

Draft Report

**EVALUATION OF MOBILE SOURCE
CONTROL STRATEGIES FOR THE
HOUSTON-GALVESTON-BRAZORIA
STATE IMPLEMENTATION PLAN**

Prepared for

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1. BACKGROUND AND PURPOSE OF STUDY

This report documents a study performed by ENVIRON International Corporation on behalf of the Houston-Galveston Area Council (H-GAC). The study was conducted in support of development of an Ozone Attainment Plan. ENVIRON International Corporation, in collaboration with subcontractors and Earth Matters and Hazel Barbour, provided assistance in identifying, evaluating, and documenting emission control measures in an attempt to determine a set of strategies to achieve emission reductions of volatile organic compounds and nitrogen oxides in the Houston-Galveston-Brazoria (HGB) nonattainment area.

This initial work involved preparing and qualitatively evaluating a master list of control strategies. H-GAC and its stakeholders began with the initial master list from public comment and involvement culminating in 2006. The master list was winnowed to those deemed of most interest to H-GAC and its stakeholders and additional measures suggested. An summary of the result of the stakeholder meetings is provided in Appendix A of this report. ENVIRON and its subcontractors then reviewed the remaining master list strategies to estimate their applicability and potential for inclusion in a regional State Implementation Plan (SIP).

BACKGROUND

The study was initiated by a request and support from the Texas Commission on Environmental Quality (TCEQ) to the H-GAC to provide assistance in developing approvable control strategies for the Houston-Galveston-Brazoria area to attain the ozone standard by the year 2018. The study was initiated to assist in the State Implementation Plan (SIP) to demonstrate attainment for the ozone standard now based on an 8-hour averaging of the fourth annual maximum during a three year period. TCEQ requested that an evaluation of control strategies be conducted in order to understand the potential benefit of strategies that could be implemented as rules or voluntary initiatives. The Houston-Galveston-Brazoria ozone nonattainment area consists of the counties of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller.

PURPOSE OF STUDY

This study is a part of an overall process to develop the revised Ozone SIP for the year 2018. The primary objective of the study was to identify and evaluate feasible control measures to reduce NO_x emissions. A secondary objective was to assist H-GAC in ensuring that area stakeholders were involved in the process of identifying the measures and in commenting on their feasibility. These efforts were intended to "feed in" to the general SIP process, which will include emission inventory development and photochemical modeling by the TCEQ; ongoing and new processes initiated by H-GAC to identify potential new control measures; and H-GAC efforts to solicit stakeholder input into these potential measures, as well as to continue to keep local legislators and planners in the eight-county nonattainment area involved in the planning.

Key tasks of this ENVIRON study included:

- 1) Review existing emission inventory and previously evaluated control measures
- 2) Assist H-GAC in identifying potential new measures

- 3) Perform a qualitative analysis of the applicability and primary pollutant affected by control strategy.

And those yet to be conducted:

- 4) Quantify effects of measures (emissions, costs, feasibility)
- 5) Coordinate with TCEQ on understanding the measure analyses in order that they could be placed into emission projections
- 6) Document control measure effects and present findings to technical, policy and steering committees
- 7) Develop control strategies and submit documentation to TCEQ

Although H-GAC is the regional transportation planning agency, the study was not limited to transportation sources. Instead, the purpose was to explore all possible on-road and off-road mobile source measures, including sources such as lawnmowers or construction equipment.

ORGANIZATION OF REPORT

The remainder of this report is organized as follows:

Section 2, Control Measure Identification, documents the process used to select individual control measures to analyze.

Section 3, Methodology for Analysis of Control Measures, briefly describes the data sources, assumptions and techniques used in the analysis.

Section 4, Summary of Results presents an overview of the results, with measure results for each measure displayed in tabular format.

Appendix A, Presents the meeting summaries for stakeholder input and comment.

2. CONTROL MEASURE IDENTIFICATION

Initial identification of potential control measures was accomplished through a public process for the HGB area in 2006. ENVIRON with H-GAC used a master control measure list as a starting point from which to identify measures for the HGB nonattainment area Ozone SIP strategies development. H-GAC were solicited additional measures for the HGB area from local stakeholders including the Regional Air Quality Planning Committee (RAQPC) to ensure that all potential emission control measures could be identified.

Refining Initial Master List

Several hundred potential on-road mobile source measures and just fewer than one hundred off-road mobile source measures were suggested in the 2006 master list. Because the process was all encompassing, many measures were suggested more than once, although in different ways. In addition, many measures that would alone have minimal effect on emissions were easily recognized as being naturally a part of larger measures and others were not well described. So many of the measures could be either combined into a larger measure or were defined in a manner that could be considered an emission reduction measure. However, the master list did include several measures that were essentially identical or address the same emission reduction strategy.

The final master list was a collection of measures that represented a refined version of all ideas proffered to date to be considered for more detailed evaluation. The general categories included such diverse groupings as clean vehicle programs, pricing measures for on-road mobile sources; and incentive programs, public fleet measures, locomotive, and marine for off-road mobile sources. A full list of the master list measures includes measures outlined in Section 4.

Evaluating Feasibility and Potential for Emission Reductions

As noted, the initial review was qualitative, as it was not feasible to model each of the individual control measures suggested. The qualitative review outlined those measures that meet minimum criteria for inclusion in a SIP, the pollutant affected, and a description of the implementation considerations. The draft master list provided here would be used to consider those measures to be included in a more detailed analysis of measures. The primary goal of the master list evaluation will be to identify those measures with the highest feasible potential emissions reduction.

3. METHODOLOGY FOR ANALYSIS OF CONTROL MEASURES

For the initial evaluation of the master list of control measures, a qualitative approach was used to distinguish the measures. This section briefly summarizes the approaches and assumptions used in the analysis of these measures.

Qualitative Review of Master List

The primary qualifier for a control measure is if the EPA considers the SIP control measures to be 1) permanent, 2) quantifiable, 3) surplus, and 4) enforceable (PSQE). The definitions of the criteria and the administrative oversight of the PSQE criteria may not be obvious from the short description of each measure. But the ENVIRON team made a judgment as to whether a program could be defined to satisfy these criteria.

EPA allows for a limited portion of the emission reductions in the SIP to be voluntary commitments that may not strictly meet all of the criteria listed above. However, for voluntary measures, the administering agency must demonstrate real emission reductions by showing funding, oversight, and verification of progress toward the emission reduction goal. For instance, the H-GAC Clean Cities and Clean Vehicles Program can demonstrate funding for clean heavy-duty vehicles and verification of disposal of the replaced vehicles even though the measure may not be considered strictly as enforceable. Therefore voluntary programs may be considered for inclusion in a SIP if defined and funded properly.

Qualitative Review of Emission Control Potential

The qualitative review of the emission control potential for each measure relies on the basic understanding of the emission inventory. TCEQ has not yet provided final emission inventories for the 2018 HGB SIP especially for nonroad sources. Control strategies for mobile sources rely on the basic understanding that diesel engines are a significant source of NOx emissions but produce a small fraction of the VOC emissions, and gasoline vehicles and engines are primarily responsible for the VOC emissions inventory while on-road gasoline vehicles also contribute to the NOx emission inventory. Therefore programs to reduce diesel engine and vehicle emissions primarily affect NOx emissions, nonroad gasoline engines affect VOC emissions, and on-road gasoline vehicles affect both VOC and NOx emissions.

Qualitative Review of Feasibility

The feasibility of each measure was not ranked, but a description of the implementation considerations is provided for each master list measure.

4. SUMMARY OF RESULTS

This section summarizes the results of the study for all measures. Table 4-1 lists each on-road measure that was analyzed in some detail, and Table 4-2 lists each off-road measure analyzed. The measures are described qualitatively but not ranked in terms of potential benefit or cost effectiveness because inventories have not been finalized and often the program's implementation has not been adequately defined. However, with stakeholder input, a list of measures deserving detailed evaluation could be selected.

The measures were not ranked by emission reduction potential for a number of reasons. The emission reduction potential depends on the level of implementation in most cases or the measure needs to have greater detail in order to evaluate the potential. For nonroad mobile sources, a 2018 forecasted emission inventory is not yet available to provide a relative assessment to compare between nonroad source emission categories or to compare with those measures for on-road sources. Lastly, there has yet to be an emission reduction target to meet attainment for the HGB area.

Rather than dismiss a measure because it might seem unimportant based on emissions reductions expected, all viable measures were included in the master list. Even small reductions might be important if implementation is more aggressive than conceived, the source category is of larger importance than expected, or if the attainment goal does not require large reductions. Another consideration could be that the measure might result in small reductions but be very cost effective or easy to implement.

Our initial list therefore marks those measures that qualify as emission reduction programs under a likely EPA review with "+" to denote which pollutant would be affected by the measure.

Each measure is described in terms of what would be implemented and a further comment field discusses the implementation considerations and other unknown factors affecting the measure.

Table 4-1. On-road vehicle emission reduction measures.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
1	17	Bicycle and pedestrian action groups	Benefits would need to be estimated from survey and other approaches to determine the use along existing or new bicycle lanes.	Bicycle and Pedestrian	2006	Y	+	+	Reporting requirements could be difficult to meet to claim emission reduction benefits. For comparison, determine the emission reduction potential of 20% of employees with commutes of 5 miles or less bicycle to and from work two times per week.
2	51	Clean Cities Technical Coalition	An example program might be the NCTCOG program where entities participate in programs to purchase clean vehicles (light or heavy-duty) for their fleets.	Clean Vehicle Programs	2006	N			The strategy, incentives, and benefits have yet to be defined.
3	54	Private sector clean fuel fleets	This measure is patterned after the H-GAC Clean Cities Program where clean engines (whether alternatively fueled or no) are purchased for fleets to reduce emissions.	Clean Vehicle Programs	2006	Y		+	CMAQ funding for clean vehicles has been a successful program for generating emission reductions. Similar to measure 22.
4	56	Close loopholes in the Texas Clean Fleet Program making fewer exemptions for fleets	The Texas Clean Fleet Program was repealed by TCEQ, and because the Tier 2 light-duty and 2007 heavy-duty vehicle emissions standards have superceded the original proposal.	Clean Vehicle Programs	2006	N			A revision and implementation of such a program needs to be described in more detail to evaluate the benefits.
5	58	Fleet review, procurement and operations policies	ENVIRON expects that this could be a voluntary version of a Clean Fleet Program.	Clean Vehicle Programs	2006	Y		+	See Measure 3
6	59	Public agency clean fleet program	Commitment by public agencies to purchase cleanest possible fleet vehicles could be an element in funding or a voluntary commitment.	Clean Vehicle Programs	2006	Y		+	See Measure 3
7	71	Electric Vehicles	This measure is considered to include each of various options for the purchase and use of electric (zero emission) light-duty vehicles.	Clean Vehicle Programs	2006	Y	+	+	This measure would affect light-duty vehicles only.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
8	99	Area-wide "Steer It/Clear It" program	This program considers quick removal of vehicles from roadway in event of a stall or non-serious accident. The benefits of the program include better traffic flow reducing slow speed operations.	Freeway Incident / Roadway Construction Management	2006	N			The benefits of the program include better traffic flow reducing slow speed operations, but the measure may not be considered permanent.
9	100	Additional freeway service patrol	Operation of additional lane miles of new roving tow truck patrols to clear incidents and reduce delay on freeways during peak periods. Reduces traffic congestion improving average vehicle speeds.	Freeway Incident / Roadway Construction Management	2006	N			See measure 8
10	101	SAFEClear - Mandatory quick removal of disabled vehicles during peak periods	Similar to Measures 8 and 9.	Freeway Incident / Roadway Construction Management	2006	N			See measure 8
11	115	Cleaner diesel fuel	There are diesel fuels that have improved performance even beyond the TxLED. This could include cetane additives or gas-to-liquids diesel fuels.	Fuel Standards	2006	Y		+	EPA evaluation of fuel benefits. http://www.epa.gov/otaq/fuelsmodel.htm
12	127	Air quality information with driver training	Include information on vehicle emissions and air pollution with new-driver and defensive-driving education.	General Public Education and Outreach	2006	N			This measure would be difficult to demonstrate emission reduction benefits.
13	144	Divert trucks from nonattainment areas	Require through-traffic trucks to travel around rather than through nonattainment areas.	Goods Movement	2006	N			While this measure would have large potential benefits, it could be difficult to implement and measure.
14	146	Peak period truck bans on freeways and major arterials	The truck bans would most likely improve average speeds of light-duty vehicles, and therefore have less benefit on emissions.	Goods Movement	2006	N			The day to day and hour to hour benefits for emissions would make it difficult to claim credit.
15	147	Permit HOV lane use by qualifying low emission vehicles (LEV)	Vehicles marked as low emitting would be allowed to use HOV lanes as an incentive for greater use.	High Occupancy Vehicle (HOV) Lanes/Managed Lanes	2006	N			Check HOV lane use - if too full already this measure cannot help. Also it would be difficult to define and mark vehicles that qualify. It is unclear that the incentive would be sufficient to demonstrate greater use of low emitting vehicles.\

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
16	150	Increase occupancy to three or more per vehicle	This measure is not defined in a manner to evaluate its effectiveness.	High Occupancy Vehicle (HOV) Lanes/Managed Lanes	2006	N			This is a measure already being implemented in some parts of Houston on Katy and NW freeways where HOV and toll incentives are used.
17	157	Single Occupant Vehicles (SOV) access to HOV and transit stations	Provide direct freeway access to adjoining HOV or transit park-and-ride facilities to encourage use and expedite access.	High Occupancy Vehicle (HOV) Lanes/Managed Lanes	2006	N			See measure 15.
18	161	Managed lanes to accommodate some single occupant vehicles in HOV lanes	In highly congested corridors where speeds are below 20 miles per hour on freeway lanes, permit limited use of HOV lanes by SOV using tolls or other limiting technique.	High Occupancy Vehicle (HOV) Lanes/Managed Lanes	2006	N			See measure 15.
19	163	Focus on finding and penalizing extreme high emitters	(a) Improved remote sensing program, or (b) enhanced enforcement of the I/M program could reduce numbers of likely high emitting vehicles escaping testing through purchase of fraudulent stickers or avoiding the program completely. Penalize fraud not high emitters	High-Emitting Vehicle Detection and Programs	2006	N			Questionable regarding excess modeled reductions (I/M modeled at 96% compliance) but could produce real reductions.
20	165	Rewards for reporting smoking or high emitting vehicles	Rewards could be dollars or discounted I/M tests and/or repairs for those reporting smoking vehicles.	High-Emitting Vehicle Detection and Programs	2006	N			See measure 163
21	172	Scrappage/buy-back plan	Monetary compensation for old vehicle scrappage. Increase the range of vehicles and heavy-duty truck engines targeted for replacement credit or subsidy.	High-Emitting Vehicle Detection and Programs	2006	Y	+	+	Increased LIRAP funding (total \$45 million this biennium) has hugely increased replacement/scrappage. LDGV's over 10 years now eligible for replacement (don't have to have failed the I/M test). TERP also requires scrappage of replaced vehicles/engines. 2010 bus 99% cleaner than 1998 bus for NOx.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
22	181	Dedicated funding for school bus replacement	Clean Cities Clean Vehicle or TERP or EPA funding sources.	High-Emitting Vehicle Detection and Programs	2006	Y		+	Could be covered under TERP.
23	186	Non-profit organization assistance program	Investigate opportunities to partner with non-profit organizations to ensure high-emitting donation vehicles are not returned to the road and reused in an "as is" condition.	High-Emitting Vehicle Detection and Programs	2006	N			Will reduce value of donation to the non-profit.
24	188	Enforce smoking vehicle reports and require repairs	Link reports to vehicles' current I/M test status. Require vehicle to be retested.	High-Emitting Vehicle Detection and Programs	2006	N			May enhance I/M compliance. Repairing to reduce smoke may not mean vehicle will pass I/M test. Currently no requirement to I/M test diesels.
25	191	Low-interest financing for low income and/or old vehicle trade-ins	Financing made available to vehicle owners not eligible for LIRAP replacement option	High-Emitting Vehicle Detection and Programs	2006	N			See measure 172.
26	193	Ban sale of high-emitting vehicles	Vehicles sold within I/M counties must have valid passing VIR	High-Emitting Vehicle Detection and Programs	2006	N			Provides additional I/M enforcement strategy
27	194	Ban high-emitting vehicles in CBD	Vehicles not allowed through check point if fail remote sensing scan, or if do not have a valid inspection sticker	High-Emitting Vehicle Detection and Programs	2006	N			Difficult to implement plus once the program is known about, vehicles may avoid CBD but be driven around in the wider HG area anyway. Additional RS expensive.
28	195	Deny registration to vehicles with repeated emission failures	This measure would require a legislative change.	High-Emitting Vehicle Detection and Programs	2006	N			Registration already denied if vehicle fails and doesn't subsequently pass I/M test. If not in LIRAP, could require repairs be done at Recognized Emissions Repair Facility.
29	201	Communicate by radio best routes through area to avoid congestion	Improvements of traffic flow would affect average speeds on roadways.	Intelligent Transportation Systems (ITS)	2006	N			The benefits would be day to day and hour to hour making it difficult to claim emission credit.
30	202	Information telephone hotline for traffic conditions	Improvements of traffic flow would affect average speeds on roadways.	Intelligent Transportation Systems (ITS)	2006	N			See measure 201.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
31	207	Provide transportation conditions internet site	Provide hotlink to local transportation conditions website or provide internal web page with transit, traffic, other conditions, schedules and directions to encourage use of modes other than driving alone.	Intelligent Transportation Systems (ITS)	2006	N			See measure 201.
32	208	Encourage bicycle use by using ITS to increase safety in strategic bicycle/automobile conflict areas	Duplicate measure.	Intelligent Transportation Systems (ITS)	2006	Y	+	+	See measure 1.
33	209	Dynamic message signs for control of truck movements	Emissions benefits of truck movements are unclear.	Intelligent Transportation Systems (ITS)	2006	N			See measure 201.
34	210	Dynamic message signs for freeway traffic control	Emissions benefits of freeway movements are unclear.	Intelligent Transportation Systems (ITS)	2006	N			See measure 201.
35	211	Real-time display of estimated time of arrivals at bus stops	Provide changeable message signing at bus stops noting ETA of the next buses arriving at the stop.	Intelligent Transportation Systems (ITS)	2006	N			See measure 201.
36	212	Increase system surveillance	The effect of this measure on traffic movements is not well defined.	Intelligent Transportation Systems (ITS)	2006	N			See measure 201.
37	214	Limit left turns on selected thoroughfares during ozone season	This measure may show capacity improvements on selected roads allowing for better average speeds.	Ozone Action Day / Ozone Season	2006	N			It may be difficult to demonstrate benefits of program. See measure 74.
38	218	Delay high emissions producing activities on ozone action days; delay activities for non-ozone action days	The program is ill defined, and any benefits experience in the nonattainment area may be offset by degradation downwind.	Ozone Action Day / Ozone Season	2006	N			Involved ozone modeling would be necessary to demonstrate any benefits to the proposed strategy.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
39	227	Preferential parking for High Occupancy Vehicle (HOV) lane users and ride sharers; Free spaces, reserved spaces	Incentive for ride sharing and reduced commuting alternative.	Parking Management	2006	Y	+	+	This measure should be evaluated as part of a Commute Solutions Program (ridesharing). If the measure is implemented consider adding it to the suite of programs for enhancing ridesharing incentives and opportunities.
40	228	Preferential parking for High Occupancy Vehicle (HOV) lane users and ride sharers; Rate reduction	Duplicate measure.	Parking Management	2006	N			See measure 39.
41	229	Preferential parking for High Occupancy Vehicle (HOV) lane users and ride sharers; Metered spaces	Duplicate measure.	Parking Management	2006	N			See measure 39.
42	231	Free parking at park-and-ride facilities for High Occupancy Vehicle (HOV) lane and transit users	Provide free parking at facilities served by transit; include costs elsewhere or subsidize. Include in weekly or monthly passes.	Parking Management	2006	N			Insignificant emission reduction effects, overlap with ridehsaring program, possible overflow at park and ride lots and unsure of current cost structure at these lots.
43	235	Increase parking at transit centers or stops	An incentive to use transit instead of personal vehicles, but not emission reduction measure itself.	Parking Management	2006	N			Should provide at least a qualitative discussion due to overflow issues at current transit centers
44	236	Use direct ramps to connect park-and-ride lots with freeway system	An incentive to use transit instead of personal vehicles, but not emission reduction measure itself.	Parking Management	2006	N			Capital intensive and low emission reductions could be demonstrated.
45	237	Locate fringe parking and park-and-ride lots on approach routes and interchanges to central and other major business districts.	An incentive to use transit instead of personal vehicles, but not emission reduction measure itself.	Parking Management	2006	N			Capital intensive and low emission reductions could be demonstrated.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
46	240	Provide parking at all major transit stations	An incentive to use transit instead of personal vehicles, but not emission reduction measure itself.	Parking Management	2006	N			Need to examine feasibility
47	241	Commuter parking pricing	No free parking. Price increase would be applied to employees adjusted for vehicle occupancy so that carpoolers would not be subject to increased parking prices.	Parking Management	2006	Y	+	+	Utilize an analysis approach whereby the current price elasticity is applied to a 25% increase in parking prices in applicable parking centers.
48	243	Parking space tax or surcharge	Duplicate measure.	Parking Management	2006	N			Same as measure 47.
49	246	Increase meter fees for on-street parking	Unclear if the current availability and cost would affect vehicle travel.	Parking Management	2006	N			Baseline data of use, availability, and pricing not available.
50	248	Eliminate employee parking subsidies	Duplicate measure.	Parking Management	2006	N			Same as measure 51.
51	249	Employee parking cash-out program	A monetary incentive to ride share or use alternative commuting options.	Parking Management	2006	Y	+	+	Re-evaluate based on current subsidies, potential for removal, and price effect on commuters. Other areas have predicted large emission reductions for this measure. Evaluate as part of measure 47.
52	253	Smart Cards pay as you go parking	Unclear if this measure represents an incentive to reduce vehicle travel.	Parking Management	2006	N			The incentive for reduced vehicle use has not been identified.
53	256	Reduce legal on-street parking spaces in high congestion areas	Effectively increasing road capacity to reduced stop and go progression improving arterial speeds.	Parking Management	2006	N			Increase average vehicle speeds for arterials.
54	262	Limit peak period parking to vehicles with two or more occupants	Use flextime, but permit only vehicles with two or more occupants to enter workplace parking facilities during peak periods.	Parking Management	2006	N			Unless this measure is better defined, only the peak traffic would be affected not reducing overall vehicle use.
55	271	Remove fuel subsidies	Fuel prices and vehicle use have a direct correlation, but the specifics of this measure (price increase) need to be defined.	Pricing Measures	2006	Y	+	+	Provide a discussion based on recent gasoline price increases and resulting effects, proposed legislation on fuel taxes and subsidies and evaluate if indicated.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
56	273	Accelerated depreciation allowance for employer provided vanpool and bicycle facilities	Incentive to provide alternative commuting options, but not an emission reduction measure by itself.	Pricing Measures	2006	N			This measure could be examined a little further to determine cost savings and additional incentives for employers to provide vanpools or bike facilities. If this examination shows sufficient potential the measure should be quantified.
57	275	Congestion pricing for major activity centers	Charge vehicles to enter high-activity centers (retail/business districts, etc.) in cities, with higher prices charged during high-traffic hours.	Pricing Measures	2006	Y	+	+	This measure was evaluated in 2006 and the conclusion was that reductions would be less than 0.01 tpd. This measure is applied in many other countries with success, but would raise a lot of implementation concerns.
58	277	Pay-As-You-Drive Insurance (per-mile)	Insurance costs would be associated with mileage driving by a vehicle increasing the incremental cost per mile driven.	Pricing Measures	2006	Y	+	+	This measure was quantified as producing among the higher emission reductions in the 2006 analysis and should clearly be quantified for the 2008 analysis. The measure has also been implemented, at least at a pilot level in other areas, and is attractive to insurers.
59	287	Local or regional fuel taxes	Fuel prices increases. Duplicate measure.	Pricing Measures	2006	Y	+	+	See measure 55.
60	291	Vehicle miles traveled - based taxes	Charge a tax or registration fee by vehicle miles traveled per year.	Pricing Measures	2006	Y	+	+	See measure 55.
61	295	Increase tolls during peak traffic periods	The application higher costs only during peak hours are likely to have an insignificant impact on regional vehicle travel.	Pricing Measures	2006	N			Based on the HOT lanes on some freeways in Houston region, this measure may have applicability now and in the future as freeways become more congested. But the effect is likely to be small because of the limited number of toll ways and penalty for driving would be applied only to peak hours.
62	298	No tolls for buses and vanpools	An incentive to use transit instead of personal vehicles, but not emission reduction measure itself.	Pricing Measures	2006	N			Possibility that removing tolls for vanpools would provide a significant incentive to employers to purchase vanpools.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
63	300	Increased speeding fines	Increase amount of fines for exceeding existing speed limits over 45 miles per hour; use additional funds generated to fund vehicle replacement of other emission-reduction programs.	Speed	2006	N			It is unclear if this measure would reduce emissions by itself or provide funds for measures that do reduce emissions.
64	302	Aggressive driving enforcement		Speed	2006	N			This would not likely be considered a permanent measure but as an element of Measure 65 or 66.
65	304	Lower speed limit in urban area to 55 miles per hour	The MOBILE model estimates lower emissions if freeway free flowing speeds of cars and especially heavy-duty trucks are reduced.	Speed	2006	Y		+	This measure may be difficult to implement because the State would need to agree to the change.
66	311	Reduce speed to 55 miles per hour for commercial trucks	Lower freeway speeds of trucks lower emissions more than lower speeds for light-duty vehicles.	Speed	2006	Y		+	Historically, Texas has not wished to have different speed limits for cars and trucks. Similar to measure 65.
67	316	Incentives for infill and redevelopment	Several measures to plan communities for lower vehicle travel.	Sustainable and Transit-Oriented Development	2006	Y	+	+	Evaluate potential using methods and projections of infill and smart growth. Combine with measure 69 and 70 and especially 137, which is recommended as the "umbrella" measure
68	319	Local medical facilities	Increase the number of local "neighborhood" facilities for routine medical procedures	Sustainable and Transit-Oriented Development	2006	N			Evaluate VMT due to medical trips, which will be a percentage of Home-to-Other and Work-to-other. The percentage could be obtained from the travel modeling section or from most recent trip surveys. But is likely to be insignificant or one part of larger measure to reduce community travel. See measure 137.
69	321	Encourage or require complementary uses in close proximity in all developments or development areas	Apply Planned Use Development (PUD) concept by area, requiring a mix of complementary uses in each square mile or other development area in accordance to a sub-area, locally developed plan.	Sustainable and Transit-Oriented Development	2006	N			See measure 137.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
70	323	Comprehensive design guidelines for activity centers	Comprehensive design guidelines for layout of schools, neighborhoods and other activity centers to maximize walkability and minimize the need for short-distance automobile trips.	Sustainable and Transit-Oriented Development	2006	N			See measure 137.
71	324	Locate personal business support centers at park-and-ride facilities (convenience businesses)	Business location selection results for numerous reasons.	Sustainable and Transit-Oriented Development	2006	N			The headway times at park and ride facilities too short to justify expense, who would use these facilities, and the probable cost of installation and maintenance would not justify additional incentive to park and ride.
72	326	Co-locate event centers and major transit centers and stations	Local event centers at sites of major transit centers to ensure high level of service.	Sustainable and Transit-Oriented Development	2006	N			This measure would be event oriented and very capital intensive. It would probably cause a percentage of event attendees to utilize transit to avoid parking problems at events so worth looking into when siting these facilities, but not a regional strategy.
73	327	Daycare and other services	Daycare, other convenience services at park-and-ride lots and transit stations.	Sustainable and Transit-Oriented Development	2006	N			Many employers already provide. Could develop a qualitative evaluation of commuting employees with children in off-site day-care and quantify extra VMT associated with driving children to day-care and then assume a percentage of those can be serviced by day-care provided at the work site.
74	328	Ban left turns	Effectively increasing road capacity to reduced stop and go progression improving arterial speeds.	Traffic Flow Improvements	2006	N			Increase average vehicle speeds for arterials.
75	342	Reversible traffic lanes	Increased capacity in commuting direction.	Traffic Flow Improvements	2006	N			
76	350	Local intersection signal improvements	Effectively increasing road capacity to reduced stop and go progression improving arterial speeds.	Traffic Flow Improvements	2006	Y	+	+	Increase average vehicle speeds for arterials.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
77	351	Traffic signal equipment or software updating	Effectively increasing road capacity to reduced stop and go progression improving arterial speeds.	Traffic Flow Improvements	2006	Y	+	+	Increase average vehicle speeds for arterials.
78	352	Emphasis on major route traffic signalization; through route traffic platooning	Effectively increasing road capacity to reduced stop and go progression improving arterial speeds.	Traffic Flow Improvements	2006	Y	+	+	Increase average vehicle speeds for arterials.
79	354	Real-time traffic flow management	Traffic signals that change timing/cycles to accommodate real-time traffic conditions.	Traffic Flow Improvements	2006	Y	+	+	Increase average vehicle speeds for arterials.
80	355	Adaptive traffic signals and signal timing	Effectively increasing road capacity to reduced stop and go progression improving arterial speeds.	Traffic Flow Improvements	2006	Y	+	+	Increase average vehicle speeds for arterials.
81	357	Light emitting diode (LED) traffic signal replacement	It is unclear how this measure could reduce emissions.	Traffic Flow Improvements	2006	N			
82	358	Two-phase signals		Traffic Flow Improvements	2006	N			Increase average vehicle speeds for arterials.
83	360	Signal timing and coordination to promote traffic progression	Currently signal coordination tends to focus on reducing delay time for individual drivers; alter coordination to promote greatest movement for traffic as a whole.	Traffic Flow Improvements	2006	Y	+	+	Increase average vehicle speeds for arterials.
84	366	Prohibit drive-thru service during ozone season	The measure might be difficult or onerous to implement.	Traffic Management	2006	Y	+		Reduced idling of vehicles
85	371	Reduce transit fares	Incentive to use transit instead of vehicles.	Transit	2006	Y	+	+	Evaluate changes in transit use occurring in a selected time period of gasoline price increases to determine potential.
86	374	Peak/off-peak transit fares	Duplicate measure.	Transit	2006	N			See measure 85.
87	376	Personalized rapid transit	Duplicate measure.	Transit	2006	N			See measure 90.
88	377	Transit schedule coordination		Transit	2006	N			Effect too small to encourage significant additional transit use.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
89	393	Guaranteed ride home	Incentive for transit use, not a reduction measure itself.	Transit	2006	N			This measure is part of various measures that enhance ridesharing programs. It is not recommended that it be evaluated individually.
90	403	Subscription bus service	On demand personalized transit service.	Transit	2006	Y	+	+	A transit enhancement measure designed to attract transit users to specialized and customized transit services. This measure may be particularly attractive in years such as the attainment year.
91	407	Business First enhanced buses	Provide buses with laptop/Internet links, telephone and other business amenities.	Transit	2006	N			An incentive for transit use, not a reduction measure by itself.
92	414	Electrify bus routes	Fixed routes with catenary electric delivery.	Transit	2006	Y		+	Direct emission reduction from electrified buses.
93	422	Monthly transit pass programs	Already implemented and difficult to predict the increase transit ridership as a result.	Transit	2006	N			Already implemented for some time. Perhaps further reduce prices.
94	423	Eliminate trips - Free transit from remote sites	This measure is ill defined especially on how reduced vehicle mileage is attained.	Transit	2006	N			This measure does not seem to provide any emission reduction.
95	424	Provide an off-peak unlimited-ride daily pass	May already be implemented in large measure through the monthly pass program.	Transit	2006	N			Evaluate extent to which this is already offered in current transit program.
96	426	Unicket programs	This is an incentive not a vehicle travel reduction measure.	Transit	2006	N			Largely including in the monthly pass program.
97	428	Simplified fare collection	Difficult to show that this is an incentive for greater transit usage.	Transit	2006	N			Not quantifiable.
98	430	Public transportation - Special fares	The measure needs to be refined in terms of the incentives and participants in the program.	Transit	2006	N			Not quantifiable without extensive survey data.
99	433	Accelerate rail expansion	Increase transit capacity.	Transit	2006	Y	+	+	If specificity on expansion and ridership can be provided by appropriate agency this measure could be evaluated.
100	436	Commuter Rail	Combine regional and light passenger rail measures.	Transit	2006	N			See measure 99.
101	437	High-speed rail	Specially designed regional passenger rail.	Transit	2006	N			See measure 99.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
102	438	Free circulator service to major generators	Free shuttle/transit service connecting remote areas with major activity generators. Increase transit capacity.	Transit	2006	Y	+	+	If the description refers to shuttles in between major employment and retail centers this measure could have significant potential. Recommend agreeing upon additional specificity with appropriate H-GAC staff.
103	441	Provide High Occupancy Vehicle (HOV) shuttle between company facilities	Effectiveness of the measure depends on the number of companies and shuttles operating.	Transit	2006	N			Evaluate number of companies that have multiple locations within Houston region along with frequent travel back and forth by employees. The benefit is likely to be small.
104	446	Teleconferencing of meetings	The available benefit is unclear.	Travel Demand Management: Business Operations	2006	N			Evaluate potential from a qualitative standpoint. Most companies implementing already to extent possible for other reasons and due to advances in web-meeting technology.
105	453	Mandated peak spreading	Require business hours to be staggered to spread peak traffic over a wider time period and reduce congestion.	Travel Demand Management: Business Operations	2006	N			The peak in Houston is longer than almost all other urban areas in the U.S. (view HOV lane times). Less opportunity for further peak spreading exists in Houston region.
106	459	Mandatory or voluntary compressed work week	The benefits of this program could be included with a variety of commute reduction options.	Travel Demand Management: Business Operations	2006	Y	+	+	This measure creates a 20% reduction in weekly trips by any participant. Recommend a mandatory and a voluntary evaluation with the latter based upon a review of current employer practices and ability to sustain a compressed work week.
107	460	Subscription buses or buspooling	Duplicate measure.	Travel Demand Management: Business Operations	2006	N			See measure 90.
108	461	Internet ridematching services	Real-time ridematching offered via a Website, by an employer, or by a third party (sponsored by city or transportation authority).	Travel Demand Management: Business Operations	2006	Y	+	+	Evaluate status of current program which began providing internet matching for ridesharing in 2006.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
109	462	Purchase vans for vanpools	Commute reduction along with the opportunity to buy cleaner vans.	Travel Demand Management: Business Operations	2006	Y	+	+	See measure 118.
110	463	Mandate or encourage vanpooling and carpooling	One of many commute reduction measures already included in the list.	Travel Demand Management: Business Operations	2006	N			Mandate not feasible. Encouragement already provided in Commute Solutions program.
111	465	Mandatory or voluntary flextime program (daily start and end time)	Temporal allocation of vehicle travel, but not a reduction measure itself.	Travel Demand Management: Business Operations	2006	N			As normally constructed, flextime allows employees to commute during off-peak hours. Because of the long peak period length in Houston this measure would not have a quantifiable effect.
112	470	Pay or other financial incentive for not driving	Employer pays employees who do not drive a monthly stipend; employees who drive receive no corresponding benefit.	Travel Demand Management: Business Operations	2006	Y	+	+	It may be more cost effective than other measures, particularly capital intensive ones. Similar to measure 51.
113	471	Employer tax credit or deduction	Institute a tax credit or deduction for employees that regularly use a non-single occupancy vehicle mode for commuting and/or for employers, based on number of employees that commute using non-SOV	Travel Demand Management: Business Operations	2006	N			Recommend qualitative evaluation with respect to implicit tax credits due to high transportation costs. Also employers in some workplaces are already providing such incentives. But it is an incentive that would require survey work to determine an emission reduction.
114	475	Incentives for Best Workplaces for Commutes Designation	Already implementing in Houston	Travel Demand Management: Business Operations	2006	N			Review status of this program. Federal funding no longer available.
115	477	Trade equivalent jobs to be closer to work	For employees of the same company but at different worksites, identify opportunities to "trade jobs" or worksites to reduce commute distance.	Travel Demand Management: Business Operations	2006	N			Employees who could do this already would in order to save time and money.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
116	484	Personalized travel planning	Based on rider's origin and destination(s), personalized travel plan of transit routes and connections provided via website or telephone service.	Travel Demand Management: Business Operations	2006	N			Difficult to reach a significant enough individuals, have them make a change and sustain that change in a way that reduces emissions. Provision of such services could enhance existing programs quantified under measures listed elsewhere in this list.
117	487	Telecommuting incentives or mandates	The measure is ill defined and is duplicative of other measures.	Travel Demand Management: Business Operations	2006	N			Mandates not feasible. Suggest combining measures into separate individual measures from Commute Solutions.
118	496	Regional Vanpool programs	Could add more to current Houston vanpooling program, but a duplicate measure.	Travel Demand Management: Regional Applications	2006	N			See measure 109.
119	499	Share hybrid vehicles	Shared vehicles among a group of owners	Travel Demand Management: Regional Applications	2006	N			No evidence that shared vehicles lower emissions because the same number of mile could be driven.
120	500	Encourage pooled ownership of single occupant vehicles for local midday travel	Encourage pooled ownership of cars, trucks; e.g., one neighborhood collectively owns an SOV for periodic use.	Travel Demand Management: Regional Applications	2006	N			No evidence that shared vehicles lower emissions because the same number of mile could be driven.
121	501	Car Sharing Programs (Flexcar)	Car-sharing programs. We give our members the key to new cars, trucks, and minivans located across a metropolitan region. You pay an hourly rate, and the company pays for the car, insurance, gas and a reserved parking spot!	Travel Demand Management: Regional Applications	2006	N			No evidence that shared vehicles lower emissions because the same number of mile could be driven.
122	503	Rideshare matching, transit marketing and information programs	This measure could be included as part of a larger strategy to reduce commuting by single occupancy vehicles.	Travel Demand Management: Regional Applications	2006	N			Reporting requirements would likely make this measure be a voluntary measure.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
123	504	Rewards for reducing total vehicle miles traveled in a city or region	It is unclear how this measure would reduce vehicle miles traveled or how it would be measured.	Travel Demand Management: Regional Applications	2006	N			
124	551	If the California Low Emitting Vehicle Program is adopted and only LEV certified, gasoline vehicles are for sale in Texas, then mandated fleets should have to purchase the ULEV alternative fuel version of the same vehicle rather than the gasoline version	The California LEV II program includes new fleet average emissions standards as well as CO2 reductions. A fleets mandate in addition to the Cal. LEV II standards would have a much lower impact.	Vehicle Emission Standards	2006	Y	+	+	TCEQ and several state have concluded that the California LEV II program would reduce VOC and NOx emissions. http://www.cdphe.state.co.us/op/agcc/meeting/minutes/2007/092107-Final.pdf http://www.flchamber.com/docs/Coalitions/Energy/DEP_CA_MotorVehicleEmissions_082307.pdf This would be in addition to measure 125.
125	553	Adopt California standards for vehicle emission rates	Public and Publicly contracted fleet rules or Statewide.	Vehicle Emission Standards	2006	Y	+	+	Benefit small if limited to these fleets. Better PM and CO2 benefits from CAL LEV. Past attempts at statewide legislation to adopt LEV II failed. If requirement is through local ordinance or contract terms, vehicles would need to be purchased in California.
126	576	Limitations on idling of heavy-duty vehicles	May require city ordinance. Will require additional power sources for local major events.	Vehicle Idling	2006	Y		+	Idling reductions, while cost effective, typically have a small impact.
127	587	Heavy-Duty Vehicle Border Inspection Program for AB 1009 (Pavley 2004)	HD commercial vehicles engines must meet US HDDV standards in place at the time of manufacture and must display valid emission control label.	Vehicle Inspection and Maintenance	2006	Y	+		Smoke check relatively easy to do, NOx would require heavy-duty dyno or possibly remote sensing for diesels. High PM correlates with low NOx.
128	589	More frequent emissions tests for taxi cabs	Require taxi fleets to be tested twice per year to get license to operate.	Vehicle Inspection and Maintenance	2006	N			Allow taxis over 5 years old to be eligible for LIRAP (c.f. current 10 year requirement for all vehicles) to provide a better benefit.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
129	592	Augment truck and bus highway inspections with community-based inspections (HDV8)	HD vehicles are inspected to detect mal-maintenance and tampering and to measure smoke emissions in mixed-use communities.	Vehicle Inspection and Maintenance	2006	Y		+	MY 93-98 reflash if not already done (NOx reductions already included in model). Smoke check relatively easy to implement but high PM means low NOx reduction.
130	594	Addition of HDGV2B weight class vehicles to inspection and maintenance program	The inspection criteria would need to be defined more precisely for these vehicle types.	Vehicle Inspection and Maintenance	2006	N			Pre MY 96 vehicles currently receive TSI test. Would need to "centralize" placement of HD dynos. OBDII phase in from MY 2004 -2008.
131	598	More frequent testing for vehicles that repeatedly fail inspection tests	EPA has not quantified the benefit of more frequent testing.	Vehicle Inspection and Maintenance	2006	N			No modeled benefit. Better to encourage these vehicles to be replaced (LIRAP) or at least require repair at Recognized Emissions Repair Facility.
132	601	Extend or expand light-duty diesel engine inspection and maintenance program	The technology has yet to be defined for inspection of these vehicle types.	Vehicle Inspection and Maintenance	2006	N			Impractical to ASM test pre MY 96 LDDVs (no cut points available)
133	604	If the largest city in a county takes part in a testing program, the entire county must opt-in.	Current I/M legislation for nonattainment areas is based on counties. EAC area requirement is for county along with the largest municipality.	Vehicle Inspection and Maintenance	2006	Y	+	+	The benefits are restricted to the small counties not already in the program.
134	623	Mandated no drive days	An extreme measure to prohibit vehicle travel include only if needed.	Vehicle Operations Management	2006	Y	+	+	Important to evaluate for perspective and as a last resort measure.
135	628	Voluntary no drive day programs	Such a voluntary vehicle travel reduction program needs to be defined more precisely.	Vehicle Operations Management	2006	N			This would be evaluated as small percentage of individuals voluntarily participating and would require extensive reporting to claim a benefit.
136	629	License plates determine access to vehicle use (odd/even driving days)	Duplicate measure.	Vehicle Operations Management	2006	N			See measure 134.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
137	630	Encourage/Mandate Livable Centers	Includes a host of ideas to reduce vehicle travel.	Sustainable and Transit-Oriented Development	2008	Y	+	+	Combine with other individual measures into one package of options for community planning.
138	631	DPS-like emissions sensors in HCTRA toll booths - enhanced smoking vehicles program	Program is ill defined in terms of the technology and how it would interact with the current inspection program.	Vehicle Inspection and Maintenance	2008	N			If we are looking for NOx, difficult to use remote sensing if multiple booths in operation. For smoke, high PM, low NOx.
139	632	Enhanced enforcement for Smoking Vehicles Program - vehicle impounding for violators (like Dallas Emissions Enforcement Pilot Program)	Link to I/M test status: encourage local police to enforce existing smoking vehicle legislation	High-Emitting Vehicle Detection and Programs	2008	Y	+		May reduce number of vehicles avoiding I/M test. Real versus modeled reductions issue. NCTCOG estimates I/M compliance at around 80% not 96% as modeled.
140	633	Limit left turns on selected thoroughfares at all times	Duplicate measure.	Traffic Flow Improvements	2008	N			See measures 74 and 37.
141	634	Higher registration fees for high emissions vehicles	The measure needs to be refined to include emissions standards and emitter status.	Pricing Measures	2008	N			The implementation issues need to be addressed carefully with regard to model year and inspection test results.
142	635	Prime parking for vanpools/carpools/hybrids	Duplicate measure.	Parking Management	2008	N			See measure 39.
143	636	Hybrid cars parking meter fee exemption	Hybrid light-duty vehicles cannot demonstrate much emission reduction, and this measure merely provides an incentive for their use.	Parking Management	2008	N			Hybrid vehicles meet the same emission standards as other light-duty vehicles.
144	637	Use of taller highway barriers to reduce "rubbernecking"	This measure would affect free flowing vehicle speeds.	Freeway Incident / Roadway Construction Management	2008	N			The benefits of the program may be difficult to demonstrate.

ID	Old ID	Control Strategy	Description	Category	Year Added	EPA PQSE	VOC	NOx	Comment
145	638	Increased use of hybrid buses	Hybrid heavy-duty vehicles have been funded to date in current air quality programs.	Transit	2008	Y		+	Benefits of this technology can be verified, but is relatively costly for emissions reductions only.
146	639	Initiate a flexbike service to encourage bicycling	Duplicate measure.	Bicycle and Pedestrian	2008	N			See measure 1.
147	640	Creation of regional government idling restriction MOU	Idling is usually a small portion of the emissions from vehicles.	Vehicle Idling	2008	Y	+	+	Demonstration of the benefit may be difficult.
148	641	Industry idling restrictions	Idling is usually a small portion of the emissions from vehicles.	Vehicle Idling	2008	Y	+	+	Demonstration of the benefit may be difficult. See measure 147.
149	642	More stringent I/M cut points	Cut points only relevant to MY 95 and older vehicles, number of which reduces considerably each year, making this less effective.	Vehicle Inspection and Maintenance	2008	Y	+	+	Decreasing benefit in the MOBILE model with each calendar year. Higher failure rate may encourage more fraud.
150	643	Accelerate development and construction of mass transit projects	Capacity improvements to mass transit combined with other bus and rail measures.	Transit	2008	N			Very capital intensive, need to discuss with agencies in terms of potential ridership increases.

Table 4-2. Non-road vehicle emission reduction measures.

ID	Control Strategy	Description	Year Added	EPA PQSE	VOC	NOx	Comment
1	Aircraft emission standards	New emission standards for aircraft engines fall under international and Federal rules.	2001	N			These are covered by international standards and any local measure would not be considered permanent.
2	Ordering lowest emission engines	Fleet management of aircraft flying into HGB.	2001	N			These are covered by international standards and any local measure would not be considered permanent.
3	Changes in general conformity to make provisions more realistic; Allow equipment turnover to count	General conformity is a criteria to meet by new projects and not included in SIPs	2001	N			This is not an emissions reduction strategy, but credit should be taken for lower emitting aircraft.
4	Modify regulations so credits can be generated for general conformity	General conformity is a criteria to meet by new projects and not included in SIPs	2001	N			This is not an emissions reduction strategy.
5a	Enhanced Texas Emission Reduction Program (TERP)	The TERP program has been responsible for significant NOx reductions to date	2005	Y		+	The TERP program could be revised to account for the realities of emission controls on on-road, nonroad, and other mobile source categories with EPA emission standards that have been promulgated in recent years.
5b	Extend TERP to 2018	Current TERP legislation provides funding for the program until 2012.		Y		+	Proactively extending this funding to 2018 would ensure that this funding would be available until the region is required to meet attainment.
6	Aftermarket Technology and Fuel Additive Research Program	EPA approval of aftermarket and fuel technologies would be necessary.	2001	N			Fuel additives not credited in the TERP might be creditable, if they pass EPA approval. One example may include cetane improvers. But the strategy would need to be better defined to provide emission reductions creditable for SIPs.
7	Improve inventory of construction equipment; Log hours of actual equipment operation	Activity reduction of nonroad equipment.	2001	N			Equipment activity reductions are difficult to prove that a reduction occurred and any reduction would not be considered permanent.
8	Government construction incentives	This measure is considered to include money, tax relief, or proposal preference to firms using clean equipment.	2005	Y		+	Incentive for the use of clean construction equipment has been attempted including the TxDOT program. But the reporting requirements and conflicts with the TERP benefit lead to less use of the program and lower benefits than were expected.
9	Develop air quality best management practices (BMPs); Use BMPs to manage emissions from construction sites, construction vehicles & wind-blown dust	The BMP could include a clean equipment use clause.	2005	N			The program needs to be better defined in terms of the use and types of equipment at each job site. The reporting burdens to justify an emission reduction would be onerous.

10	Limitations on idling of heavy-duty construction equipment	Idle reduction either through the use of automatic shut-off or operator training.	2005	Y		+	Many states have regulations to reduce equipment idling. The benefits of the rule may vary depending upon the implementation and enforcement of the programs, but generally idling emissions reductions are small but cost effective.
11	Water injection for diesel engines	Engine and Fuel Technology	2001	Y			See 5 TERP, measure 5.
12	Alternative-fueled equipment for all equipment types	Engine and Fuel Technology	2001	Y			See 5 TERP, measure 5.
13	Alternative fuel heavy-duty equipment	Engine and Fuel Technology	2001	Y			See 5 TERP, measure 5.
14	Lean NOx catalyst	Engine and Fuel Technology	2001	Y			See 5 TERP, measure 5.
15	Early introduction of low-NOx engines	Engine and Fuel Technology	2001	Y			See 5 TERP, measure 5.
16	Selective catalytic reduction (SCR)	Engine and Fuel Technology	2001	Y			See 5 TERP, measure 5.
17	Compression ignition standards for vehicles and equipment	Engine Standards	2001	N			EPA has already implemented Tier 4 regulations for nonroad equipment.
18	Spark ignition standards for vehicles and equipment	Engine Standards	2001	N			Small and large spark-ignition engines have been covered by EPA rulemakings.
19	Lower sulfur fuels	Fuel Standards	2001	N			No VOC or NOx benefit beyond Federal mandates for low sulfur gasoline by 2004, on-road diesel by 2006, and all off-road diesel by 2012.
20	Texas Low Emission Diesel (TxLED)	Fuel Standards	2001	N			Implemented
21	Lawnmower exchange; Trade in old gas powered equipment for discounts on zero emission models	A retirement program for old and malfunctioning lawn and garden equipment.	2005	Y		+	The benefits of such a program could be established, but focus primary on VOC reductions. It should not be restricted to lawnmowers and also include other equipment such as smaller blowers, string trimmers, etc. The overall benefits would be expected to be small, but could be cost effective.
22	Lawnmower recycling programs (rebate program); replace gas mowers with electric	Duplicate measure.	2005	Y			See 21
23	Promote use of cleaner lawn and garden equipment such as lower-emission four-stroke and electric-powered equipment	Duplicate measure.	2001	Y			See 21
24	"Buy a Clunker" concept for small gas equipment	Duplicate measure.	2001	Y			See 21
25	Disincentives such as fines if caught mowing during Ozone Alerts	Operational restriction.	2001	N			This is not a permanent measure and difficult to demonstrate compliance.

26	Ban equipment such as two-stroke engines	Operational restriction.	2001	N			This would preempt Federal rules.
27	No-mowing days	Operational restriction.	2005	N			This is not a permanent measure and difficult to demonstrate compliance.
28	Grass cutting; Public works will delay cutting grass till 6 pm on ozone action days	Operational restriction.	2005	N			This is not a permanent measure and difficult to demonstrate compliance.
29	Landscape ordinance for nonresidential areas	This measure would need to be included in permits, building zoning, or municipal rules.	2005	Y	+		This measure refers to lower maintenance landscaping that reduces the need for off-road equipment usage such as lawnmowers and could reduce water consumption as well. These types of programs are difficult to administer and verify.
30	Use of auxiliary power units (APUs) for locomotives operating; Controls for locomotives are preempted by Federal law, but voluntary controls might have some success	This measure is equivalent to an anti-idling measure.	2005	N			Automatic idle shut-off devices may be installed on equipment. This measure was largely applied by the larger railroads on a voluntary basis.
31	Accelerated purchase of Tier II locomotive engines	An accelerated fleet turnover measure would need to be implemented on a voluntary basis.	2005	Y		+	This measure has been superceded by EPA rules for existing and future locomotives. The rule includes a remanufacturing provision for locomotives in operation today. The rule might be implemented more quickly with incentives for remanufacture or replacement of older engines.
32	Electrification of rail	Rail electrification is nearly exclusively a passenger rail option, such as the Houston light rail line.	2005	N			This option may be available for expanded light-rail or other passenger rail options. But the emission reductions would be less use of on-road vehicles.
33	Efficiency improvements on In-Use Class 1 Rail Equipment (R11)	This measure would improve rail connections, eliminate at grade road and rail crossings.	2005	Y		+	Rail improvements might be considered if it can be shown that locomotive idling or braking events can be reduced. Usually these improvements also have safety and congestion relief benefits.
34	Limitations on idling of locomotives	Duplicate measure.	2005	N			Automatic idle shut-off devices may be installed on equipment and reductions justified through reporting. Similar to measure 30.
35	Portable engine fleet turnover	This measure addresses nonroad engines assigned to a specific industrial facility.	2008	Y		+	Includes registration and accelerated turnover of equipment to more recent model years but affects a small portion of the nonroad emission source categories. http://www.arb.ca.gov/portable/portable.htm

36A	Low Sulfur Fuel for Marine Vessel Main and Auxiliary Engine	Low sulfur fuels provide a modest NOx reduction with large particulate and SOx emissions reductions.	2008	Y		+	California is proposing this measure as a rule, and the Port of Los Angeles as an incentive. http://www.arb.ca.gov/ports/marinevess/marinevess.htm
36B	Harbor Craft Fleet Management	Harbor craft include tugs, ferries, supply, excursion, and other smaller commercial marine vessels.	2008	Y		+	The California rule if finalized in its June 2008 proposed format would include provisions for mandated turnover of harbor craft engines to those meeting lower emission standards. Could be implemented as a voluntary measure to replace engines. http://www.arb.ca.gov/ports/marinevess/harborcraft.htm
37	Cargo Handling Equipment Fleet Management	Cargo handling equipment includes nonroad equipment used at intermodal (ports and rail) facilities to move freight.	2008	Y		+	Encourage accelerated turnover or retrofit of equipment used at ports and intermodal rail yards. http://www.arb.ca.gov/ports/cargo/cargo.htm
38	Clean Fuel Option: Expand TxLED Use.	The use of TxLED could occur in source categories not currently required to implement the fuel use including marine and other engines.		N			The use of TxLED is already required for sale for marine and locomotive fuel sales in the 110 counties affected by the Texas regulation. http://www.tceq.state.tx.us/implementation/air/sip/clean_diesel.html#Draft
39	Provide full funding for the National Retrofit Program	EPA has set up the mechanism for providing grants to reduce emissions from off-road equipment under the National Clean Diesel Campaign, http://www.epa.gov/cleandiesel/	2008	Y		+	The funding varies by year (\$47 million in 2008) and is competitive from all states. The funding level is relatively small when applied nationwide.
40	Allow private companies to apply for NRP grants	Clean equipment grants program.	2008	Y		+	Further investigation into the application process is required to determine the applicant restrictions, which are determined by EPA.
41	Allow NRP grants to cover incremental costs for TERP or CMAQ retrofits	Supplemental funding for other existing funding programs.	2008	N			The use of TERP funds to provide matching might be possible, but would make the Clean Diesel and TERP applications more complicated. The mix of national and state funding however does not lead to more emission reduction.
42	Establish emissions trading program for nonroad vehicles (DERC)	Emission trading for stationary sources applied to mobile sources.	2008	N			Verification of emission reduction credits is likely to be difficult.
43	Allow use of TERP funds for administrative costs. Specifically, this can be used to help small companies without the time or resources to apply and track retrofits	TERP revisions.	2008	N			The TCEQ would find this difficult to justify, and a legal review of the enabling legislation would be necessary to determine if TCEQ is allowed to provide administrative funding. This measure by itself would not reduce emissions.

44	Provide cooperative grant assistance to encourage small companies (<20 employees) who do not have the resources to manage grants alone to apply for TERP	TERP revisions.	2008	N			This measure might be addressed through greater staffing at TCEQ or the TERP administrative entity. The emission reduction benefit would be associated with increase participation rather than with the program itself.
45	Development of a Port of Houston Clean Air Action Plan that seeks to minimize emissions from ships, cargo handling equipment, on-road drayage trucks, and port-related rail.	Clean Port initiative including on-road and nonroad source categories.	2008	Y		+	A port related approach could yield emission reductions, but the program would need to be better defined. The strategies available exist in other measures listed.
46	Adopt policies and programs to increase the number of clean construction machines used on public works projects.	Clean construction equipment. Duplicative measure.	2008	Y			See Measures 8 and 9

Appendix A

Summaries of the Houston-Galveston Area Council of Governments Meetings with Texas Commission on Environmental Quality and Various Stakeholders concerning the Houston-Galveston-Brazoria Eight-Hour Ozone State Implementation Plan

Airports/ Airlines Stakeholder Meeting

May 22, 2008; held at H-GAC office in central Houston.

Five stakeholders were present at this meeting: Roy Conn, Marianne Csaky, Jim Parise, John Hall, Dave Walden, with TCEQ and H-GAC staff: Lola Brown, Theresa Pella, Santos Olivarez, Shelley Whitworth, Graciela Lubertino, Andrew DeCandis, and Kelli Angelone. TCEQ presented information concerning emissions inventories for the airport industry for the years 2000, 2002, and 2005. H-GAC presented information on suggested airport mobile control strategies and also on third-party TERP grants.

Comments and concerns included:

- 1) Questions regarding TCEQ's methodology for industry growth rates
 - a. Federal Aviation Administration possesses 2007 data on the industry and perhaps TCEQ's data is gleaned from another source. TCEQ promised to send that information out.
- 2) How could the airports/ airlines industry contribute to air quality improvement?
 - a. The industry has already made large contributions, especially in the area of fuel conservation.
- 3) TCEQ asked if military flights at Houston's major airports were an important issue because their data only covers commercial flights.
 - a. The consensus was that military flights were mainly from smaller airports and were a minor part of major airport traffic.
- 4) Some efforts on the part of airports may be hard to quantify.
 - a. H-GAC recommended sharing information with TCEQ because there may be methods for quantifying those efforts, or ways may be found to do so if the efforts are seen to merit an attempt.
- 5) Is TxLED already used in off-road emission inventories?
 - a. It has been established that TxLED or ultra-low sulfur diesel is used by most off-road and on-road equipment because it is widely available.
- 6) Due to low turn-out on the part of stakeholders at the meeting, it was suggested that H-GAC come present the same information at some regular meetings that airport-industry groups hold for themselves.
 - a. As of 7/15/2008, those presentations have not been given despite efforts on the part of H-GAC and airport-industry groups to coordinate.

Construction Industry Stakeholder Meeting

June 3, 2008; held at H-GAC office in central Houston.

Twenty-one stakeholders were present at this meeting: Charles Webb, Jeff Nielsen, Terry Williamson, Bob Lanham, Jeff Greene, Dale Kornegay, Peck Boswell, Herb Young, AP Boyd, Greg Webb, Mike Wenske, Jim Slack, Phillip Kong, Kyle Walker, Michael DeVita, Jerry Mayer, Dana Blume, Jay Adams, and Armando Jaramillo, David Boehm, with TCEQ, TxDOT, and H-GAC staff members: Santos Olivarez, Lola Brown, Anusuya Iyer, Charles Airiohuodion, Shelley Whitworth, Graciela Lubertino, Andrew DeCandis, and Kelli Angelone.

TCEQ presented information concerning the emissions inventories for the construction industry for the years 2000, 2002, and 2005. H-GAC presented information on the suggested construction mobile control strategies and also on third-party TERP grants.

Comments and concerns included:

- 1) Industry representatives asked if the entire Non-Road Draft Master Control Strategies list could work as a VMEP.
 - a. TCEQ and H-GAC replied that there might be some concerns as to how CMAQ and TERP would be credited, but that it was possible.
- 2) Any research into technological improvement for the industry need to be short-term research that brought technologies to the general market.
- 3) The issue of logging hours of actual equipment usage was seen to be a violation of businesses' privacy, as well as not very beneficial for industry, although government groups really need this data to develop more accurate inventories.
- 4) Selective catalytic reduction was seen as a viable long-term solution which should be investigated.
- 5) Concern was expressed that the wording of some control strategies implied mandated use of technologies, and it was advised that this might exacerbate the price of fuel, something industry representatives agreed would be undesirable.
- 6) Construction representatives were certain that ultra-low sulfur fuels were being used in almost all equipment because that type of fuel is widely available.

Railroad Industry Stakeholder Meeting

June 12, 2008; held at H-GAC office in central Houston.

Three stakeholders were present at this meeting: Mike Clift (BNSF), Nicholas Williams (representing Congressman Nick Lampson), and Melissa Hagan, with TCEQ, TxDOT, and H-GAC staff members: Theo Vosub, Lola Brown, Koy Howard, Donna Huff, Charles Airiohoudion, Shelley Whitworth, Andrew DeCandis, and Kelli Angelone. TCEQ presented information concerning the emissions inventories for the railroad industry for the years 2000, 2002, and 2005. H-GAC presented information on the suggested railroad mobile control strategies and also on third-party TERP grants.

Comments and concerns included:

- 1) Will the funds from the third-party TERP grant that H-GAC is going to be awarded available for other groups beside the ones that requested it?
 - a. Parties not listed on third-party TERP grants are still eligible to apply for those funds.
- 2) Proposal of a control strategy to help railroads in the Houston-Galveston-Brazoria region obtain auxiliary power units would not be helpful because they are only effective for railroads in cold climates.
- 3) The larger railroads have idle-reduction technologies on almost all of their locomotives that reduce fuel consumption and emissions during extended idling events, so more reduction in idling or automatic shut-off technologies would not significantly reduce emissions.

- 4) Industry representatives commented that TCEQ's eligibility formulas made it more difficult for railroads to qualify for funding.
- 5) Most locomotives are retrofitted, and Tier II locomotives are the lowest emissions tier level currently available on the market.

First Marine/ Ports Stakeholder Meeting

June 12, 2008; held at H-GAC office in central Houston.

Eighteen stakeholders were present at this meeting Robert Anatra, Chuck Graham, Matt Chapman, Kenneth Kidwell, John Pace, Kenneth Gathright, Bradley Loomis, Richard Myers, Brad Stoker, Nathan Wesely, Owen Parker, Christine Harris, Kevan McGregor, Jim Guidry, Lisa McMicheal, Stuart Mueller, Harless Benthur, and Sylvia Medina, with TCEQ, TxDOT, and H-GAC staff members: Theo Vosub, Koy Howard, Lola Brown, Donna Huff, Charles Airiohoudin, Shelley Whitworth, Graciela Lubertino, Andrew DeCandis, and Kelli Angelone. TCEQ presented information concerning the emissions inventories for the ports industry for the years 2000, 2002, and 2005. H-GAC presented information on the suggested ports mobile control strategies and on third-party TERP grants.

Comments and concerns included:

- 1) TxLED or ultra-low sulfur diesel may be the only type of fuel available to those in the ports industry, rendering that suggested control strategy obsolete unless it needs to be documented.
- 2) General concern was expressed regarding the clarity of the control strategies and industry's ability to provide meaningful comment. H-GAC has since then 'cleaned up' and offered further guidance and description on the control strategies list.

Second Marine/ Ports Stakeholder Meeting

June 19, 2008; held at H-GAC office in central Houston

Nine stakeholders were present at this meeting Mark Rodriguez, Addie Wiseman, Kenneth Gathright, Bob Fry, Shelby Startz, Blake Beall, Amy Husted, Tom Tray, Sherry Felder, with TCEQ and H-GAC staff members Theo Vosub, Donna Huff, Shelley Whitworth, Graciela Lubertino, Andrew DeCandis, and Kelli Angelone. TCEQ presented information concerning the emissions inventories for the ports industry for the years 2000, 2002, and 2005. H-GAC presented information on the suggested ports mobile control strategies and on third-party TERP grants. H-GAC mentioned that the marine sector had the largest projected growth in regional NOx emissions.

Comments and concerns included:

- 1) Industry representatives asked TCEQ if aggregated ship data was available. They wanted to know if data was available broken down into inland vessels and ocean-going vessels. TCEQ said they would look into it.
- 2) There was concern that projected growth data from the ports would be skewed because most industry growth would be on the trucking side. H-GAC wondered if projected

growth was still available anyway, because that data would be helpful for inclusion in the emissions inventories.

- 3) One example put forth by H-GAC as an emissions reduction technology were ship stack wet scrubbers. Industry representatives said that was a good example, but scrubbers do not reduce NO_x much but do reduce particulate matter. Selective catalytic reduction (SCR) on ships has been considered, but the technology is still in the demonstration phase of implementation.
- 4) Industry representatives mentioned the California law governing foreign ocean-going vessels and their emissions, which was overturned by the Supreme Court.
- 5) Two control strategies industry inquired about were the “California Marine Vessel Main and Auxiliary Engine Rule” and the “California Harbor Craft Rule”. H-GAC explained that these were added when TCEQ included them at a previous meeting and that industry might want to enter into a Memorandum of Agreement or Memorandum of Understanding with H-GAC concerning one or both of these strategies, but that they were not being proposed to industry as strategies to implement as mandates.