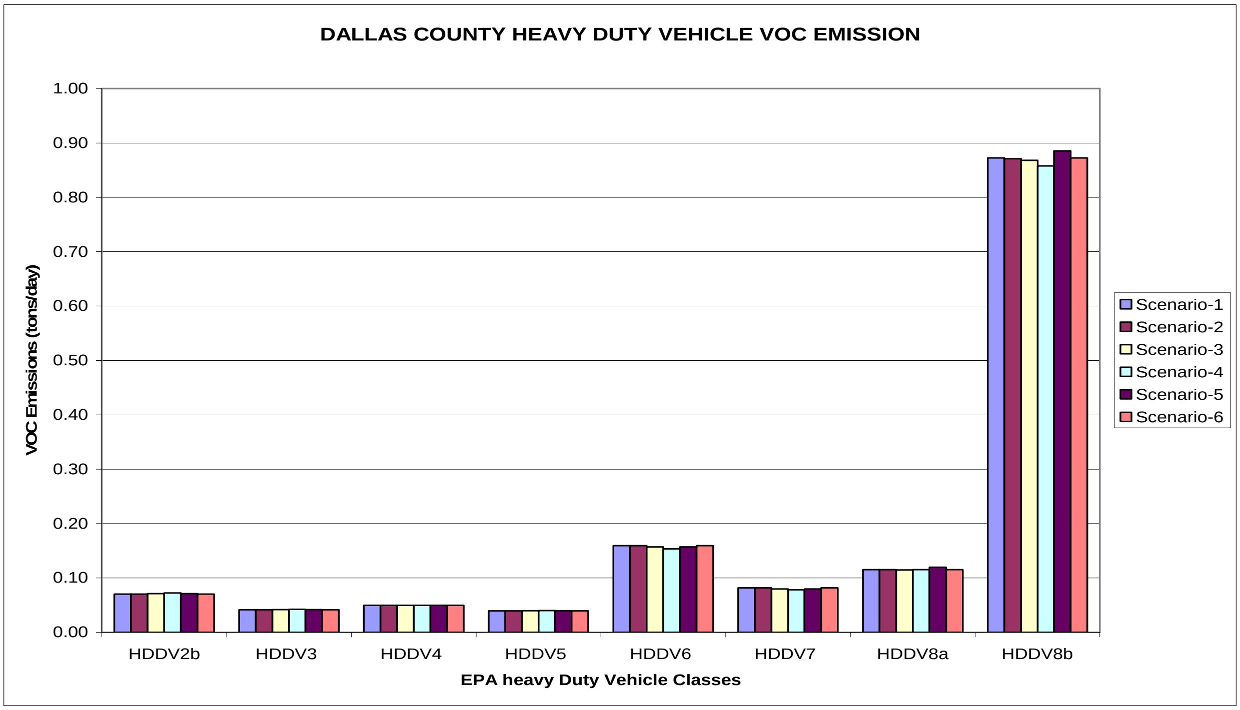


EXHIBIT 27

PERIMETER COUNTY HDDV VOC EMISSIONS FROM MODELED SCENARIOS

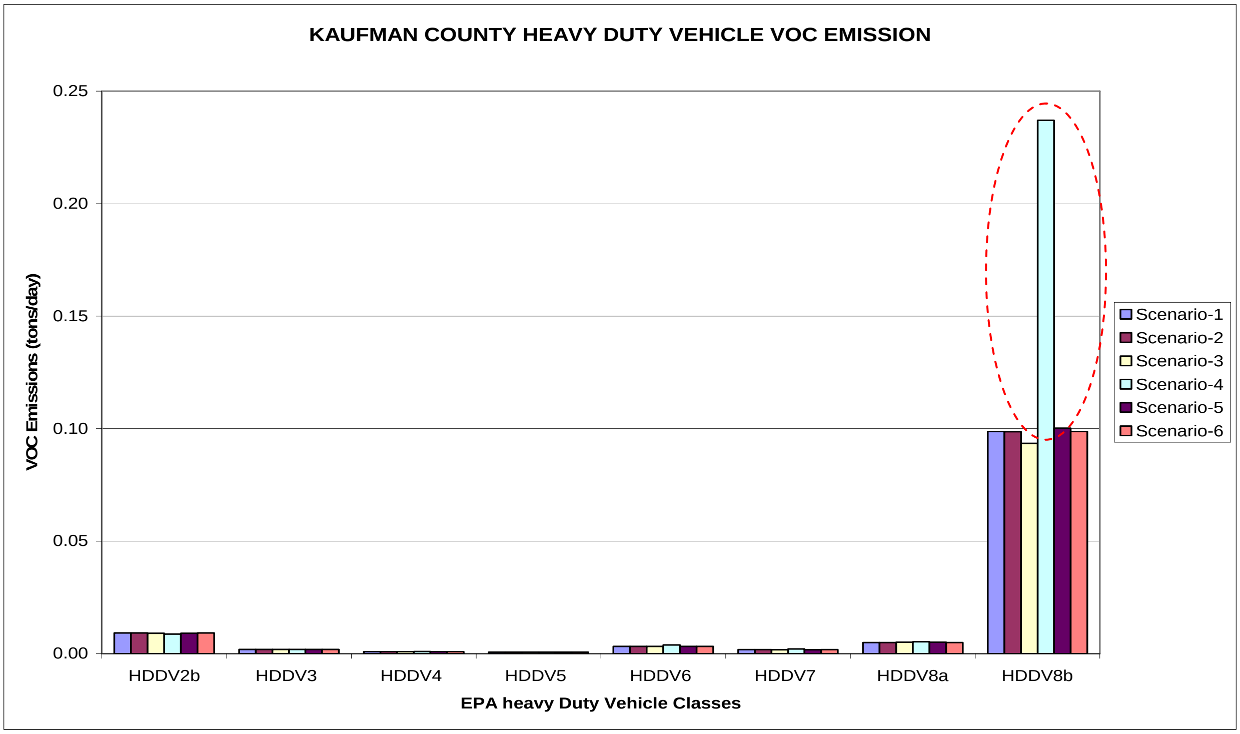
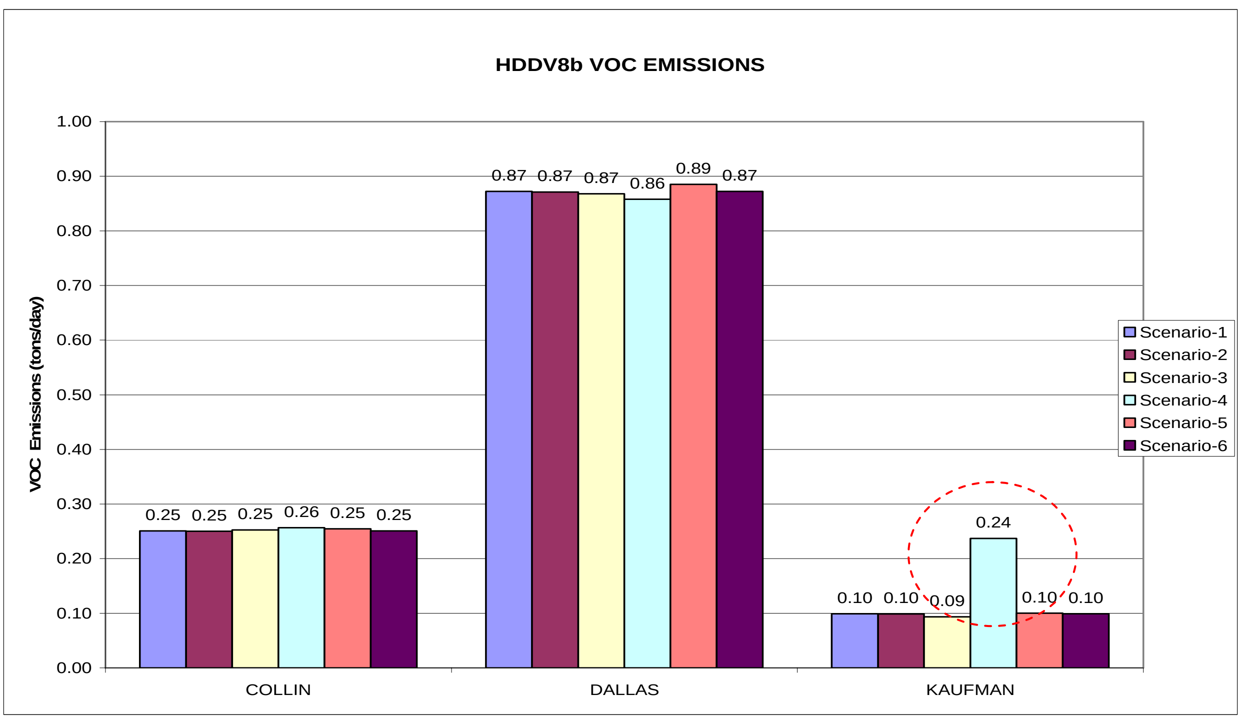


EXHIBIT 28

HDDV8B VOC EMISSIONS FROM MODELED SCENARIOS



Furthermore, when NCTCOG analyzed daily VOC emission factors for all the scenarios, Rural County HDGV8b class showed a high daily emission factor for Scenario-4 as shown in Exhibit 29, but the daily emissions were suppressed by the low percentage of VMT mix. Urban County did not show any variation in daily emission factors for all the scenarios as evident in Exhibit 30. HDDV8b and HDGV8b for Perimeter County varied with a substantial increase in daily VOC emission factor for Scenario-4 as shown in Exhibit 31. As only diesel vehicles of 8b class were registered in Perimeter County, HDGV8b class should have had a zero emission factor for both NOx and VOC. When the diesel fraction was forced to 0.95 for all the zeroes in HDGV8b class, it produced a small percent of share to HDGV8b class, which produced a high daily VOC emission factor. VOC emission by model year is provided in Exhibit 32.

Appendix B contains the diesel fractions used for the Base Case and all scenarios. To support the diesel fractions, Appendix C contains the registration distribution used in conjunction with the diesel fractions.

EXHIBIT 29

RURAL COUNTY MOBILE6.2 VOC EMISSION FACTORS FOR MODELED SCENARIOS

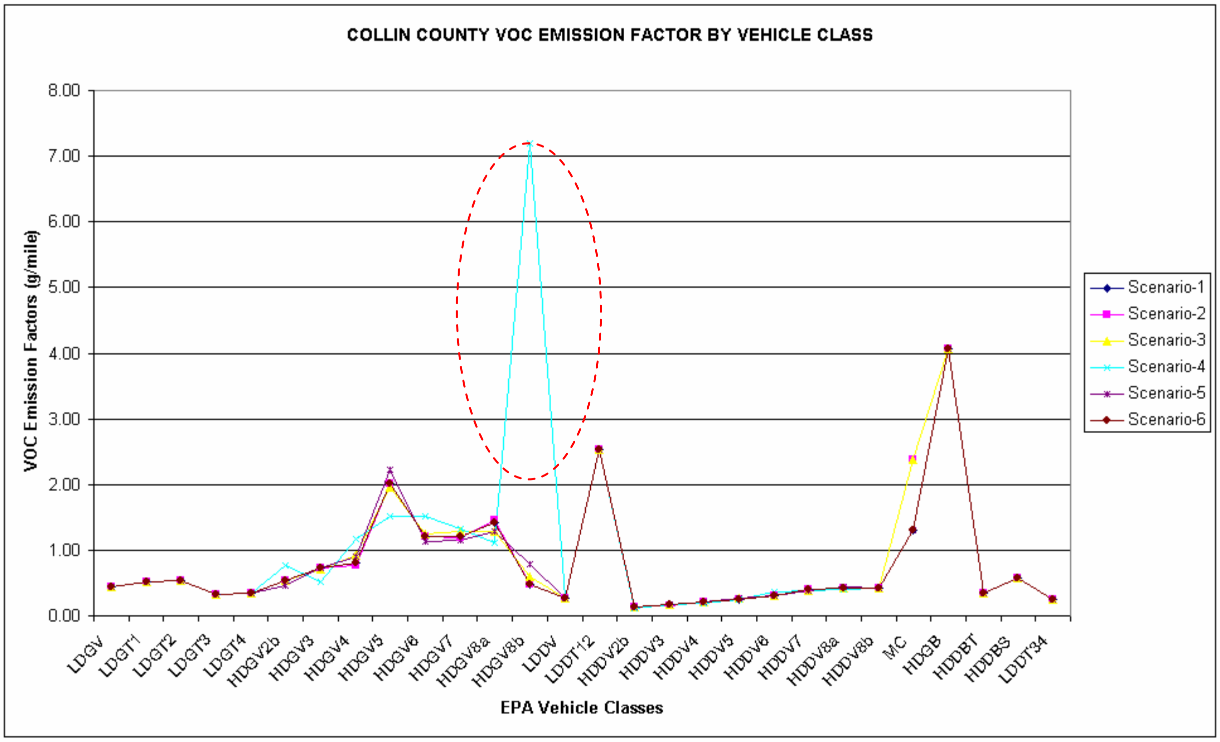


EXHIBIT 30

URBAN COUNTY MOBILE6.2 VOC EMISSION FACTORS FOR MODELED SCENARIOS

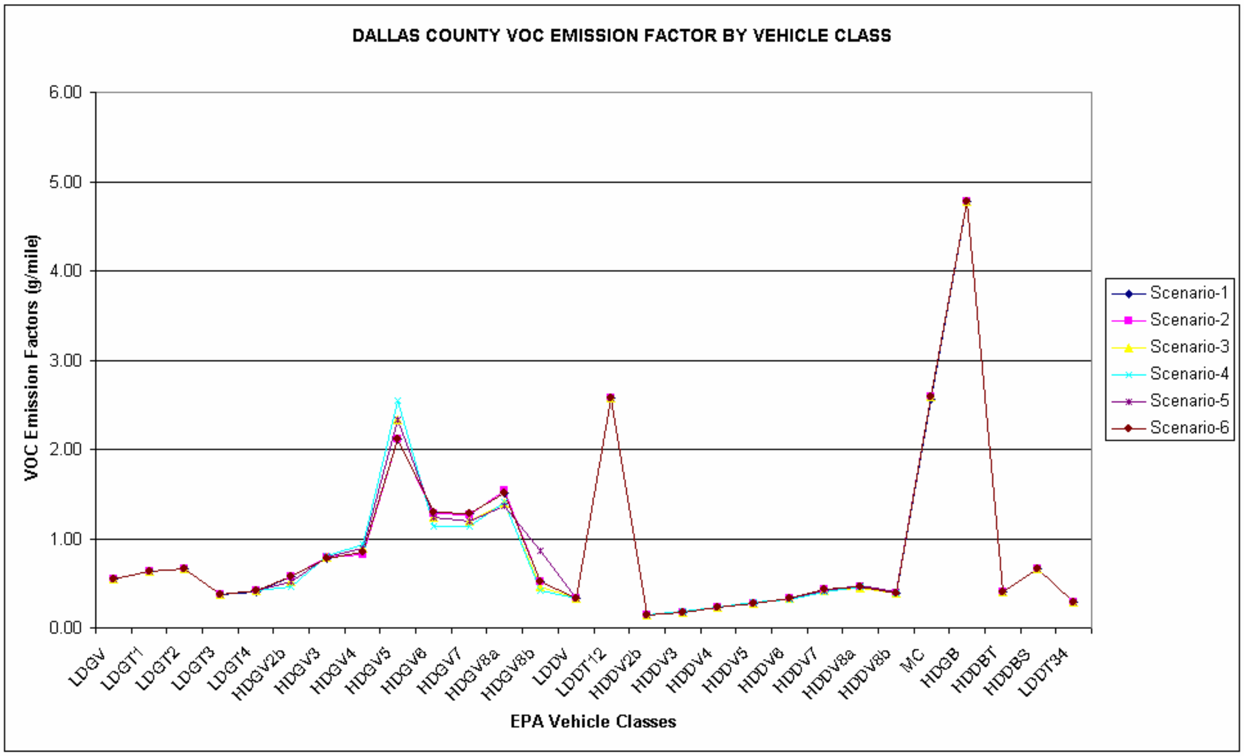


EXHIBIT 31

PERIMETER COUNTY MOBILE6.2 VOC EMISSION FACTORS FOR MODELED SCENARIOS

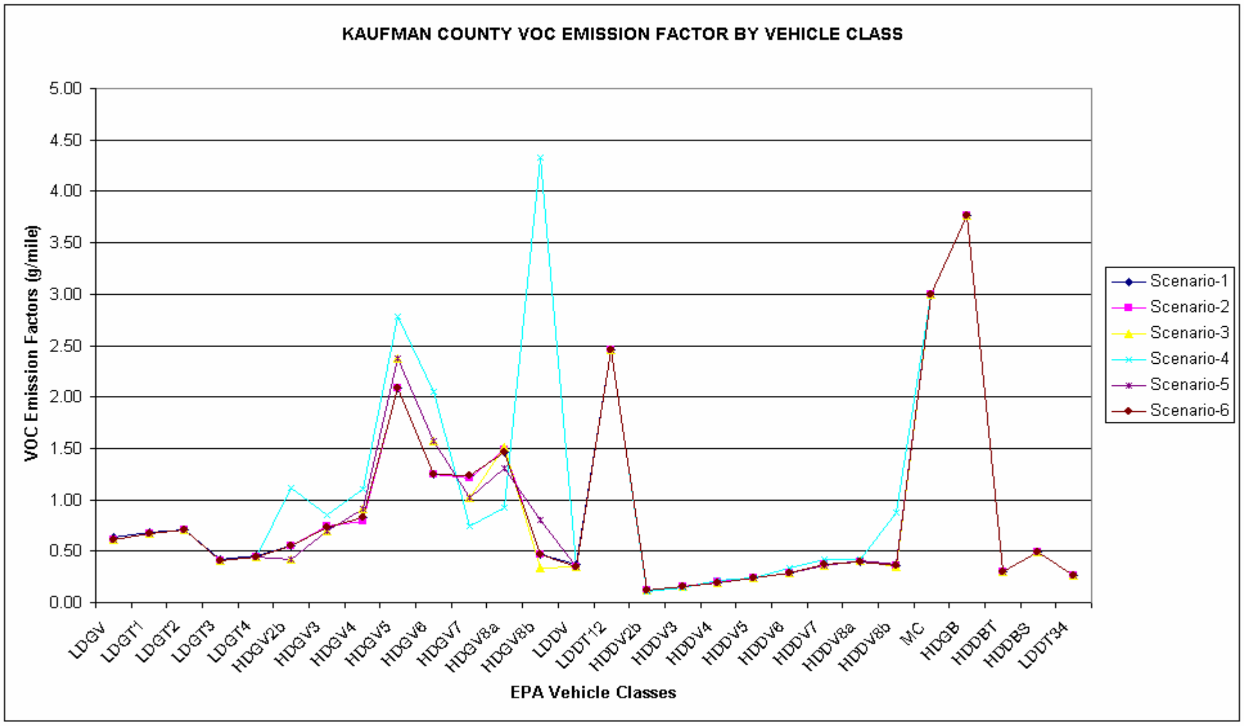
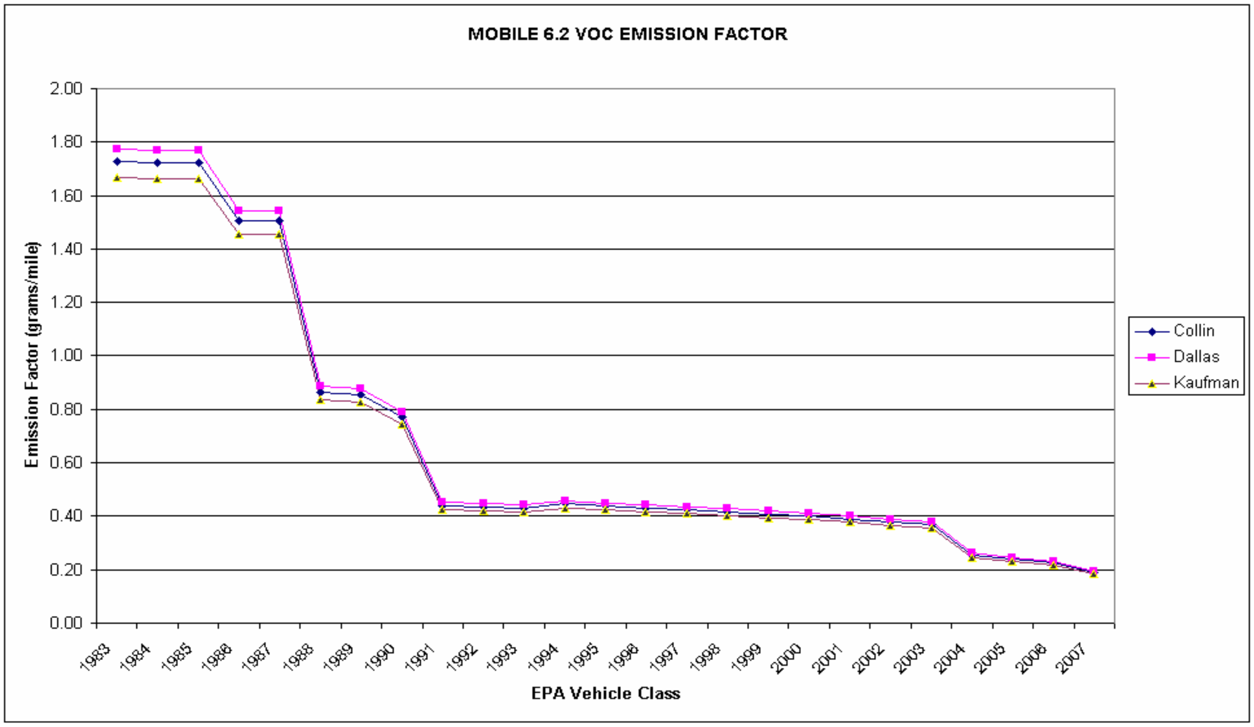


EXHIBIT 32

MOBILE6.2 VOC EMISSION FACTORS



CONCLUSION AND RECOMMENDATION

Modeled Scenarios 2, 3, 5, and 6 all have nine-county interactions for light-duty vehicles. NCTCOG would prefer to use the census data for commuter interaction because it would account for the vehicles traveling from one county to another county and a good distribution of percentages of vehicles by year. Modeled Scenarios 2 and 3 utilized modeled output for estimating HDV interaction from TransCAD and these Scenarios might not be depicting reality but the basic idea of modeling is to produce modest results of reality. Modeled Scenario-5 was built on statewide data for HDDV8a and HDDV8b classes assuming that they interact statewide, but the results might be overestimated emissions due to some older model vehicles that may not be traveling in our region or may be used for local needs in other regions, which might be increasing the emission factors. This is the reason why Scenario-5 had high emissions throughout our study. Modeled Scenario-6 utilized the region-specific TxDOT registration data for heavy-duty classes, which improved the emission factors and emissions in general. Modeled Scenario-6 would be the best selection of the alternatives provided. This run uses region-specific data that best represents the modeled area. As more sophisticated methods of data collection become available the HDV class should remain a summation of counties modeled. The future will provide a better method of HDV interaction between counties.

RECOMMENDED READING

For additional information on diesel fraction modeling, the following reports are recommended.

Transportation Research Board, National Research Council, Board on Environmental Studies and Toxicology, Commission on Geosciences, Environment, and Resources, Committee to Review EPA's MOBILE Model, Modeling Mobile Source Emissions, (Washington D.C., 2000).

Tracie R. Jackson, "Fleet Characterization Data for MOBILE6: Development and Use of Age Distributions, Average Mileage Accumulation Rates and Projected Vehicle Counts for Use in MOBILE6," Report Number M6.FLT.007 (Assessment and Modeling Division, Office of Mobile Sources, U.S. Environmental Protection Agency, March 1999).

Chandra R. Bhat, Gozen A. Basar, Sandeep S. Conoor, Monique Stinson, Larissa Wobus, "Description of Data Acquisition and Development of Traffic Inputs for MOBILE6," Research project 4377-2 (TXDOT, USDOT, FHA Center of Transportation Research, Bureau of Engineering Research, The University of Texas at Austin, August 2002).

APPENDIX A

MOBILE 6.2 Vehicle Classification

Number	Abbreviation	Description
1	LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
2	LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
5	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, greater than 5,751 lbs. ALVW)
6	HDGV2b	Class 2b Heavy-Duty Gasoline Vehicles (8,501-10,000 lbs. GVWR)
7	HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
8	HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
9	HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
10	HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
11	HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
12	HDGV8a	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
13	HDGV8b	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
14	LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
15	LDDT12	Light-Duty Diesel Trucks 1and 2 (0-6,000 lbs. GVWR)
16	HDDV2b	Class 2b Heavy-Duty Diesel Vehicles (8,501-10,000 lbs. GVWR)
17	HDDV3	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
18	HDDV4	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
19	HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
20	HDDV6	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
21	HDDV7	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
22	HDDV8a	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
23	HDDV8b	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
24	MC	Motorcycles (Gasoline)
25	HDGB	Gasoline Buses (School, Transit and Urban)
26	HDDBT	Diesel Transit and Urban Buses
27	HDDBS	Diesel School Buses
28	LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

APPENDIX B

Diesel Fractions

APPENDIX C
Vehicle Registration Distribution