REVISIONS TO THE STATE IMPLEMENTATION PLAN
FOR THE CONTROL OF OZONE AIR POLLUTION

REQUIREMENTS FOR GASOLINE VOLATILITY
AND SULFUR CONTENT IN EAST AND CENTRAL TEXAS

AND

FEDERAL CLEAN AIR ACT §211(c)(4)(C) WAIVER REQUEST

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
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RULE LOG NO. 98058-SIP-AI

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CLEANER GASOLINE SIP
LIST OF ACRONYMS

AAMA - American Automobile Manufacturers Association
BPA - Beaumont/Port Arthur
CARE - Clean Air Responsibility Enterprise
CBG-Cleaner Burning Gasoline
CO - Carbon Monoxide
COAST - Coastal Oxidant Assessment for Southeast Texas
CRC - Coordinating Research Council
Commission - Texas Natural Resource Conservation Commission
DFW - Dallas/Fort Worth
ELP - El Paso
EP - End Point
EPA - United States Environmental Protection Agency
FCAA - Federal Clean Air Act
FTE - Full Time Employee
HGA - Houston-Galveston
I/M - Inspection and Maintenance
LDT - Light-Duty Trucks
LDV - Light-Duty Vehicles
LEV - Low Emission Vehicles
MY - Model Year
NAAQS - National Ambient Air Quality Standard
NLEV - National Low Emission Vehicles
NMHC - Non-Methane Hydrocarbon
NO_x - Nitrogen Oxides
ORVR - On-Board Refueling Vapor Recovery
OTAG - Ozone Transportation Assessment Group
PPB - Parts Per Billion
PPM - Parts Per Million
PSI - Pounds Per Square Inch
RFG - Reformuated Gasoline
RVP - Reid Vapor Pressure
SIP - State Implementation Plan
TCAS - Texas Clean Air Strategy
TCM - Transportation Control Measures
ULEV - Ultra Low Emission Vehicles
VOC - Volatile Organic Compound

CLEANER GASOLINE SIP
LIST OF APPENDICES

Section VI: CONTROL STRATEGY

B. OZONE CONTROL STRATEGY

1. - 8. (No change.)

9. SIP REVISIONS FOR THE ATTAINMENT DEMONSTRATION (Revised. See attached chapters.)

a. - c. (No change.)

d. Cleaner Gasoline (New.)

10. - 13. (No change.)

14. HEARING REQUIREMENTS (Revised.)

a. - i. (No change.)

j. The state has conducted four public hearings for this SIP and accompanying rule revisions. Locations, dates, and times are as follows:

City	Date/Time	Location
Austin	January 25, 1999 - 11:00 a.m.	TNRCC Complex 12100 N. IH-35, Building F, Room 2210
San Antonio	January 25, 1999 - 7:00 p.m.	City Council Chambers 103 Main Plaza
Lufkin	January 26, 1999 - 2:00 p.m.	City Council Chambers 300 E. Shepherd, Room 102
Tyler	January 26, 1999 - 7:00 p.m.	Tyler Junior College Regional Training and Development Complex 1530 South Southwest Loop 323, Room 104

CHAPTER 1: INTRODUCTION

The State of Texas has four 1-hour ozone nonattainment areas: HGA, DFW, BPA, ELP. SIPs for attainment of the 1-hour ozone NAAQS are under development for the HGA, DFW, and BPA areas. Several other areas around the state have already had exceedances of the 8-hour NAAQS. Due to the significant air quality concerns under the 1-hour NAAQS, and the new challenges imposed by the 8-hour NAAQS, the commission is proposing regional types of controls for ozone.

The cleaner gasoline proposed in this SIP revision would have a lower RVP outside DFW and HGA, and a limit on the amount of sulfur in each gallon of gasoline. The RVP required in this SIP revision is 7.8 psi starting May 1, 2000. The RVP limit would be in effect every summer from May 1st through October 1st. A 7.8 psi RVP fuel is expected to reduce evaporative emissions from automobiles, off-highway gasoline powered equipment, and all gasoline storage and transfer operations. Evaporative VOC emissions from automobiles will be reduced by at least 14%.

The sulfur cap is 150 ppm per gallon of gasoline, starting January 1, 2004. Low sulfur gasoline is expected to reduce NO_x emissions from today's cars by 8.5% according to the EPA complex model. The rules would further provide for counties or large cities to opt into these regulations earlier than proposed here provided certain conditions are met. If EPA were to adopt sulfur regulations to require compliance by January 1, 2004, the commission's rules would no longer apply, allowing the federal sulfur rules to take precedence. However, early opt-in areas would continue to follow the sulfur requirements of their early compliance plan until EPA actually implemented its regulations unless otherwise specified in the commission order.

Sulfur is a catalyst poison, and all vehicles with catalysts are adversely impacted by sulfur poisoning. Most cars and light trucks manufactured since MY 1975 have had catalysts installed. Sulfur competes for the active sites on the catalyst surface with the ozone precursors the catalyst is attempting to control, VOC and NO_x. Sulfur can also increase emissions of CO, a metabolic poison. In addition, sulfur interferes with the oxygen storage capacity on catalytic surfaces further exacerbating the impacts on NO_x emissions. Sulfur poisoning can be reversed on some vehicles under certain conditions. Most advanced technology cars, such as NLEV and proposed Tier II vehicles, can have their emission controls severely compromised by elevated sulfur levels found in fuel.

Section 211(c)(4)(A) of the FCAA prohibits states from prescribing or attempting to enforce any "control or prohibition" of a "characteristic or component of a fuel or fuel additive" if EPA has promulgated a control or prohibition applicable to such characteristic or component under §211(c)(1). Section 211(c)(4)(C) provides an exception to this prohibition for a nonidentical state standard contained in a SIP where the standard is "necessary to achieve" the primary or secondary NAAQS that the SIP implements. EPA can approve a SIP provision as necessary if the Administrator finds that "no other measures that would bring about timely attainment exist," or that "other measures exist and are technically possible to implement, but are unreasonable or impracticable." Therefore, Texas is proposing this revision to the SIP as adequate justification and is requesting a waiver from §211(c)(4)(A) of the FCAA.

CHAPTER 2: BACKGROUND

At the time the 1990 FCAA Amendments were enacted, the focus on controlling ozone pollution was centered on local controls. However, for many years an increasing number of air quality professionals have asserted that ozone is a regional problem requiring regional strategies in addition to local control programs. As nonattainment areas across the United States prepared attainment demonstration SIP revisions in response to the 1990 FCAA Amendments, several areas found that modeling attainment was made much more difficult, if not impossible, because of high ozone and ozone precursor levels entering from the boundaries of their respective modeling domains (e.g., high background levels of ozone).

The commission conducted air quality modeling and upper air monitoring that found regional air pollution should be considered when addressing air quality in Texas' ozone nonattainment areas. This work is supported by research conducted by the OTAG, the most comprehensive attempt ever undertaken to understand and quantify the transport of ozone. Both the commission and OTAG study results point to the need to take a regional approach to controlling air pollutants.

As part of the COAST project, the commission and its contractor (Environ, Inc.), conducted regional-scale modeling to develop future year boundary conditions for the COAST modeling domain. The emissions inventory used in this modeling was based on the OTAG emission inventory. The modeling was conducted for a domain covering most of Texas as well as several southern states.

During the OTAG process, the commission modeling staff ran several sensitivity analyses using this regional modeling setup to assess the impact of potential OTAG reductions on Texas. Applying the OTAG 5c reductions across the domain (60% reduction of point source NO_x, 30% reduction of low-level

NO_x, 30% reduction of VOC), compared to the case of no reductions, indicates that modeled reductions would significantly reduce ozone throughout most of the eastern half of Texas. Overall, the modeling indicates that a regional reduction strategy would be beneficial across a wide area of the state.

During modeling for the HGA attainment demonstration SIP revision, the commission modeling staff conducted sensitivity analyses to determine the benefits regional reductions might have on HGA, when applied simultaneously with local reductions. Unlike the commission regional modeling exercises discussed above, these model runs offer an opportunity to assess separately the benefits of reductions made within and outside a region, since model runs with and without the regional reductions scenarios in HGA were conducted. Modeling runs were completed to evaluate the 8-hour average ozone concentrations in the COAST modeling domain for September 8, 1993 with 2007 projected emissions and assuming a reduction of 70% NO_x and 15% VOC in the 8-county HGA area. Even with the large reductions in HGA, much of the upper Texas Coast is projected to be well above the 8-hour standard. Also, Austin, Victoria, and Corpus Christi showed modeled 8-hour average concentrations above 80 ppb. The benefit of applying OTAG 5c reductions outside the HGA 8-county area clearly showed that the reductions are beneficial to HGA and provided additional ozone benefits of between five and ten ppb in HGA. This modeling provides part of the evidence of the benefit of regional reductions on Texas' nonattainment areas. Additional modeling conducted by the agency showed 1-hour reductions of between 1 and 3.6 ppb in much of east and central Texas.

Conclusions from the commission's work are supported by OTAG studies that also illustrate the importance of implementing a regional air quality control strategy. Overall, the conclusions and recommendations of OTAG are very consistent with a regional approach to ozone control, leading to the determination that to achieve the NAAQS.

CHAPTER 3: TECHNICAL INFORMATION

3.1 OVERVIEW

The commission has evaluated a cleaner gasoline for the eastern and central parts of Texas. After much research, industry consultation, and communication with local, state and federal agencies, the commission has proposed a fuel it believes will move Texas much closer to achieving its overall air quality goals. The fuel the agency has proposed is a low RVP gasoline with a sulfur cap. Results of the commission’s evaluation efforts to date are summarized below along with more detail on the proposed low RVP/150 ppm sulfur fuel.

At the time the 1990 FCAA Amendments were enacted, the focus on controlling ozone pollution was centered on local controls. However, for many years an increasing number of air quality professionals have felt that ozone is a regional problem requiring regional strategies in addition to local control programs. As nonattainment areas across the United States prepared attainment demonstration SIPs in response to the 1990 FCAA Amendments, several areas found that modeling attainment was made much more difficult, if not impossible, because of high ozone and ozone precursor levels entering from the boundaries of their respective modeling domains, commonly called transport.

The commission has conducted air quality modeling and upper air monitoring that found regional air pollution should be considered when studying air quality in Texas’ ozone nonattainment areas. This work is supported by research conducted by OTAG, the most comprehensive attempt ever undertaken to understand and quantify the transport of ozone. Both the commission and OTAG study results point to the need to take a regional approach to controlling air pollutants.

As part of the COAST project, the commission and its contractor Environ, Inc., conducted regional-scale modeling to develop future-year boundary conditions for the COAST modeling domain. The emissions inventory used in this modeling was based on the OTAG emission inventory and the modeling was conducted for a domain covering most of Texas as well as several southern states.

During the OTAG process, the commission's modeling staff ran several sensitivity analyses using this regional modeling setup to assess the impact of potential OTAG reductions on Texas. Applying the OTAG reductions across the domain (clean gasoline (federal reformulated gasoline), stationary source controls, the NLEV program, ozone action days, and a series of national rules to be promulgated by the EPA among others), compared to the case of no reductions, indicated that modeled reductions would significantly reduce ozone throughout most of the eastern half of Texas. Overall the modeling indicated that a regional reduction strategy would be beneficial across the wide area of the state.

During modeling for the HGA attainment demonstration SIP, the commission's modeling staff conducted sensitivity analyses to determine the benefits regional reductions might have on HGA, when applied simultaneously with local reductions. Unlike the commission's regional modeling exercises discussed above, these model runs offer an opportunity to assess separately the benefits of reductions made within and outside a region, since model runs with and without the regional reductions scenarios in HGA were run. Modeling runs were completed to evaluate the 8-hour average ozone concentrations in the COAST modeling domain for September 8, 1993 with 2007 projected emissions and assuming a reduction of 70% NO_x and 15% VOC in the 8-county HGA area. Even with the large reductions in HGA, much of the upper Texas Coast is well above the 8-hour standard. Also, Austin, Victoria, and Corpus Christi show 8-hour average concentrations above 85 ppb. The benefit of applying OTAG reductions outside the HGA 8-county area clearly showed additional ozone benefits of between five and ten ppb in HGA.

Additional modeling indicates that mobile source reductions (cleaner gasoline, NLEVs, and Stage I vapor recovery) have a potential to reduce peak 8-hour ozone averages of between 1 and 4 ppb in much of east and southeast Texas, with the greatest reductions seen in the Austin and San Antonio areas. This modeling indicates significant reductions in some areas with lessor reductions in others. The main conclusion to be drawn from these models is that the appropriate controls have been selected for reducing ozone levels. Modeling has also been completed assessing the potential benefits for 1-hour ozone standards. This most recent modeling shows reductions of between 1 and 3.6 ppb in much of east and central Texas.

This modeling provides part of the evidence of the benefit of regional reductions on Texas' nonattainment areas and provides further justification that a regional strategy will help maintain air quality in attainment and near-nonattainment areas. Conclusions from the commission's work are supported by OTAG studies that also illustrate the importance of implementing a regional air quality control strategy.

A cleaner gasoline is also supported based on the mobile nature and commuter lifestyle the larger urban areas promote. The majority of Texas' population centers are in the coverage area for cleaner gasoline. The highway system of Houston-Corpus-San Antonio-Austin-Dallas/Fort Worth-Tyler/Longview connects these major population centers. It's important that the fuel used by automobiles traveling between these cities is equally clean. Emissions control is very difficult in nonattainment and near-nonattainment areas if vehicles traveling in from other areas contain gasoline that is not as clean as it could be.

Timing is another critical issue where a cleaner gasoline can help. Several of our near-nonattainment areas face critical years between now and 2004 when EPA is expected to start its Tier II vehicles and low sulfur gasoline program. By implementing a cleaner fuel, the entire eastern half of the state would experience emission reductions in the critical mobile source inventory which is vitally important to our major metropolitan areas.

The commission has completed modeling. The first run was modeled with NLEV, cleaner gasoline, Stage I, and 50% point source NO_x reductions and showed upwards of a twelve ppb decrease in ozone. A modeling run was also made using only the mobile source controls (the NLEV program, cleaner gasoline, and Stage I vapor recovery). This second modeling run showed an overall ozone reduction of about 4 ppb. Based on the available monitoring data, these levels of reduction may be enough to keep the near-nonattainment areas in attainment with the 8-hour NAAQS. Reductions in the regional levels of ozone and ozone precursors will help to reduce the maximum ozone concentration and the duration of ozone events in the nonattainment areas. With the mobile nature and commuter lifestyle of larger urban areas, a cleaner gasoline over a broader area is much more reasonable and practicable than other types of controls. Further modeling for the
1-hour ozone standard backs up the results seen for 8-hour modeling (i.e. 1-3.6 ppb reductions in
1-hour ozone readings).

Texas and other states have used low RVP fuels for a number of years as an effective program for reducing ozone levels. While EPA is not looking at RVP, it is considering lowering the sulfur content of all U.S. gasoline concurrent with its evaluation of new motor vehicles standards (Tier II). The Tier II regulations should be finalized in late 1999 with a new fuel starting in 2004. Texas has watched and has been a part of the national debate on cleaner gasoline. Texas will continue these efforts and if the national situation continues in a timely and positive direction, Texas may not need to proceed on its own with the lower sulfur aspect of cleaner gasoline. However, if reductions in sulfur at the national level are not consistent with where Texas needs be in relation to mobile source controls and do not occur in a timely manner, then Texas must proceed with sulfur controls on gasoline.

Through the NLEV program, automobile manufacturers have made a commitment to introduce cleaner cars to the nation earlier than what would have been required by the FCAA. Additionally, EPA has proposed Tier II regulations which will also lead to improvements in the popular sport utility vehicles. The reductions from these actions, although significant, may not be enough to get Texas where it needs to be in relation to overall air quality. Improvements in gasoline quality alone also may not be enough. An improvement in gasoline quality, combined with the advanced vehicle technology, will move Texas closer to achieving its overall air quality goals than either step alone could possibly achieve.

Texas refineries supply gasoline not only to the Texas market but also to markets outside of Texas. One state which will be relying on Texas and other Gulf Coast refineries for its supply of low RVP/low sulfur gasoline is Georgia. Gasoline already being delivered for the Atlanta area is very similar to the fuel being proposed by Texas. Also at the national level, sulfur reductions are likely to be the means most refiners will use to meet the Phase II RFG requirement for NO_x reductions. Phase II RFG will have sulfur levels very close to what is proposed for the Texas market. Sulfur reductions are also part of EPA’s Tier II proposal. Based on these factors, EPA's evaluation of fuel sulfur limits, Phase II RFG with reductions in fuel sulfur, and other states' consideration of sulfur limits, the commission believes the fuel proposed here is consistent with national trends regarding improvements in fuel quality.

Starting in late 1997, the commission began to evaluate different types of cleaner burning fuels (gasoline, diesel, etc.) as part of an overall regional strategy. The commission eventually settled its focus on a cleaner gasoline. Of the cleaner gasolines under consideration, four were evaluated thoroughly: 1) federal RFG; 2) a gasoline with equal emissions performance to federal Phase II RFG; 3) a formula-based fuel with low RVP, low sulfur fuel; and 4) California reformulated gasoline.

After further discussions, the commission completed its analysis on the top two fuels of choice, a performance-based fuel with emissions limits equal to federal phase II RFG, and a fuel with controls on RVP and sulfur. The low RVP/low sulfur fuel was settled upon for the following reasons: 1) emissions performance; 2) effect on advanced technology cars; 3) impacts on off-road emissions; and 4) low production costs.

3.2. EMISSIONS PERFORMANCE

Several of the state's areas are in need of significant NO_x reductions along with some level of VOC reductions. Photochemical grid modeling shows that NO_x reductions are necessary for the HGA, DFW, and BPA nonattainment areas to demonstrate attainment of the 1-hour ozone standard and are very beneficial for the state’s near-nonattainment areas to comply with the 8-hour ozone standard. Therefore, one of the first objectives of a cleaner gasoline was that it achieve NO_x reductions.

Additional state and federal modeling has shown that reductions in VOCs, specifically in the urbanized areas, continue to contribute to reductions in ozone. Lower RVP gasoline will reduce evaporative emissions of VOCs from not only motor vehicles but from refueling operations, gasoline terminals, off-road equipment, and refineries. The reduction of sulfur will help today's cars maintain their certified emissions levels and tomorrow's more advanced cars reach and maintain their low tailpipe emission limits.

Radian completed specific modeling for the commission in September 1997 (“Evaluating the Impact of Reformulated Gasoline in the DFW Area”) evaluating low RVP and RFG. EPA’s complex model indicates VOC emission reductions of 14.3% with 7.8 psi RVP fuel and a 150 ppm cap on sulfur. NO_x reductions of 8.5% are also seen with the low RVP/low sulfur fuel proposed here.

Some national studies conducted by a variety of groups regarding the impact of fuel sulfur on current and advanced technology vehicles have been completed. Some of these groups include: private industry (such as the AAMA), the automotive and refining industries (The Auto/Oil Air Quality Research (Auto/Oil) program), the federal government (EPA), state government (California, Georgia, Arizona), and other groups, such as the CRC and OTAG.

Estimates by EPA in their “Staff Paper on Gasoline Sulfur Issues” indicate that in-use vehicles, such as vehicles certified to the Tier 0 standard which have been available through MY 1993 and vehicles certified to the Tier I standard which have been available since MY 1994, show additional reductions in emissions associated with a reduction in gasoline sulfur levels.

Decrease in Emissions with Fuel Sulfur Decreasing from Average In-Use Level (330 ppm) for Tier 0 and Tier I Vehicles (Source EPA)						
	NMHC		CO		NO_x	
Sulfur	150 ppm	40 ppm	150 ppm	40 ppm	150 ppm	40 ppm
Tier 0	4.6 %	13.0 %	4.4 %	12.6 %	5.0 %	11.1 %
Tier I	not tested but assumed to be equivalent to Tier 0	16.3%	not tested but assumed to be equivalent to Tier 0	16.4%	not tested but assumed to be equivalent to Tier 0	11.0 %

Using EPA's Complex Model, Georgia estimated the benefits of its low RVP/low sulfur gasoline. The Complex Model shows the following emission reductions from conventional fuel (modeled with 8.7 psi RVP, 330 ppm sulfur, benzene at 1.53 volume percent, olefins at 9.2 volume percent, and aromatics at 32 volume percent) for the second phase of Georgia's program (modeled with RVP at 7.0 psi, 40 ppm sulfur, olefins 4 volume percent, and aromatics 22 volume percent):

Emission Reductions: Georgia Evaluation of Their Phase II Formula-Based Gasoline Using EPA's Complex Model			
VOC	CO	NO_x	Air Toxics
23.9%	NA	14.71%	20.59%

It should be noted that the Complex Model assumes a 1990 (Tier 0) technology vehicle. It does not take into consideration Tier I or advanced technology cars (LEVs, ULEVs), nor does it consider the effects on heavier light-duty trucks (LDT 3's and 4's).

OTAG also evaluated a low sulfur fuel in typical attainment areas (no I/M, etc.) and found that with a 150 ppm sulfur level the following emission reductions were obtainable:

Emission Reductions: OTAG Evaluation of Low Sulfur (150 ppm) Gasoline			
VOC	CO	NO_x	Air Toxics
2.5 - 5.3%	3.3 - 8.0%	4.4%	NA

3.3. EFFECT ON ADVANCED TECHNOLOGY CARS

For advanced technology cars (LDV) and LDTs covered by the NLEV program (LEVs/ULEVs), EPA estimated emission increases with fuel sulfur above 40 ppm. These numbers are not comparable to the earlier table on Tier 0 and Tier I emissions improvements with low sulfur fuel. It was assumed that a low sulfur fuel would be used to certify advanced technology vehicles; therefore, the emissions impacts of fuel sulfur levels are indicated as percent increases over 40 ppm sulfur certification fuel.

Increase in Emissions with Fuel Sulfur Increases from Baseline (40 ppm) for LEVs and ULEVs (LDVs and LDTs) (Source EPA)						
Pollutant	NMHC		CO		NO_x	
Sulfur, ppm	150 ppm	330 ppm	150 ppm	330 ppm	150 ppm	330 ppm
All LDV/LDT1	26.7 %	43.0 %	58 %	75.8 %	65.7 %	136 %
All LDT2/LDT3	23.0 %	26.4 %	12.5 %	31.2 %	33.7 %	65.5 %

3.4 IMPACTS ON OFF-ROAD EMISSIONS

For non-road engines, there will be evaporative VOC benefits associated with the low RVP/low sulfur fuel. There may also be some exhaust benefits for VOC. However, NO_x benefits may be very minor, mainly because sulfur effects are associated with catalyst-equipped vehicles and engines, and non-road engines typically are not catalyst-equipped. VOC emission reductions of upwards of 3% may be seen in off-road sources.

3.5 STATE LEGAL AUTHORITY TO IMPLEMENT CLEANER GASOLINE

State authority for the commission to implement Cleaner Gasoline is contained in the following statutes:

- Texas Health and Safety Code §382.011 (general power and duties),
- Texas Health and Safety Code §382.012 (authority for SIPs),
- Texas Health and Safety Code §382.017 (authority to promulgate rules),
- Texas Health and Safety Code §382.019 (authority to control mobile sources),
- Texas Health and Safety Code §382.037(g) (confirms no specific authority needed for fuel standards if the standards are 1) federal standards, 2) necessary to achieve attainment, or 3) made in consultation with the Texas Department of Health and it is determined that a fuel standard is needed to protect public health),
- Texas Water Code Chapter §7.002 (commission can enforce its rules).

3.6 PRODUCTION COSTS OF LOW RVP/LOW SULFUR GASOLINE

Low RVP gasolines are used as VOC control strategies and do not have significant additional production costs. Average summertime RVP is about 8.5 - 9.0 psi. Other states have found that it generally costs from 0.3 to 0.5 cents more per gallon to produce low RVP (7.0 psi) gasoline. According to EPA's Regulatory Impact Analysis for RFG, RVP controls cost about 0.2 cents per psi of RVP reduced. For example going from 8.8 psi to 7.8 psi would cost about 0.2 cents per gallon. Therefore, the RVP reduction proposed here would cost less than 0.3 cents per gallon.

The American Petroleum Institute contracted with MathPro to estimate sulfur reduction costs. The estimated costs are as follows:

Estimated Cost of Reducing Gasoline Sulfur (MathPro for API)			
Average Sulfur Control Level (ppm)	150	100	40
Cost (cents/gallon)	2.7	3.4	5.1

EPA also estimated costs of reducing sulfur and determined the following:

Preliminary Estimates of Sulfur Reduction Costs (Volume-Weighted Average for PADDs 1 and 3, 8% return on investment)			
Average Sulfur Control Level (ppm)	150	100	40
Cost (cents/gallon)	1.1 - 1.8	1.9 - 3.0	5.1 - 8.0

However, EPA said they were aware of emerging technologies that could reduce sulfur reduction costs down to 1-2 cents per gallon when going from 330 ppm to 40 ppm sulfur. The costs for a 150 ppm fuel would logically be lower. Today, Georgia is receiving 7.0 RVP and 150 average sulfur fuel. This fuel is costing an average of 2.0 cents more per gallon than conventional fuel.

3.7 AGENCY IMPACTS

A low RVP/low sulfur fuel would be easier to enforce in the long run than a performance-based fuel. The commission will enforce the program at the refinery gate and at the bulk terminal. Enforcement at the retail level will also be accomplished as necessary through scheduled and unscheduled retail level sampling. With only two parameters to check initially (RVP and sulfur), fuel testing would be simplified over a performance-based fuel like federal RFG.

Georgia has decided to enforce its program mainly at the refinery level. Each refiner is required to take two samples of each batch of fuel and have it tested. This same sample will be sent to a state contracted lab for verification. It also plans on using its Stage II inspectors to pull follow up samples as the inspector is doing the regular Stage II inspection.

The Arizona Weights and Measures Department is responsible for enforcing the Arizona CBG program. It has six inspectors for the whole state, one dedicated to Maricopa County. Arizona has tested for gasoline quality since the early 90's, and the parameters tested include: sulfur, octane (research, motor, and index), distillation temperatures (10%, 50%, 90%, EP, and residue), oxygen (type and quantity), aromatics (including benzene), olefins, and saturates. Arizona had its own lab until about 1997, and now has a contract to complete this testing. The one inspector dedicated to Maricopa County collects approximately 80 random samples a month. According to Arizona, each station eventually gets inspected. The Arizona Legislature appropriated one FTE for the Arizona Weights and Measures Department to organize the program and register the refiners, and $150,000 for the Arizona CBG program in Maricopa County. Arizona has such low costs due to the fact that they already have a gasoline inspection program in place.

The area proposed to be covered by the Cleaner Gasoline program is larger and impacts more gas stations and people than Arizona's program. The Texas program will cover 98 counties and about 40% of the state's population and gas stations.

CHAPTER 4: EVALUATION OF OTHER CONTROLS

In the HGA and DFW areas there are significant mobile source control measures in place. Some of these include inspection and maintenance (I/M), Stage I vapor recovery, Stage II vapor recovery, RFG, and transportation control measures (TCMs). Additional mobile source controls will be put in place through federal regulations such as NLEV, heavy-duty on-highway diesel controls, small gas engines, locomotives controls etc.

The federal mobile source controls are national programs which will be implemented in all counties. However, most are being phased in such that these controls will not be in place soon enough for many of Texas' near nonattainment areas to avoid nonattainment designation. In addition to the clean gasoline, Stage I controls is another program that can be implemented quickly and therefore is also being proposed.

State law (§382.037(c)) prohibits the Texas Motorist Choice program from expanding to additional areas unless the mayor of the largest city and the county judge agrees to expansion of the program. At this time, there is not significant local interest in expanding the Texas Motorist Choice program to attainment areas, making I/M impracticable as a wider control measure.

Stage II vapor recovery is prohibited by state law from expansion into attainment areas (Texas Health and Safety Code, §382.019(c)). In addition, Stage II vapor recovery is being replaced by on-board refueling vapor recovery (ORVR). ORVR will capture the majority of vehicle refueling vapors within the next 12 to 18 years. The state prohibition combined with the federal implementation of ORVR makes Stage II impracticable for use as an additional control measure.

With significant VOC point source controls already in place in the HGA and DFW areas, additional VOC point source controls for these areas do not appear to be reasonable at this time. Significant point source controls for NO_x will be put in place in the HGA and DFW areas. The magnitude of the reductions necessary indicates that point source controls alone are not able to reduce ozone levels enough to demonstrate attainment; therefore, additional NO_x controls must come from the mobile source area. Cleaner gasoline will contribute to provide NO_x reductions from commuters coming in from outlying areas.

The commission is also evaluating the implementation of point source NO_x controls outside the HGA and DFW areas. The commission believes that the combination of mobile source controls (such as cleaner gasoline, NLEV, and Stage I vapor recovery), and point source NO_x controls outside the HGA and DFW areas will be sufficient to significantly reduce the ozone levels in the state's nonattainment areas.

Modeling has previously been submitted to EPA regarding the amount of emission reduction necessary to achieve the NAAQS in the HGA and DFW areas to achieve attainment (see Tables 1, 2, 3, and 4). The NO_x and VOC reductions necessary to achieve the NAAQS are significant (see Tables 5, 6, 7, and, 8).

Several other areas of the state have already had exceedances of the 8-hour NAAQS. The emissions inventory in several of these areas are largely composed of mobile sources. Without the cleaner gasoline, these areas cannot reasonably and practically achieve attainment of the NAAQS.

Table 1. Attainment Target Calculations for 2007 NO_x Emissions in the HGA Area

	Episode Day			
	9/8	9/9	9/10	9/11

Required reduction from 2007 base EI				
Worst-case	83%	78%	85%	80%
Best-case	62%	53%	67%	61%
2007 Projected NO_x emissions (tons/day)				
Worst-Case (Base 2007 EI)	1467	1457	1531	1376
Best-Case (Alt. EI I)	986	978	1035	930
2007 Attainment target (tons/day)				
Worst-case	249	321	230	275
Best-case	375	460	342	363
1990 baseline NO_x emissions (tons/day)	1330			
Adjusted for Alt. EI I Assumptions	908			
Required reduction relative to 1990 baseline				
Worst-case	82%	77%	83%	80%
Best-case	59%	49%	62%	60%
Required Reduction in tons/day				
Worst-case	1081	1009	1100	1055
Best-case	533	448	566	545
Reductions by 1999 from 9% SIP	(104)	(104)	(104)	(104)
Remaining required reductions				
Worst-case	977	905	996	951
Best-case	429	344	462	441

Table 2. Attainment Target Calculations for 2007 VOC Emissions in the HGA Area

	Episode Day			
	9/8	9/9	9/10	9/11
Required reduction from 2007 base EI	15%			
2007 Projected VOC emissions (tons/day)	831	838	849	847
2007 Attainment target (tons/day)	706	712	722	720
1990 baseline VOC emissions (tons/day)	1064			
Required reduction relative to 1990 baseline	34%	33%	32%	32%
Required reductions in tons/day	358	352	342	344
Reductions by 1999 from 15% & 9% SIPs	(305)	(305)	(305)	(305)
Remaining required reductions in tons/day	53	47	37	39

Table 3. Attainment Target Modeling: Reduction Levels and Predicted Design Values

	Reduction		Predicted Design Value
Model Run #	NO_x	VOC	(ppb)
1 (1999 Base)	0%	0%	139
2	30%	25%	128
3	40%	25%	124
4	50%	25%	121
5	60%	25%	116
6	70%	25%	109
7	80%	25%	100

Table 4. Attainment Target Modeling: Reduction Levels and Peak Modeled Ozone

Model Run #	Reduction		Peak Modeled Ozone (ppb)		
	NO_x	VOC	6/21/95	6/22/95	7/3/96
1 (1999 Base)	0%	0%	140	145	168
2	30%	25%	130	135	154
3	40%	25%	126	129	149
4	50%	25%	122	124	142
5	60%	25%	116	118	134
6	70%	25%	109	110	127
7	80%	25%	100	99	120

Table 5. Potential VOC Control Strategies

Federal Control Strategies

Control Measure	Estimated 2007 Emissions Reduction (tpd)
Small Gasoline Engines *(began phase-in 1995--phase in complete by 2005)*	50.80
Heavy Duty Diesel Non-Road *(began phase-in 1995--phase-in complete by 2008)*	1.74
Locomotives *(final rule--begin phase-in 1999--complete by 2005)*	0.00
Reformulated Gasoline, FMVCP Tier I, I/M *(RFG Phase II begins in 2000--other programs in place)*	29.06
Recreational Marine Engines *(began phase -in 1995--complete by 1998)*	5.42
Commercial Aircraft *(rule took effect in 1994)*	1.17
RFG Non-Road Mobile Sources *(RFG Phase II begins in 2000)*	3.48
MACT Standards--Core Counties *(*Please see note below)*	16.5
MACT Standards--Perimeter Counties out to 100km	3.5

State Control Strategies

National Low Emissions Vehicle Program--Core Counties *(begins phase-in MY2001)*	4.66
National LEV Program--perimeter counties–100km	0.95
Reformulated Gasoline out to 100km	16.33
VOC RACT out to 100km	7.90
Stage I out to 100km	23.91
Excess VOC Reduction Carryover from 9% SIP	0.69
Voluntary Industry Reductions	Amount not available at time of proposal

Local Options Control Strategies

Reductions Available from Local Option (See Appendix 9c-J for more details)	60.91

*Historically, most MACT standards have been promulgated 1-2 years after their required promulgation date. There are approximately 30 MACT standards that were slated to be promulgated by 1997. Most appear to be running 1-2 years late for their predicted promulgation date. There are approximately 60 standards in the 2000 bin. Current EPA information is that most are on track for promulgation by 2000. Compliance dates for MACT standards are typically three years after promulgation. Therefore, even if the historical pattern of delay occurs for the 1997 bin standards, it's reasonable to assume that sources will be in compliance by 2002, and that the 2000 bin standards will be promulgated and generating emission reductions by 2005.

Table 6. Potential NO_x Control Strategies

Federal Control Strategies

Control Measure	Estimated 2007 Emissions Reduction (tpd)
On-Road Heavy Duty Diesel Standards *(proposed in 1997--effective date 2004)*	6.98
Heavy Duty Diesel Non-Road *(began phase-in 1995--phase-in complete by 2008)*	32.61
Locomotives *(final rule--begin phase in 1999--complete by 2005)*	6.49
Reformulated Gasoline, FMVCP Tier I, I/M *(RFG effective in 2000--other programs in place currently)*	39.93

State Control Strategies

National Low Emissions Vehicle Program--Core Counties *(currently under negotiation--could begin phase-in MY2001)*	12.15
National LEV Program--perimeter counties–200km	7.44
Reformulated Gasoline--perimeter counties--200km	12.38
NO_x RACT applied to perimeter counties--200km	80.00
Excess Reductions from 9% SIP--Carryover	4.25
Voluntary Industry Reductions	Amount not available at time of proposal
Point Source Combustion Modification--Tier I--Core Counties	241.00
Point Source Flue Gas Controls--Tier II--Core Counties	584.00
Point Source Tier I +Tier II=Tier III--Core Counties	620.00
Point Source Tier I--Perimeter Counties	333.00
Point Source Tier II--Perimeter Counties	811.00
Point Source Tier III--Perimeter Counties	864.00
Reformulated Gasoline for Non-Road Sources	Amount not available at time of proposal

Local Options Control Strategies

Reductions Available from Local Option (See Appendix 9c-J for more details)	72.74

Table 7

Table 8

CHAPTER 5: DISCUSSION OF TEXAS' 8-HOUR NEAR-NONATTAINMENT AREAS

The 8-hour ozone levels are shown below. As is shown, several areas, if evaluated today, would be in violation of the 8-hour ozone NAAQS. A cleaner gasoline in the 2000-2003 time frame would contribute greatly to improving these monitored numbers. Without the cleaner gasoline, these areas cannot reasonably and practicably achieve attainment of the NAAQS.

Current 8-Hour Ozone Averages

	Fourth High Eight Hour Average Ozone in parts per billion				
Area	'95	'96	'97	'98	3 year ('96-'98) Average of 4th high (where available)
Beaumont Port Arthur	100	84	93	96	91
Dallas/Fort Worth	111	97	104	101	98
El Paso	87	79	75	92	82
Houston/Galveston	116	123	110	117	116
Longview	102	82	91	104	92
Austin	N/A	N/A	87	81	84
Corpus Christi	89	83	77	82	80
Laredo	N/A	57	63	67	65
Lower Rio Grande Valley	69	65	65	71	67
Midlothian	N/A	83	83	97	87
San Antonio	95	82	84	90	85
Tyler	95	86	87	90	87
Victoria	87	71	78	78	75

Justification for a cleaner gasoline is based on the immediate need to reduce emissions in east and central Texas. There is no other program the state could implement in as timely manner with as significant air quality benefits.

Texas has very significant challenges ahead regarding its potential 8-hour near-nonattainment areas. Based on the emissions inventory and the 8 levels these areas are currently monitoring, a mobile source control program, such as cleaner gasoline, is the quickest most effective mobile source control strategy the state could implement. Additional modeling based on the 1-hour standard also showed significant reductions in ozone levels with implementation of clean gas, NLEV, and Stage I.

The mobile source emissions inventory from each near-nonattainment area, especially Austin and San Antonio make up a sizable portion of the overall emissions. Therefore, any ozone control strategy must include some type of mobile source control. A fuel control strategy is one way of getting immediate emission reductions from on-road, off-road, and area sources. The VOC emissions from bulk loading of gasoline storage vessels will be reduced through less evaporative emissions from the lowered RVP of cleaner burning gasoline. Sulfur reductions will improve the NO_x performance of today's cars while helping advanced technology cars maintain their certified emissions levels.

Appendix A

Results of Preliminary Regional Modeling for Texas

Results of Preliminary Regional Modeling for Texas

Summary of Modeling Results

The TNRCC modeling staff have completed a preliminary modeling assessment of potential benefits from regional mobile source strategies. The conclusions of this preliminary modeling are:

- Modeling of regional **mobile source** reductions (cleaner burning gasoline, NLEVs, and Stage I vapor recovery) indicates potential peak 8-hour average ozone reductions of **between 1 and 4 ppb in much of East and South Texas**, with the **greatest reductions in the Austin-San Antonio areas** (see Figures 1-3).

- Modeling of regional **point source** reductions (assuming a reduction of 50%) indicates widespread reductions in the peak 8-hour average ozone, with **benefits of more than 12 ppb in some areas**. **Benefits of 3 to 6 ppb can be seen along a broad band stretching from Corpus Christi to Tyler and Longview** (see Figures 4-6).

- Modeling of the **combined point and mobile source** strategies shows a **larger area of reductions** in peak 8-hour average ozone above 3 ppb than either of the strategies modeled individually (see Figures 7-9).

Model Formulation

! We conducted preliminary modeling to evaluate the potential benefit of regional mobile and point source emission reductions to ozone levels in Texas:

  - ♦ Emissions were projected to the future year 2007, assuming current[1] controls only.
  - ♦ National diesel regulations were assumed region-wide.

! We modeled a mobile source strategy consisting of the following elements:

  - ♦ National Low Emitting Vehicles (NLEV)[2].
  - ♦ Cleaner burning fuels.
  - ♦ Stage I vapor recovery.

! We also modeled a 50% regional point source NO_X reduction.

! We then modeled the combined point source/mobile source scenario.

! Reductions were modeled in the appropriate geographic regions

[1]Current as of the 1993 base year upon which the modeling was based.

[2]We modeled a "mature" NLEV program, assuming the entire fleet of light-duty vehicles were NLEVs. In 2007, it is expected that about 40% of vehicles will be NLEVs.

Important Points to Remember About the Preliminary Regional Modeling:

- ! We used an “off-the-shelf” model formulation, which was developed for a different purpose.
  - ♦ Emissions were based on an early version of the OTAG inventory.
  - ♦ Future projections to 2007 were based on OTAG statewide growth assumptions.
  - ♦ Nonattainment area-specific controls beyond 1993 were not included in the future inventory.
  - ♦ The 1993 base case model performance evaluation was based on a limited set of rural monitors.
- ! Only one time period (September 8-11, 1993) was analyzed.
  - ♦ Ozone levels across eastern Texas were generally high during the time period modeled.
  - ♦ Other time periods may show more or less benefit from other regional strategies
- ! The reductions modeled were based on rather general assumptions, and may ultimately differ from the reductions actually achieved.
- ! The modeling reported here is preliminary. AQP staff plan to conduct much more in-depth modeling beginning this fall, after completion of the Dallas/Fort Worth SIP modeling.
  - ♦ We plan to model additional episodes to ensure that a wide range of meteorological conditions are represented.
  - ♦ We plan to use much improved emissions data, including data collected locally by the near-nonattainment area MPOs.

Table of Modeled Reductions

Regional Component	Applicable Region	Inventory Component	NO_X Reduction	VOC Reduction
NLEVs	Statewide	On-Road Mobile Sources	10%/12.5%[1]	10%/12.5%[1]
		Area/Nonroad Mobile Sources		
		Point Sources		
Stage I Vapor Recovery	Central and East Texas Counties	On-Road Mobile Sources		
		Area/Nonroad Mobile Sources		3%
		Point Sources		
Cleaner Burning Gasoline	Area Proposed for Cleaner Burning Gasoline	On-Road Mobile Sources	5%	12%/25%[2]
		Area/Nonroad Mobile Sources		10%
		Point Sources		
Point Source NO_X Controls	Central and East Texas Counties	On-Road Mobile Sources		
		Area/Nonroad Mobile Sources		
		Point Sources	50%	

[1]NLEV reductions assume 100% of light-duty fleet. Reductions of 10% (VOC and NO_X) were assumed within area proposed for cleaner burning gasoline, while reductions of 12.5% were assumed elsewhere in Texas.

[2]In areas which already have phase I RFG (Houston/Galveston and Dallas/Fort Worth nonattainment areas), cleaner burning gasoline was assumed to reduce VOC by 12%. The reduction in the remainder of the proposed cleaner burning gasoline area was assumed to be 25%.