APPENDIX J

Vehicle Idling Restriction Documentation

Houston/Galveston Attainment Demonstration and
Post-1999 Rate-of-Progress SIP

December 2000

Motor Vehicle Idling Restrictions

This strategy will implement motor vehicle engine idling restrictions in the HGA ozone nonattainment area that, beginning April 1, 2001, limit the engine idling time of motor vehicles with a gross vehicle weight rating of greater than 14,000 pounds to five consecutive minutes while the vehicle is operating in the affected area.

The idling restrictions will lower NO_x emissions from both gasoline powered and diesel powered motor vehicles in the affected areas. Because NO_x emissions are precursors to ground-level ozone formation, reduced emissions of NO_x will result in ground-level ozone reductions. By 2007, the idling restrictions will reduce NO_x emissions in the affected areas by 0.48 tons per day (tpd). In addition, the idling restrictions will also reduce VOC emissions by 0.19 tpd from affected vehicles.

The idling restrictions will require that all motor vehicles with a gross vehicle weight rating of greater than 14,000 pounds restrict engine idling to five consecutive minutes in the eight counties in the HGA ozone nonattainment area which includes Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties.

THE NEED FOR THE STATE MOTOR VEHICLE IDLING RESTRICTIONS

The commission has developed a NO_x control strategy consisting of motor vehicle engine idling restrictions that it believes is an essential element in the control strategy package needed for the HGA ozone nonattainment area to be able to demonstrate attainment of the NAAQS. Beginning April 1, 2001, the idling restrictions limit the engine idling time of motor vehicles with a gross vehicle weight rating of greater than 14,000 pounds to five consecutive minutes while the vehicle is operating in the affected area.

A main attractiveness of this strategy is that it provides emission reduction benefits while also providing a cost savings to the regulated community through the reduction in motor fuel consumption.

The NO_x strategy implementing engine idling restrictions in the HGA ozone nonattainment area was chosen based upon the following reasons:

1. Emissions performance;
2. Impacts on emissions from affected motor vehicles;
3. Modeling; and
4. Length of time needed to achieve benefits.

<u>Emissions Performance</u>
State and federal modeling has shown that reductions in NO_x continue to contribute to reductions in ozone. Engine idling restrictions will reduce emissions of NO_x , VOC, and PM from both gasoline powered and diesel powered motor vehicles. Engine idling restrictions are also beneficial in that NO_x , VOC, and PM emission reductions will be seen in all affected motor vehicles in the HGA ozone nonattainment area - both old and new.

<u>Impacts on Emissions from Affected Motor Vehicles</u>
By 2007, the engine idling restrictions will reduce NO_x emissions in the affected area by 0.48 tpd. In addition, the idling restrictions will also reduce VOC and PM emissions from affected motor vehicles.

Modeling

The modeling to determine NO_x benefits for this SIP revision from implementing engine idling restrictions was performed by Eastern Research Group (ERG). The NO_x benefits from implementing an Idling Rule were calculated for the eight county area in the following groups: 1) Harris County; 2) Urban Counties; and 3) Rural Counties. Urban counties include Brazoria, Ft. Bend, Galveston, and Montgomery. Rural counties include Chambers, Liberty, and Waller. In order to determine the NO_x benefits, it was necessary to calculate baseline emissions with no Idling Rule in place, and then compare this total to the emissions after the Idling Rule has been implemented. The methodology for calculating the baseline and post-implementation emissions is outlined below and includes all assumptions.

Step 1: Total HDDV and HDGV Operating Time

Average vehicle speed and total vehicle miles traveled (VMT) for each county group were obtained from the Wednesday COAST modeling episode for the 8 county area in 2007. The source of the VMT was the October, 2000 revision to the *Mobile Source Emissions Inventory Coastal Oxidant Assessment for Southeast Texas* done by Texas Transportation Institute. Fleet Characterization data for MOBILE6 was used to determine the VMT fraction for heavy-duty vehicles greater than 14,000 GVW (~17% for gasoline, and ~74% for diesel vehicles). These parameters permitted the calculation of total running time per day for the entire vehicle class. Once the operating time was calculated, it was necessary to apply the percentage of time the fleet was operating in the idling mode, because the average speed data was based only on running mode data. Based on the weighting factors used in the HDD engine certification cycle (provided in 40 CFR 86 Subpart D), a 20% idling mode time was used for diesel engines, and 18.9% for gasoline engines (FTP idle mode fraction). This additional time was then applied to the running mode time to give a total operating time. The following is an example calculation for Harris County HDDVs:

1 hour / 43.0 miles * 101,551,829 miles/day * 0.046 HDDV VMT fraction = 109,804 hours/day

109,804 hrs/day * 1.20 operating time factor = 131,764 HDDV hrs/day

Tables 1a and b display the input data and results for these calculations.

Table 1a: Calculation of total HDDV Fleet Operating Times

County Group	Avg Vehicle Speed (mph)	Total HDDV VMT (mi/day)	HDDV Fleet Run Time (hrs/day)	Operating Time Factor (idle + running time)	HDDV Fleet Operating Time (hrs/day)
Harris	49	4,085,920	83,386	1.2	100,063
Urban	49	1,208,867	24,671	1.2	29,605
Rural	49	290,263	5,924	1.2	7,108

Table 1b: Calculation of total HDGV Fleet Operating Times

County Group	Avg Vehicle Speed (mph)	Total VMT (mi/day)	HDGV Fleet Run Time (hrs/day)	Operating Time Factor (idle + running time)	HDGV Fleet Operating Time (hrs/day)
Harris	49	348,034	7,103	1.2	8,449
Urban	49	114,809	2,343	1.2	2,787
Rural	49	26,741	546	1.2	649

Step 2: Baseline HDDV and HDGV Idle NOx Emissions

Idle emission factors were obtained using MOBILE5b with 1999 vehicle registration data for each area in 2007. These factors were then adjusted to account for the effects of the Low Emission Diesel rule (5.7% reduction) and applied to the total operating hours to calculate the baseline idle emissions for each county group. In addition, the HDDV emission factors were also adjusted to account for the absence of vehicles less than 14,000 GVW, assuming these vehicles had idle rates equal to LDDTs. ERG also assumed that all HDDVs have equal idle times regardless of weight class, for the purpose of this adjustment. The following is an example calculation for Harris County:

131,764 hrs/day * 35.42 (adjusted) g/hr NOx * 0.20 idle time * 1 ton/ 907,180 g = 0.857 tons/day NOx

Tables 2a and b display the input data and results for these calculations.

Table 2a: Baseline HDDV Idle NOx Emissions

County Group	HDDV Fleet Idle Time (hrs/day)	Adjusted Idle Emission Factor (g/hr)	Baseline Fleet Idle NOx Emissions (tons/day)
Harris	100,063	35.42	0.651
Urban	29,605	40.15	0.218
Rural	7,108	37.62	0.049

Table 2b: Baseline HDGV Idle NOx Emissions

County Group	HDGV Fleet Idle Time (hrs/day)	Idle Emission Factor (g/hr)	Baseline Fleet Idle NOx Emissions (tons/day)
Harris	8,449	8.07	0.012
Urban	2,787	8.91	0.004
Rural	649	8.94	0.001

Step 3: Determining Reduction in NOx Emissions

To determine the decrease in NO_x emissions after implementation of the Idling Rule, it was necessary to determine how much the idling time would decrease, assuming 100% rule effectiveness. To do this, first the number of HDDVs and HDGVs in the Houston-Galveston area were calculated by dividing the total fleet VMT/day (listed in Part 1) by the average VMT/day for each vehicle type. This average was calculated using default MOBILE5b milage accumulation rates and 1999 registration data for HDGVs. Milage accumulation rates for HDDVs were obtained from the U.S. EPA OTAQ Internet site: http://www.epa.gov/otaq/models/ap42/ap42-h7.pdf. The data for these calculations are provided in Tables 3a and b. Note that these figures estimate the total number of vehicles operating on the roads in the eight county area, and are substantially different than the number of vehicles actually registered in the region.

Table 3a: Total Number of HDDVs in Houston-Galveston Area

County Group	HDDV Fleet VMT (mi/day)	Default Avg HDDV VMT/day*	Total # HDDVs
Harris	4,085,920	89.1	45,857
Urban	1,208,867	81.8	14,777
Rural	290,263	83.9	3,459

*The default average HDDV VMT/day is based on the by-model year registration data for the county groups. The daily average is based on an assumed 5 day work week, 52 weeks/year (260 days/year).

Table 3b: Total Number of HDGVs in Houston-Galveston Area

County Group	HDGV Fleet VMT (mi/day)	Default Avg HDGV VMT/day*	Total # HDGVs
Harris	348,034	36.5	9,547
Urban	114,809	30.5	3,768
Rural	26,741	30.3	882

*The default average HDGV VMT/day is based on the by-model year registration data for the county groups. The daily average is based on an assumed 5 day work week, 52 weeks/year (260 days/year).

The total operating time calculated in Part 2 was then divided by the total number of vehicles calculated in Table 3 in order to determine the total operating time per vehicle. Then the percent idle mode time was applied to the total operating time per vehicle to get the baseline idle time per vehicle. Tables 4a and b show the data for these calculations.

Table 4a: Baseline Idle Time Per HDDV

County Group	HDDV Fleet Idle Time (hrs/day)	Total # HDDV	Baseline Idle Time per HDDV (min/day)
Harris	100,063	45,857	26.2
Urban	29,605	14,777	24.0
Rural	7,108	3,459	24.7

Table 4b: Baseline Idle Time Per HDGV

County Group	HDGV Fleet Idle Time (hrs/day)	Total # HDGV	Baseline Idle Time per HDGV (min/day)
Harris	8,449	9,547	10.1
Urban	2,787	3,768	8.4
Rural	649	882	8.4

Under the assumptions of the proposed rule, idle events would be limited to five minutes in duration. For purposes of calculating NOx emissions reductions for this analysis, it was assumed that there are two idling events greater than five minutes in the base case. These two idling events are assumed to take place when the vehicle is initially started and at another point when the vehicle arrives where it will be loaded/unloaded. The following example calculations for Harris County shows how the Idling Rule would reduce NOx emissions for HDDVs.

Baseline Idling Time per HDDV = 29.8 min/day
If Idling Rule allows for 2 (10 minute) idling events, baseline idle time is reduced by:

29.8 min/day -10 min/day = 19.8 min/day

HDDV Fleet NOx emissions reduced by Idling Rule:

19.8 min/day * 1 hr/60min * 35.42 g/hr * 1 ton/907,180 g * 52,991 HDDV = 0.68 tons/day

Tables 5a and b display the NOx reductions with an Idling Rule assuming two idling events and 100 percent rule effectiveness.

Table 5a: HDDV NOx Reductions from Idling Rule Assuming Two Idling Events Per Day

County Group	Baseline Idle Time/ HDDV (min/day)	Amount of Baseline Idle Time Reduced with Rule assuming 2 idle events (min/day)	Idle Emission Factor (g/hr)	HDDV Fleet NOx Emissions Reduced by Idling Rule allowing 2 idle events (ton/day)

Harris	26.2	16.2	35.42	0.483
Urban	24.0	14.0	40.15	0.153
Rural	24.7	14.7	37.62	0.035
Total				**0.671**

Table 5b: HDGV NOx Reductions from Idling Rule Assuming Two Idling Events Per Day

County Group	Baseline Idle Time/ HDGV (min/day)	Amount of Baseline Idle Time Reduced with Rule assuming 2 idle events (min/day)	Idle Emission Factor (g/hr)	HDGV Fleet NOx Emissions Reduced by Idling Rule allowing 2 idle events (ton/day)
Harris	10.1	0	8.07	0
Urban	8.4	0	8.91	0
Rural	8.4	0	8.94	0
Total				**0**

Next, ERG applied an 80 percent rule effectiveness adjustment directly to the emission reductions in Tables 5a and 5b. This step was needed in order to be more realistic about the compliance level, since 100 percent compliance might be over-optimistic. Table 6 reports the results of this adjustment.

Table 6. Rule Effectiveness-Adjusted Reductions
NO_x, Tons per Ozone Season Day

County	HDGV	HDDV
Harris	0	0.3864
Urban	0	0.1224
Rural	0	0.028
total	0	0.5368

ERG also performed an identical calculation of VOC benefits, estimated to be a reduction of 0.19 tpd before rule effectiveness calculations. The attached spreadsheet summarizes these calculations.

As a final step, the idle rule is being revised to allow diesel transit buses (DTB) and diesel commercial buses (DTB) to idle up to 30 minutes. This procedure involves estimating the contribution of these two HDDV sub-categories to the total HDDV mix. A previous study done by the ERG using MOBILE6 registration and mileage accumulation data provided the fractions of HDDVs which would be allowed additional idling time. Appendix B contains these calculations. The adjustment does not appear to affect

gasoline vehicles (HDGV). Tables 7 and 8 report the final idle emission benefits in tons per standard ozone season weekday.

Table 7. Final Rule Reductions
NO_x, Tons per Ozone Season Day

Scenario	HDGV	HDDV
Baseline	0	0.671
80 % Rule Effectiveness	0	0.1342
30-Minute Idling for DTB, DCB	0	0.055
total	0	0.4818

Table 8. Final Rule Reductions
VOC, Tons per Ozone Season Day

Scenario	HDGV	HDDV
Baseline	0	0.261
80 % Rule Effectiveness	0	0.0522
30-Minute Idling for DTB, DCB	0	0.021
total	0	0.1878

ERG was not able to obtain an estimate of the average number of discrete idling events expected per day for HDDVs. Therefore the above only provides an estimate of likely emission reductions.

Finally, the above analysis does not account for extended idling as might be seen at interstate truck stops. Line-haul rigs often leave their engines in idle mode for several hours at a time in order to power auxiliary equipment such as air conditioners. However, ERG has not been able to obtain reliable data regarding the frequency and duration of such events in order to calculate a benefit associated with idle restrictions at truck stops. In addition, truck stop idle emissions are not accounted for in the current HDD engine certification cycle, and therefore are not included in the current SIP inventory.

Length of Time Needed to Achieve Benefits

The most important aspect of using the engine idling restrictions is that the benefits are seen immediately. Once the engine idling restrictions begin, emission reductions begin for both old and new heavy-duty motor vehicles that operate in the affected area resulting in an immediate impact on the air quality in the HGA ozone nonattainment area.

EMISSION REDUCTIONS NEEDED FOR ATTAINMENT OF THE NAAQS

The HGA ozone nonattainment area will need to ultimately reduce NO_x more than 750 tpd to reach attainment with the one-hour ozone NAAQS. In addition, a VOC reduction of about 25% will have to be achieved. The engine idling restrictions will contribute to attainment and maintenance of the one-hour ozone NAAQS in the HGA area through the reduction of NO_x and VOCs emissions from motor vehicles with a gross vehicle weight rating of greater than 14,000 pounds. The engine idling restrictions also may contribute to a successful demonstration of transportation conformity in the HGA area. Modeling has also shown that over 20% of the NO_x emissions come from mobile sources. As such, the control strategy package for the HGA ozone nonattainment area needs to include strategies that have an immediate impact on mobile sources. The engine idling restrictions will have an immediate impact through the reduction of NOx, VOCs, and PM emissions from affected motor vehicles.

CONCLUSIONS

The engine idling restrictions will reduce NO_x emissions from affected motor vehicles in the affected areas by 0.48 tpd and is a vital component of the overall NO_x emissions reduction strategy for the HGA ozone nonattainment area. In addition, the idling restrictions will also reduce VOC emissions by 0.19 tpd from affected vehicles. Therefore, the commission finds that the engine idling restrictions are essential to the timely attainment of the one-hour NAAQS in the HGA ozone nonattainment area.