Appendix 4

VMEPs

VOLUNTARY MOBILE EMISSION REDUCTION PROGRAM (VMEP)

A summary of the expected emission reductions by 2007 from voluntary programs is shown in the table below. A description of each initiative and the progress through the end of 2006 is outlined in subsequent summaries of each program.

Overall, the expected emission reductions from voluntary programs are expected to be 0.8 tpd for VOC and 7 tpd for NOx by the end of 2007. Most of the VOC and half of the NOx emission reductions from on-road sources were obtained through H-GAC administered programs.

Summary of VMEP Measures for Inclusion in HGA SIP Mid-Course Revision
[Progress to date, through December 2006, using 2007 emission rates]

Measure	Description	VOC Reduction in 2007	NOx Reduction in 2007	Progress to Date and Future Plans
Vehicle Repair or Scrappage	Emission reductions through H-GAC administered **LIRAP** to repair or replace high emitting vehicles.	0.26	0.25	Includes benefits from vehicles scrapped estimated to occur in 2005 – 2007 under the current program.
Smoking Vehicle/ Clean Air Action	TCEQ program – marketing and advertising by H-GAC	0	0	LIRAP and Smoking Vehicle Program contribute to low emission inspection waiver rates
Clean Cities / Vehicle Program	Public and private heavy-duty engine/vehicle replacement/retrofit	0.06	3.45	CMAQ funded projects through October 2006.
Commute Solutions	Van pools, additional transit, alternative commuting, and other initiatives	0.38	0.37	Additional commuting initiatives begun in 2004
Regional Computerized Traffic Signal System	Average speed on local streets increased by 21%	0.004	0.001	Federal CMAQ portion funded.
Locomotives	MOA	0.10	2.0	Union Pacific and BNSF have submitted their progress and programs that have met the goal.
Commercial Marine	Tugs/Tows–MOA	0.0	1.14	The Texas Waterways Operators have demonstrated emission reductions.
Total Emission Reduction up to date (end 2006)		**0.8 tpd**	**7.2 tpd**	
Total Emission Reductions needed (by end of 2007)		**0.8 tpd**	**7.0 tpd**	
Total On-road Emission Reduction		**0.7 tpd**	**4.1 tpd**	

1. Vehicle Repair and Scrappage

***Summary of Strategy*:** H-GAC is administering Low Income Repair and Assistance Program (LIRAP) on behalf of Brazoria, Harris, Fort Bend, Galveston and Montgomery counties. For administering the program, H-GAC claims the emission reductions achieved only through the scrapped portion of LIRAP. This amounts to 90 vehicles during the first 10 months of 2006, compared with 3,994 repaired vehicles during that same period.

LIRAP reduces the inspection waiver rate and therefore, overall emission reductions are not credited here because TCEQ has indicated that vehicles would have been repaired regardless of whether the subsidy existed or not. EPA issued guidance that the life of the emission reduction from scrappage programs should be no more than 3 years. So emission reductions begun in 2004 would still be valid for 2007.

***Status*:** The number of repairs has led to a commensurate reduction in the HGB area inspection and maintenance waiver rate. The number of LIRAP repairs in 2005 was nearly equivalent to the waiver rate of 3% used in the emission modeling for 2007. The actual waiver rate was below 0.1%, and using an interpolation as shown in Table 1 below, emissions with a 0.1% waiver rate are further reduced by 0.25 tpd VOC and 0.24 tpd NOx.

Table 1. HGB Emission inventory impact of lower waiver rates (TCEQ, 2007)

Scenario	**Emissions (tons per day)**		
	NOx	**VOC**	**CO**
On-road inventory 3% waiver rate	200.12	90.89	1103.4
Inventory Impact of 2% waiver rate	-0.08	-0.09	-1.48
Inventory Impact of 1% waiver rate	-0.17	-0.18	-2.96
Inventory Impact of 0% waiver rate	-0.25	-0.26	-4.45

Vehicle replacement (scrappage) provides emission reductions in addition to the benefit of repair because newer vehicles meeting lower emission standards replace older vehicles. During a three-year period, about 324 vehicles were replaced, averaging 0.005 VOC and 0.005 NOx tons per year for each vehicle replaced. This is based on program survey data indicating that the average age of the replacement vehicle was 11 years, versus 17 years for scrapped vehicles. Therefore the estimated reduction for 2007 from this program is 1.6 tpy VOC and NOx, including about 0.01 tpd for the additional reduction beyond what would have been realized through repair.

***Continued Implementation*:** The program is on-going.

Sample Calculation: The expected emission reduction was determined using an the average age distribution of the replaced and replacement vehicles and EPA's estimate of light-duty vehicle emissions rates. (http://www.harc.edu/Projects/AirQuality/Projects/Projects/H072AB) The emission rates and activity in miles per years were distributed across all light-duty vehicle types to produce one average estimated emission reduction as shown in Table 2.

Table 2. LIRAP retired and replacement vehicles for 2005 projected to fleet average NOx emissions (g/mile) and reduction calculated for calendar year 2007. (Excess emission reductions over that from repairing the vehicles.)

Fleet Description	LDGV	LDGT1	LDGT2	LDGT3	LDGT4
Retire Vehicles (g/mile)	1.67	1.88	2.14	2.09	2.31
Replacement Vehicles (g/mile)	0.95	1.03	1.39	1.53	1.97
17-year old vehicle activity average (Miles/Year)	6,636	5,909	5,909	6,827	6,827
NOx Emission Reduction (tpy/vehicle)	-0.0053	-0.0055	-0.0049	-0.0042	-0.0026

2. Smoking Vehicle Program

***Summary of Strategy*:** The program is based on TCEQ's existing Smoking Vehicle Program (in existence since 1992), which had little advertising or marketing in this region. The local effort is through H-GAC's Clean Air Action program with the goal of increasing program awareness. Reply cards indicate that on average, 39% of the people notified through this program have repaired their vehicles.

***Status*:** The program is on-going.

***Continued Implementation*:** Continuing marketing/advertisement of the program is required.

Sample Calculation: No specific emission reduction is claimed for this measure. But combined with the LIRAP program it is resulting in very low waiver rates from the emission inspection program. Emission reductions are credited under LIRAP, as described in the preceding section.

3. Clean Cities / Clean Vehicles Program

***Summary of Strategy*:** Through the Clean Cities/Clean Vehicles program, H-GAC is aggressively pursuing participation from public and private fleet owners in introducing low-emission technology into their vehicle fleets (primarily heavy-duty trucks and buses) and their fueling infrastructure. Federal funds (Congestion Mitigation and Air Quality – CMAQ) are available for eligible projects using approved technology to reduce smog-forming emissions from on-road motor vehicles. This program has been highly successful in implementing emission controls from on-road mobile sources.

***Status*:** Progress through October 2006 is 3.45 tpd of NOx reductions with $46 million committed to these projects.

***Continued Implementation*:** Additional funding (at least $10 million is available to spend in addition to the current progress through fiscal year 2006) and program participation will be needed to reach an overall goal of greater than 3 tpd from this measure for public and private fleets. But participation and interest continues to be high.

Sample Calculation: The emission reductions were determined using the before and after retrofit/replacement engine emission rate and the annual mileage of the vehicle. Each vehicle type was calculated individually and summed to determine the progress of the program. The emission rate accounts for the use of TxLED and other unique characteristics of the Houston-Galveston area. The before and after emission rates were calculated based on the EPA MOBILE6 model, using TCEQ input files modified to give by-model-year output and are provide in online documentation (http://www.houston-cleancities.org/calculator.htm). The list of projects conducted under this program is shown in Table 3.

Silver Eagle Distributors (replacement of 1991 engine with a 2004 engine)

NOx Emission Reduction = (18.275 – 5.728) (g/mile) x 31,581 (miles) = 0.437 tpy

VOC Emission Reduction = (0.552 – 0.321) (g/mile) x 31,581 (miles) = 0.008 tpy

Table 3. Clean Vehicles Projects Description

Applicant	Project Description	Total project cost	Eligible CMAQ funds	Emission Reduction (tpy)
Alvin ISD	13 propane buses (7 conversions, 6 new)		$55,650	0.36
City of LJ (HD trucks)	Purchase 3 new CNG garbage trucks	$180,000	$109,350	0.73
Alvin ISD	2 propane conversion kits for school buses	$9,400	$7,050	0.06
METRO	4 hybrid-electric buses	$1,748,225	$1,200,624	6.74
W.M. Dewey and Son, Inc.	5 Class 8b engines replaced with engines meeting or exceeding 2004 emission standards	$241,975	$181,482	1.563
Silver Eagle Distributors	Purchase 26 new clean diesel engines; reflash ECM on 16 existing engines	$357,000	$267,750	8.90
Houston Distributing Company, Inc	20 Class 8a and 8b engines replaced with engines meeting or exceeding 2004 emission standards	$796,215	$545,850	3.639
United Parcel Service	68 HD tractors to be removed from HGA nonattainment area and replaced w/ tractors using engines meeting 2004 emissions std	$986,925	$740,194	48.00
City of Lake Jackson	1 new CNG garbage truck	$60,000	$13,050	0.09
Houston ISD	80 new bus engines (2004 engine standards	$2,493,807	$2,233,260	12.66
Houston ISD	2 new bus engines (2004 engine standards)	$74,442	$55,831	0.37
Cy-Fair ISD	Replace 30 existing Carpenter buses with new buses utilizing 2004 or cleaner engines	$1,184,850	$729,000	4.86
Waste Management	SCR systems for 12 existing engines	$474,000	$355,500	5.51
Houston Distributing Company, Inc - phase II	Replace 46 existing heavy-duty diesel engines with engines that meet or exceed 2004 engine emission standards	$1,816,770	$1,090,560	7.27
Silver Eagle Distributors - phase II	Replace 69 existing heavy-duty diesel engines with engines that meet or exceed 2004 engine emission standards	$2,775,675	$2,081,756	14.4
Clear Creek Independent School District	Replace 41 existing diesel engines with engines that meet or exceed 2004 emission standards	$1,619,295	$770,100	5.134
City of Lake Jackson	Purchase 2 new compressed natural gas refuse haulers	$86,371	$22,350	0.149
Dickinson ISD	Retire 6 bus engines; replace 7 with engines that meet or exceed 2004 emission stds	$276,465	$117,482	0.783
Klein ISD	Replace 18 existing diesel engines with engines that meet or exceed 2004 emission standards	$710,910	$285,034	1.900
Del Papa Distributing Company	Replace 12 existing heavy-duty diesel engines with engines that meet or exceed 2004 engine emission standards	$482,840	$362,130	5.98
Cemex	Replace 76 existing diesel engines with engines that meet or exceed 2004 emission standards	$3,481,560	$2,611,170	51.56
Mink Investments (Best Transport)	Replace 30 existing diesel engines with engines that meet or exceed 2004 emission standards	$1,451,850	$1,088,887	17.85
Brazosport Independent School District	Retire 10 existing diesel engines from fleet; replace 21 existing diesel engines with engines that meet or exceed 2004 emission standards	$829,395	$533,737	3.558
Dienst	Replace 11 existing diesel engines with engines that meet or exceed 2004 emission standards	$439,000	$210,888	1.41
Montalbano	Replace 5 existing diesel engines with engines that meet or exceed 2004 emission standards	$153,790	$115,343	1.19
Allied Concrete	Replace 50 existing diesel engines with engines that meet or exceed 2004 emission standards	$2,290,500	$1,717,875	20.76
Con Rock Ready Mix	Replace 3 existing diesel engines with engines that meet or exceed 2004 emission standards	$186,000	$139,500	2.82
Grisham Grading	Replace 10 existing diesel engines with engines that meet or exceed 2004 emission standards	$620,000	$465,000	6.36
Mabe	Replace 2 existing diesel engines with engines that meet or exceed 2004 emission standards	$124,000	$93,000	2.51

HEB/Blue Energy	Convert 42 HD diesel trucks to LNG (credit for 12 trucks to go to TERP and credit for 22 existing trucks to be donated to H-GAC); LNG fueling station upgrade	$2,357,681	$1,768,268	37.78 (7.56 credited to TERP)
Bealine Service Company, Inc	Replace 24 existing heavy-duty diesel engines with engines that meet or exceed 2004 engine emission standards	$1,161,480	$871,110	13.75
Dorsett Brothers Concrete Supply, Inc.	Replace 44 existing diesel engines with engines that meet or exceed 2004 emission standards	$2,015,640	$1,511,730	23.31
Special Distribution Services, Inc	Replace 28 existing diesel engines with engines that meet or exceed 2004 emission standards	$1,169,010	$876,758	7.74
Faust	Replace 10 existing diesel engines with engines that meet or exceed 2004 emission standards	$305,780	$163,843	1.09
RS Concrete	Replace 27existing diesel engines with engines that meet or exceed 2004 emission standards	$1,674,000	$1,255,500	35.26
Waller ISD	7 School buses replaced with new vehicles	$276,465	$116,813	0.78
Klein ISD (2)	15 school buses with new vehicles	$592,425	$295,050	1.97
Tomball ISD	2 school buses with new vehicles	$74,442	$32,000	0.21
Sweeny ISD	2 school buses with new vehicles	$80,000	$55,200	0.37
Sheldon ISD	3 school buses with new vehicles	$111,000	$64,500	0.43
North Forest ISD	11 school buses with new vehicles	$407,000	$305,250	2.24
Conroe ISD	40 school buses with new vehicles	$1,488,844	$912,450	6.08
Fort Bend ISD	18 school buses with new vehicles	$710,910	$90,783	0.61
Schultz Brothers, Inc.	5 trucks replaced with new engines	$236,805	$177,604	4.63
Bell Hot Shot Delivery Services, Inc.	4 trucks replaced with new engines	$248,000	$186,000	2.22
GOPDQ.Net, LLC	14 trucks replaced with new engines	$561,830	$421,373	7.31
Sysco Food Services of Houston, LP	44 trucks replaced with new engines	$1,876,710	$1,162,248	7.86
Burrus Contractors Supply	5 trucks replaced with new engines	$215,275	$161,456	1.96
Craig & Heidt	1 trucks replaced with new engines	$62,000	$46,500	0.79
Aeriform Corporation	19 trucks replaced with new engines	$832,795	$624,596	5.57
City of Lake Jackson (3)	3 trucks replaced with new engines	$175,250	$131,250	1.14
Texas TransEastern	8 trucks replaced with new engines	$366,480	$274,860	11.57
Faust Distributing Co., LTD	10 trucks replaced with new engines	$341,645	$256,233	2.99
Disposal Dr, Inc.	3 trucks replaced with new engines	$186,000	$139,500	4.59
Burks (Island) Concrete	8 trucks replaced with new engines	$496,000	$372,000	6.94
Bison Building Materials	49 trucks replaced with new engines	$2,202,515	$1,651,886	23.34
UVAC	1 truck replaced with new engines	$48,395	$36,296	0.54
American Corrugated Box Co, Inc.	2 trucks replaced with new engines	$91,620	$68,715	0.90
Nation Waste, Inc.	2 trucks replaced with new engines	$124,000	$93,000	2.83
ISC Building Materials	3 trucks replaced with new engines	$131,115	$98,336	1.19
Milstead Automotive	13 trucks replaced with new engines	$575,735	$398,978	5.03
Frito Lay, Inc.	18 trucks replaced with new engines	$824,580	$618,435	22.34
T & L Distributing	4 trucks replaced with new engines	$176,925	$132,694	4.02
Selwyn Lalla	2 trucks replaced with new engines	$124,000	$93,000	3.26
Rainbow Rider Enterprises, Inc.	4 trucks replaced with new engines	$248,000	$186,000	4.44
Jetco Delivery	24 trucks replaced with new engines	$1,064,725	$798,544	12.2
Silver Eagle Distributors (3)	6 trucks replaced with new engines	$274,860	$206,145	1.57
Dr. Pepper Bottling	12 trucks replaced with new engines	$511,830	$383,873	4.66
Service Steel Warehouse, LP	9 trucks replaced with new engines	$435,555	$326,666	12.89
W.M. Dewey & Son, Inc.	12 trucks replaced with new engines	$580,740	$435,555	4.18
Idealease of Houston	52 trucks replaced with new engines	$2,236,615	$1,677,461	17.75
Richway Cartage	15 trucks replaced with new engines	$725,925	$544,444	7.4
Brazos River	1 trucks replaced with new engines	$39,495	$29,621	0.22
Thorpe Products Company	3 trucks replaced with new engines	$118,485	$88,864	0.60
Fox Metals	2 trucks replaced with new engines	$91,620	$68,715	1.02
Tornado Waste	3 trucks replaced with new engines	$186,000	$139,500	3.60
Farmer's Copper	2 trucks replaced with new engines	$85,305	$63,979	1.00
Champion Rentals	1 truck replaced with new engine	$45,810	$34,358	0.37

Koy Concrete	10 trucks replaced with new engines	$458,100	$343,575	3.37
Builders Gypsum Supply	37 trucks replaced with new engines	$1,865,750	$1,399,313	10.52
Rustin Transportation	3 trucks replaced with new engines	$176,700	$132,525	2.86
Mainland Concrete	5 trucks replaced with new engines	$310,000	$232,500	5.09
Lone Star Integrated	12 trucks replaced with new engines	$619,500	$464,625	5.08
State Sign	5 trucks replaced with new engines	$197,475	$108,900	0.73
Palletized Trucking	17 trucks replaced with new engines	$1,054,000	$790,500	11.96
APR Acquisitions (Aztec)	11 trucks replaced with new engines	$440,760	$300,418	2.64
Arbor Care	2 trucks replaced with new engines	$78,990	$59,243	1.09
Campbell Transportation	10 trucks replaced with new engines	$625,000	$468,750	15.10
Cooper's Sanitation	3 trucks replaced with new engines	$124,800	$93,600	1.51
KIC Transportation	3 trucks replaced with new engines	Not yet est.	$108,889	0.88
Mid-Con Contractors	1 trucks replaced with new engines	Not yet est.	$34,358	0.57
Modern Method Gunite	1 trucks replaced with new engines	Not yet est.	$36,296	20.30
Earth Materials	10 trucks replaced with new engines	Not yet est.	$465,000	11.15
Con Rock Ready Mix	17 trucks replaced with new engines	Not yet est.	$790,500	23.80
Montalbano Lumber	4 trucks replaced with new engines	Not yet est.	$101,694	1.76
South Bay Gunite	6 trucks replaced with new engines	Not yet est.	$197,925	4.19
Fort Bend County Road & Bridge	5 trucks replaced with new engines	Not yet est.	$219,375	3.71
Deer Park Lumber Co.	3 trucks replaced with new engines	Not yet est.	$88,864	0.77
Stahlman Lumber Co.	1 trucks replaced with new engines	Not yet est.	$29,621	0.20
Galena Park ISD	7 trucks replaced with new engines	Not yet est.	$120,000	0.80
METRO	165 2006 hybrid buses replacement of 1997 conventional buses		Voluntary	133.6
METRO	142 engine replacements 2002 for 1997 engines		Voluntary	20.4
METRO	Automatic idle shutoff devices (3.4% of 75% of Transit Bus activity)		Voluntary	18.4
Total (October, 2006)				862 tpy 3.45 tpd[1]

[1] – Per TERP calculation

4. Commute Solutions

The Commute Solutions program run by H-GAC includes a variety of initiatives to reduce single occupancy vehicle commuter travel. Average daily 2007 NOx and VOC emission reductions are estimated for the following Commute Solutions programs:

- Vanpooling (Regional Program with METRO and miniPool)
- Rideshare incentive (NuRide)
- Best Workplace for Commuters (BWC)
- Telework

As documented here, the vanpool and BWC programs are generating the largest reductions; vanpools about 0.18 tons per day and Best Workplaces about 0.18 tpd. Telework and rideshare programs make up the balance of the estimated 0.37 tpd emission reduction for VOC and NOx from Commute Solutions. The Best Workplaces calculations were based on best estimates and typical assumption of progress with precise data for 2007 being collected. The NuRide program is generating much less commuter and emission reductions through 2006, but is in its initial phase of implementation. The vanpool estimates are quite robust because rideshare incentives are used to collect utilization data provided by riders themselves and reported via vendors.

4.1. Regional Vanpool Program

***Summary of Strategy*:** The vanpool program provides incentives for commuters to use vans and meet riders at a central location, such as a park and ride lot. The commutes are typically long distance and attract riders in higher numbers than a carpool program.

***Status*:** Using vendor reported data as of October 2006, the vanpool program now includes a total of 646 vans (up from 418 in January 2005) serving 7,596 riders. The average round trip distance of each van is 62.8 miles (rounded to 63) and there are now an average of 11.76 riders (rounded to 12) per van for estimating the effects of the Metro program. The Metro vanpool program has 482 vans. On an average month there are about 22 work-days, so this program is currently reducing an average 267,221 miles per day of passenger vehicle travel.

The miniPOOL program has 164 vanpools with an average of 22 days per month of use and which reduced travel by 883,897 miles in October 2006, or an average of 40,177 miles per day of travel. These estimates are already corrected for VMT by the van itself. Taken together the programs are reducing 307,398 miles of passenger travel per day.

***Continued Implementation*:** The vanpool program has been expanded in the last two year and plans are to continue or further expand the program. The emissions reduction projected here reflect progress through 2006 with some further expansion in 2007 likely to occur.

Sample Calculation: The emission reduction is determined by estimating the emission reductions achieved by reduced vehicle trips, and then by subtracting the van emissions from that number.

307,398 miles a day multiplied by (0.587 VOC or 0.595 NOx g/mile) = 0.20 tpd of VOC and 0.20 tpd NOx.

Emissions from van (LDGT4) = (0.412 VOC or 0.864 NOx g/mile) x 63 miles = 26 grams of VOC or 0.06 lbs. per day per van and 54.4 grams of NOx or 0.12 lbs. per day per van.

VOC emissions reduced– van emissions = 0.20 tons. – 0.015 tons = 0.18 net tons per day reduced.
NOx emissions reduced– van emissions = 0.21 tons – 0.029 tons = 0.17 net tons per day reduced.

4.2. Rideshare Incentive

***Summary of Strategy*:** H-GAC launched an innovative rideshare incentive program in July 2005, using the NuRide system. This system better allows commuters to find others with similar commutes to increase vehicle occupancy.

***Status*:** According to the NuRide reporting system, the program reduced 6,214,348 miles of travel between November 2005 and October 2006. This works out to an average of 23,901 miles per day. NuRide also subtracts the impact of vanpools on their trip and VMT reduction impacts to avoid double counting with the vanpool incentive program.

***Continued Implementation*:** In November 2005 there were 1,822 NuRiders and by October 2006 there were 5,800, a participation increase of 46 percent.

Sample Calculation: At a current rate of reduction of 23,901 miles per day, the NuRide program is reducing 0.016 tons per day of NOx and 0.015 tons per day of VOC.

4.3. Best Workplaces for Commuters (BWC)

***Summary of Strategy*:** The Best Workplaces for Commuters (BWC) program is part of the VMEP program and helps both commuters and employers to improve air quality through reductions in vehicular travel. The program began in February 2000 and continues to grow. Studies show that employers offering commuter benefits improve employee recruiting and retention, increase employee job satisfaction, and save money on parking and federal taxes while providing improvements to air quality. H-GAC continues working with companies to promote alternatives to commuting (teleworking, carpools, greater use of public transportation, and walking or biking) among employees. The program provides consultant assistance to human resource managers interested in the benefits of developing and implementing site-specific programs. This program is being counted as an extra emission reduction because it has been estimated that the employers that implement the BWC program do not report to NuRide (carpool) or Telework and therefore are not substracted from the BWC estimates.

***Status*:** The BWC estimates are based on national participation rates applied to Houston employers with summary data on the number of employees participating in the program. The participation rate (from the EPA BWC website) of 20% was estimated. A 2004 random survey of BWC employers in four regions (including Houston) revealed a VMT and emission reduction impact ranges from 7.4% - 15%, compared to non-participating employers, using the national average proportion of ridesharers who have a common worksite destination. Therefore the more recent estimates have projected an increase in participation rates.

***Continued Implementation*:** According to H-GAC, there are 107 companies now participating as EPA-approved BWC worksites. Based on statistics for November 2006 for 95 of these companies (89%), the average number of employees per participating company is 1,137. This implies there are now 121,659 employees working for BWC participating companies. Using the method from the VMEP mid-course revision, 20% of these employees would switch to an alternative mode after the worksite implemented its BWC enhanced program. This would mean that 24,332 would be new alternative mode users. Subtracting the potential vanpoolers counted in the vanpool program (7,596), the net new alternative mode users would be 16,736. An estimate of two-day-a-week alternative mode use was also made, resulting in 6,694 new alternative mode users per work day. Using an average round trip commute distance of 40 miles, this would reduce 267,776 miles of travel per day. This would result in emissions reductions of 0.175 tons of VOC and 0.175 tons of NOx per day.

Sample Calculation:

Emission reduction = (EE – VAN) x RTD x PDAYs x EFNOx (or EFVOC) ÷ 907,200 (g/ton)

EE:	Eligible Employees (new alternative mode users)
VAN:	Number of vanpoolers region-wide in regional program
RTD:	Round Trip Distance
PDAYs:	Average participation days per work week
EFVOC:	VOC average emission factor for 2007
EFNOx:	NOx average emission factor for 2007

4.4. Telework

***Summary of Strategy*:** Telework is an initiative to reduce employee commutes by allowing employees to work from home. Telework is a strategy incorporated in each company's commute options. H-GAC has been working with companies to incorporate and measure the impact of new telework initiatives.
***Status*:** The telework program has grown from 824 employees to over 1,400 with the recent addition of Hewlett Packard. On average, teleworkers are telecommuting once per week.

***Continued Implementation*:** The program is on-going.

Sample Calculation: Given that round trip work distances are average 40 miles, and an average of 1 telework day per week, it is estimated that telework is reducing travel by an average of 11,200 miles per weekday. This results in an emission reduction of 0.007 tons per day of VOC and NOx.

5. RCTSS Signal Timing

***Summary of Strategy*:** This strategy is designed to reduce idling time by traffic light synchronization. H-GAC is funding the implementing entities: Harris County, City of Houston, TxDOT and METRO. RCTSS strategy will in the near future do one more thing: With the help of video cameras and loops in the lanes of the roadway, staff of Transtar will able to monitor various arterials and will able to remotely change from Transtar the signals from red to green or vice-versa depending on which direction of traffic is more dense, then Signal Timings will as well be changed when ever needed.

***Status*: This is an on-going program.** The federal portion of the funding for project implementation has been committed.

***Continued Implementation*:** Reduced idling and braking from mistimed lights will result in emission reductions. The implementation is on-going.

Sample Calculation: The emission reduction was calculated using the difference in emissions rate at the average speed prior to the project and that at the average speed after the project multiplied by the VMT for that roadway link.

$$\text{Emissions Reductions} = (EF_{prior} - EF_{after}) \times VMT + (Delay_{prior\text{-}onpeak} - Delay_{after\text{-}onpeak}) \times EF_{idling} + (Delay_{prior\text{-}offpeak} - Delay_{after\text{-}offpeak}) \times EF_{idling}$$

6. Locomotive Voluntary Reductions

***Summary of Strategy*:** This measure was projected to result in a 17 percent emission reduction (2 tpd NOx) calculated from a base 2007 inventory of 12.1 tpd NOx. The emission reductions can be derived from a number of control strategies from improved efficiency, new engines or other control methods.

***Status*:** This project is the first Memorandum of Agreement (MOA) signed by the Environmental Protection Agency, the Texas Commission on Environmental Quality, the Houston-Galveston Area Council and private entities – Burlington Northern and Santa Fe Railway Company (BNSF) and Union Pacific Railroad Company – for the Voluntary Mobile Emission Reduction Program. The agreement was signed in December 2000. For the mid-course review, both Union Pacific and BNSF submitted progress reports and plans for meeting the voluntary agreement, and the projects are outlined below. Progress to date equals 478 tpy and more than 2 tpd are expected from planned emission reductions as shown in Table 4 below.

Table 4. Mid-course review rail emission reduction projects (through 2004) and planned by 2007

Company	Projects	NOx (tpy)
Union Pacific	Idle reduction from Automatic Start Stop (AESS) on 83 locomotives through 2003	(290)
Union Pacific	Additional 70 AESS installations	266
Union Pacific	Accelerated turnover to lower emitting engines dedicated to HGA	Undetermined
BNSF	Increase efficiency, 8.8% improvement estimated	(135)
BNSF	Idle reduction from AESS on 8 switch engines locomotives	(28)
BNSF	Line-haul AESS on portion of fleet	(25)
BNSF	Install AESS on an additional 15 switch engines	53
Total (tpy) (tpd)	**Progress to Date**	**(478) (1.3 tpd)**
Total (tpy)	**Planned for 2007**	**797 (>2 tpd)**

***Continued Implementation*:** Union Pacific and BNSF Railroads have prepared plans to reduce emissions from switching and line-haul engines which will more than meet the MOU goal of 2 tpd NOx reduction. The railroads are preparing documentation that the plans have fulfilled the voluntary emission reduction strategy.

7. Commercial Marine

***Summary of Strategy*:** Texas Waterway Operators (TWO) was intended to generate emission reductions through projects associated with commercial marine measures. TWO is a coalition of 22 independent entities of tugboat, tank barge or towing vessel operating companies engaged in waterborne transportation within the boundaries of the HGB. H-GAC signed an MOA with TWO to reduce emissions from tug and barge traffic. TWO has submitted a plan to satisfy the agreement by replacing or repowering older tugs with engines meeting lower emission standards and reduced idling time.

***Status*:** TWO submitted a progress report detailing that most of the projects involved engine replacement with two shoreside power projects totaling 1.14 tpd reduction. Examples of marine measures under consideration include, but are not limited to:

a) Early integration of new engines
b) Retrofit engines with emission reduction technologies
c) Local fleet management by using more efficient equipment
d) Methods to reduce tug and towing vessel idling time

***Continued Implementation*:** TWO detailed the projects implemented by 2007 that were used to reach the voluntary goal of 1.14 tpd NOx emission reduction. A small amount of VOC reduction was likely realized through use of newer engines, but no VOC reductions are credited for this measure.

8. Background for Emission Reduction Calculations

This section is to outline how the emission factors that are being used to calculate emission reductions are calculated. For instance, the average light-duty vehicle emission rates were used to estimate the impact of commute options to reduce vehicle emissions through reduced mileage traveled. Average emission rates include expected fleet age distribution and in-use activity, including average speed per link and relative facility type operation. The average emissions rates in Tables 5 and 6 were derived by taking the daily emissions divided by the daily vehicle miles traveled (VMT) for the August 30, 2007 episode day emissions predictions, including adjustments for ambient conditions (humidity and temperature) and TxLED fuel. (TTI, 2005)

Table 5: Area-wide average emission rates (g/mile) for light-duty vehicles in HGA in 2007

Vehicle	LDGV	LDGT1	LDGT2	LDGT3	LDGT4	LDDV	LDDT12	LDDT34	MC	LD Avg.
VOC	0.596	0.600	0.632	0.376	0.412	0.321	2.53	0.279	2.66	0.587
NOx	0.543	0.518	0.748	0.595	0.864	0.754	2.47	0.606	1.01	0.594

Table 6: Area-wide average emission rates (g/mile) for heavy-duty diesel vehicles in HGA in 2007

Vehicle	HDDV2b	HDDV3	HDDV4	HDDV5	HDDV6	HDDV7	HDDV8a	HDDV8b	HDDBT	HDDBS
VOC	0.14	0.18	0.22	0.25	0.35	0.44	0.47	0.43	0.37	0.61
NOx	2.43	3.26	3.97	4.26	5.94	7.72	11.15	10.50	14.44	10.15

References

TTI (2005), provided through H-GAC, April 2005.