8 Hour Ozone Flex Program Austin-Round Rock Metropolitan Statistical Area

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LIST OF FREQUENTLY USED ACRONYMS

8-hour O_3 Flex Program: 8-Hour Ozone Flex Program
CAC: Central Texas Clean Air Coalition
CAF: CLEAN AIR Force of Central Texas
CAMPO: Capital Area Metropolitan Planning Organization
CAPCOG: Capital Area Council of Governments
CAPP: Clean Air Partners Program
EAC: Early Action Compact
EACTF: Early Action Compact Task Force
EI: Emissions Inventory
EPA: U. S. Environmental Protection Agency
I&M: Vehicle Emission Inspection and Maintenance
MOA: Memorandum of Agreement
MSA: Austin-Round Rock Metropolitan Statistical Area
NAAQS: National Ambient Air Quality Standards
NO_x: oxides of nitrogen
O_3: Ozone
ppb: parts per billion
ppm: parts per million
SIP: State Implementation Plan
TCEQ: Texas Commission on Environmental Quality
TERMS: Transportation Emission Reduction Measures
TERP: Texas Emission Reduction Program
tpd: tons per day
tpy: tons per year
TxLED: Texas Low Emission Diesel
TxDOT: Texas Department of Transportation
VMEP: Voluntary Mobile Source Emission Reduction Program
VOC: volatile organic compounds

Chapter One: Introduction

Local governments, community and business leaders, environmental groups, and concerned citizens in the Austin-Round Rock Metropolitan Statistical Area (MSA) are committed to ensuring good air quality. These groups work with the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA) to implement voluntary programs to assure continued attainment of the federal 8-hour standard for ground-level ozone (O_3).

The 8-hour O_3 Flex program is the latest in a series of regional initiatives and builds on the region's previous plans: the 1-hour O_3 Flex program and the Early Action Compact. These voluntary initiatives allow the region to address regional ozone problems proactively rather than wait to address them through the prescribed federal nonattainment process. Through these efforts, directed by the elected officials of the Central Texas Clean Air Coalition (CAC), the region has maintained compliance with the federal ozone standard despite a population growth rate that far exceeds the state and national average (Figure 1.1).

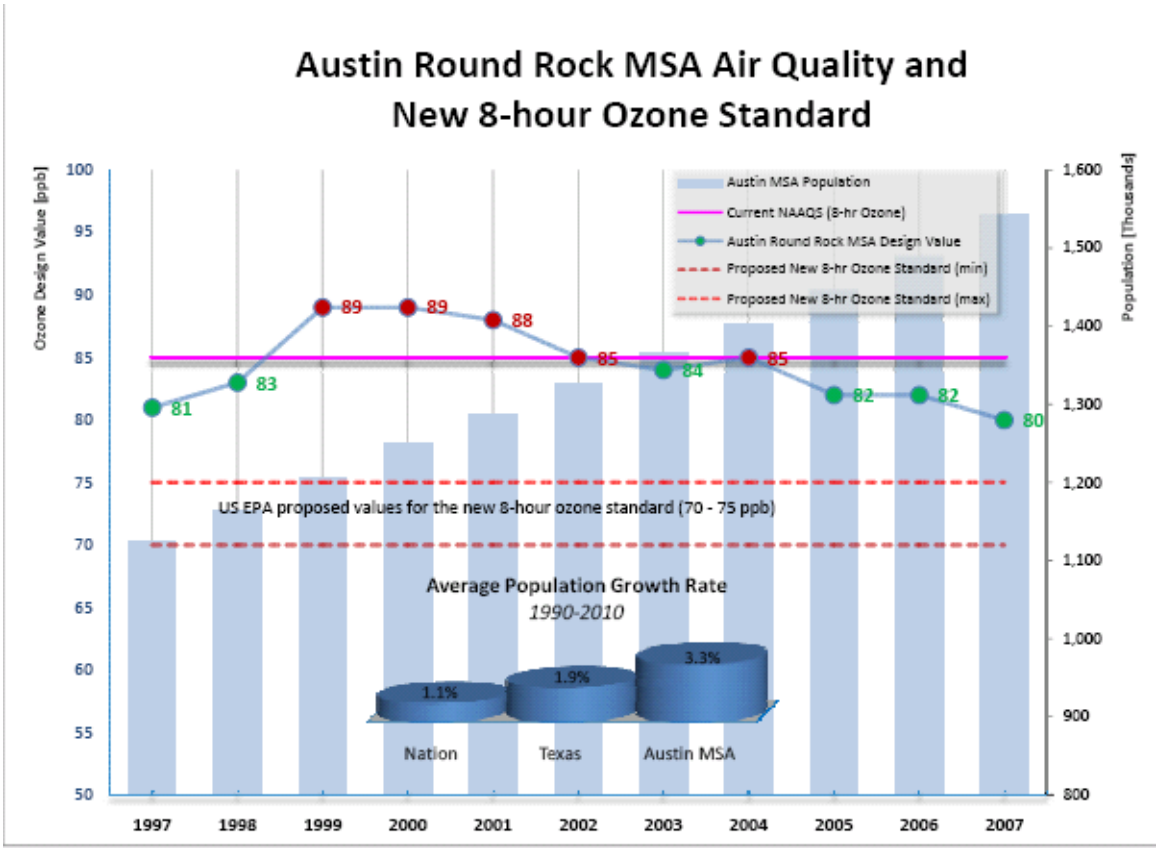


Figure 1.1 Austin Round-Rock MSA Air Quality and Population Growth Trends

1.1 Ground-level Ozone

Implementing the 8-hour O_3 Flex program supports reduction of emissions that produce ozone. Ozone is a form of oxygen with three atoms instead of the usual two. It is a photochemical oxidant. At ground level, ozone is the main component of smog. Ozone is not emitted directly into the air but is formed through chemical reactions between natural and man-made emissions of volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of heat and sunlight. Reducing ozone levels requires reductions in ozone precursors, predominantly VOCs and NO_x.

1.2 Health and Environmental Effects

High levels of ground-level ozone can be a health hazard. People with lung disease, children, seniors, and people who are active outdoors can be affected when ozone levels are unhealthy. Studies link high levels of ground-level ozone exposure to:

- lung irritation that can cause inflammation much like a sunburn;
- wheezing, coughing, pain when taking a deep breath, and breathing difficulties during exercise or outdoor activities;
- permanent lung damage to those with repeated high-level exposure to ozone; and
- aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illnesses like pneumonia and bronchitis.

High levels of ground-level ozone can have detrimental effects on plants and ecosystems. These effects include:

- interfering with the ability of sensitive plants to produce and store food, making them more susceptible to certain diseases, insects, other pollutants, competition and harsh weather;
- damaging the leaves of trees and other plants, negatively impacting the appearance of urban vegetation, national parks, and recreation areas; and
- reducing crop yields and forest growth, potentially impacting species diversity in ecosystems.

1.3 Federal Ozone Standards

The Federal Clean Air Act directs EPA to set National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. Ground-level ozone is one of the pollutants for which EPA has promulgated primary and secondary NAAQS. Primary standards set limits to protect public health, including the

health of "sensitive" populations such as asthmatics, children, and seniors. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings.

The primary and secondary ozone standards, in effect as of April 30, 2004, are set at 0.08 parts per million (ppm), or 84 parts per billion (ppb) using the accepted rounding conventions. To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured annually at each regulatory monitor within an area must not exceed 0.08 ppm, or 84 ppb. The 3-year average is called the design value.

EPA and the states monitor ambient air quality by installing monitoring equipment and collecting air samples at specific monitoring sites. If the pollutants in the sampled air exceed levels allowed by the NAAQS, the area around the monitor (usually counties or MSAs) is determined to be non-compliant and may be designated as a nonattainment area for the non-compliant pollutant.

Nonattainment areas must follow a prescribed process for cleaning up their air and comply with additional federal requirements on industry and transportation. The additional requirements may make industrial operations more costly and can delay federal transportation projects.

1.4 Austin-Round Rock MSA's 8-Hour Ozone Flex Program

According to EPA guidance, "The 8-Hour Ozone Flex (8-O_3 Flex) program is a voluntary agreement between Federal, State/Tribal and local communities to encourage 8-hour ozone attainment areas nationwide to reduce ozone emissions as needed to maintain the National Ambient Air Quality Standard (NAAQS) for ozone. The program will support and reward innovative, voluntary, local strategies to reduce ground-level ozone, thereby improving air quality and helping areas maintain attainment. In addition, the program will allow States and locals to receive "credit" for these efforts in the State/Tribal Implementation Plans, and help them avoid a violation of the 8-hour ozone standard."

The local governments of the Austin-Round Rock MSA expressed their intent to participate in the 8-hour O_3 Flex program in a letter from the CAC Chair, Austin Mayor Will Wynn, dated December 20, 2006, to U.S. EPA Regional Administrator Richard E. Green. (See Appendix A)

In compliance with EPA's May 2006 guidance the region's 8-hour O_3 Flex program comprises the following elements:

- Chapters 1 & 2 contain the required air quality history and technical data;

- Chapter 3 is the Action Plan. It includes voluntary emission reduction measures, contingency measures, coordination and public participation, and schedules/reporting; and
- Chapter 4 is the Memorandum of Agreement (MOA). It is the formal acceptance of the MSA's 8-hour O_3 Flex program by EPA, TCEQ, and the local governments listed in section 1.7.1. It includes general commitments and objectives, responsibilities, expected duration, conditions for modification or early termination, signature page and date.

1.5 Eligibility Requirements

Participation in an 8-hour O_3 Flex program is available for areas that:

- currently are designated attainment or unclassifiable/attainment for the 8-hour ozone standard, as published on April 30, 2004 (69 FR 23858) and are monitoring attainment of the 1-hour ozone standard;
- were neither designated at the time of 8-hour designations nonattainment for the 1-hour ozone NAAQS nor designated attainment for 1-hour ozone standard with an approved 1-hour ozone maintenance plan;
- have not been redesignated to nonattainment for the 8-hour ozone standard;
- have a current design value which show attainment of the 8-hour ozone standard; and
- have air monitors in place and meet the requirements of 40 Code of Federal Regulations CFR 58 Appendix A, or the QA Handbook for Air Pollution Measurement System, Volume II (http://www.epa.gov/air/oaqps/qa/index.html).

The Austin-Round Rock MSA meets all criteria in EPA's guidelines for participation in an 8-hour O_3 Flex program.

1.6 Geographic Boundaries

The proposed 8-hour O_3 Flex program applies to the five counties included in the Austin-Round Rock MSA. These counties are Bastrop, Caldwell, Hays, Travis, and Williamson (Figure 1.2). For Central Texas, using the defined MSA is a reasonable and suitable approach to setting the area's air quality planning boundaries.

The predominant sources of anthropogenic VOC and NO_x in the region are on-road, non-road, and area. The impacts of, and increases in, emissions from these sources are primarily related to the urban character of the region (e.g., population densities, urban/suburban growth, commuting patterns).

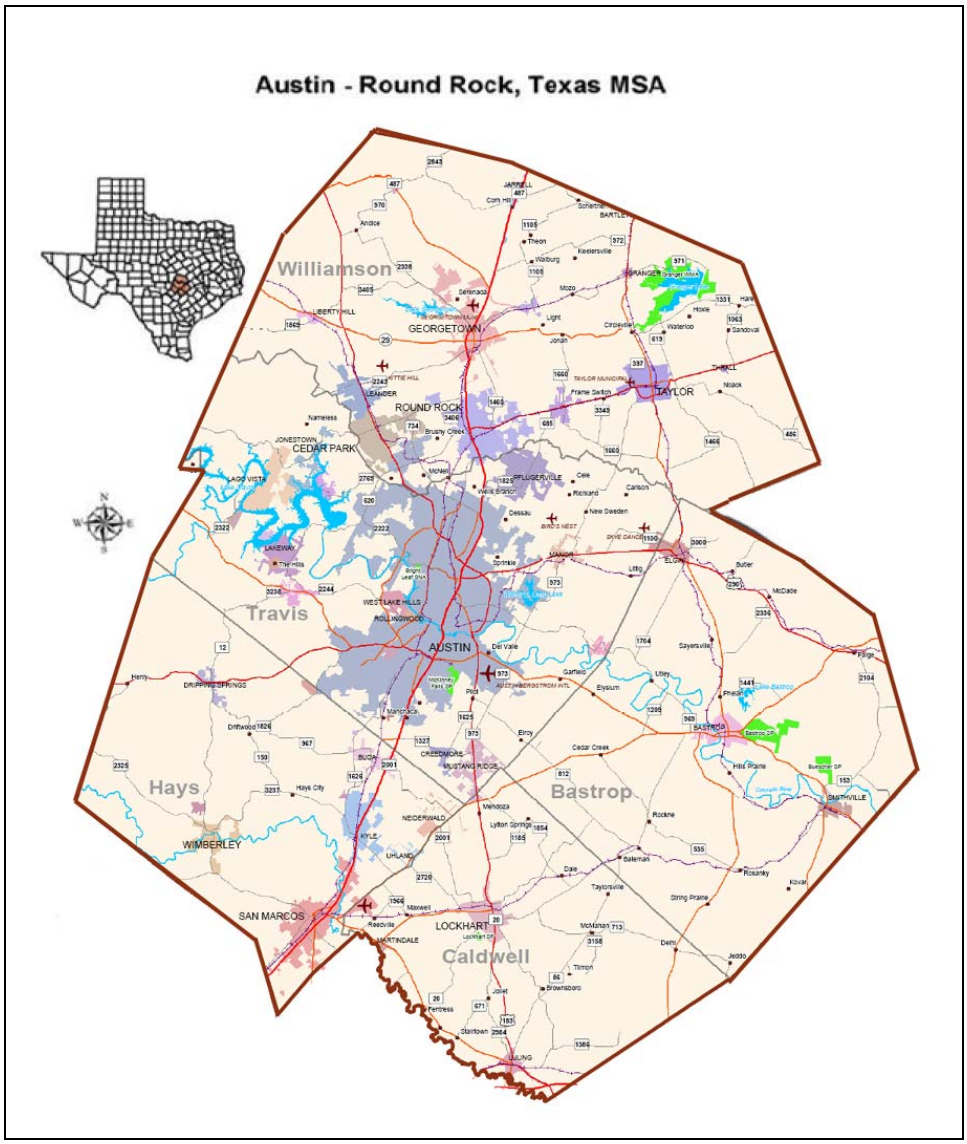


Figure 1.2 Map of Austin-Round Rock MSA

1.7 Participating Stakeholders

1.7.1 Signatory Parties and Participating Organizations

Along with EPA and TCEQ, the following local governments are signatory parties to the Austin-Round Rock MSA 8-hour O_3 Flex Memorandum of Agreement (MOA):

City of Austin	City of Luling	Caldwell County
City of Bastrop	City of Round Rock	Hays County
City of Elgin	City of San Marcos	Travis County
City of Lockhart	Bastrop County	Williamson County

In addition to the signatory parties, the following organizations participated in the development of this 8-hour O_3 Flex program. Several of these participants, denoted by an asterisk, have also made commitments to implement emission reduction measures. (See Appendix B for commitments from local government and participating organizations.)

*Capital Area Metropolitan Planning Organization (CAMPO)

*Capital Metropolitan Transportation Authority

*Capital Area Council of Governments (CAPCOG)

Central Texas Clean Cities

Central Texas Regional Mobility Authority

Clean Air Coalition of Central Texas

CLEAN AIR Force of Central Texas

Clean Air Partners Program

Clean School Bus Program

Environmental Defense

Greater Austin Chamber of Commerce

*Lower Colorado River Authority

*Texas Department of Transportation (TxDOT), Austin District

*Texas Department of Transportation (TxDOT), Headquarters Office

*Texas Commission on Environmental Quality, Austin Headquarters Office

University of Texas at Austin

Additional local governments and participating organizations may be added during the term of the MOA.

1.8 Building on Success

Central Texas has a history of proactive air quality initiatives. Since 1996, the Texas Legislature has provided near-nonattainment area funding to the area for use in performing planning functions related to the reduction of ozone concentrations in the area. The region was among the first in the nation to adopt an O_3 Flex Agreement. Designed to help the region maintain compliance with the former 1-hour ozone standard, implementation of the O_3 Flex emission reduction measures started in the 2002 ozone season.

In March 2004, the region adopted an Early Action Compact (EAC) to support maintenance of the 8-hour ozone standard. Emission reduction measures implemented for the EAC include a Vehicle Inspection and Maintenance Program, Heavy-Duty Vehicle Idling Restrictions, additional state rules, and a comprehensive collection of voluntary locally implemented measures. The region met the EAC objective of compliance with the 8-hour standard by December 31, 2007.

The Central Texas Clean Air Coalition (CAC) directs the region's air quality policy. The CAC is a voluntary association comprising elected officials from all five counties of the Austin-Round Rock MSA. It is responsible for development, adoption, and implementation for the region's clean air plans.

Since 1993 the CLEAN AIR Force of Central Texas (CAF), a non-profit organization comprising business, government, environmental and community leaders, has coordinated public awareness and education campaigns. Since its inception, the CAF has been at the forefront of local outreach efforts. This has provided the public with a solid understanding of air quality issues. The CAF continues to expand public awareness of the issues through education campaigns and programs.

Chapter Two: Background

2.1 Status of Air Quality

The ozone season for the Austin-Round Rock MSA begins April 1st and ends October 31st. The Austin-Round Rock MSA is designated in attainment of the NAAQS for ozone. The current design value is 80 ppb (calculated as an average of the 4th highest reading from 2005, 2006 and 2007). Figure 2.1 shows design value trend and fourth-highest readings at the two regulatory monitors in the Austin Round-Rock MSA.

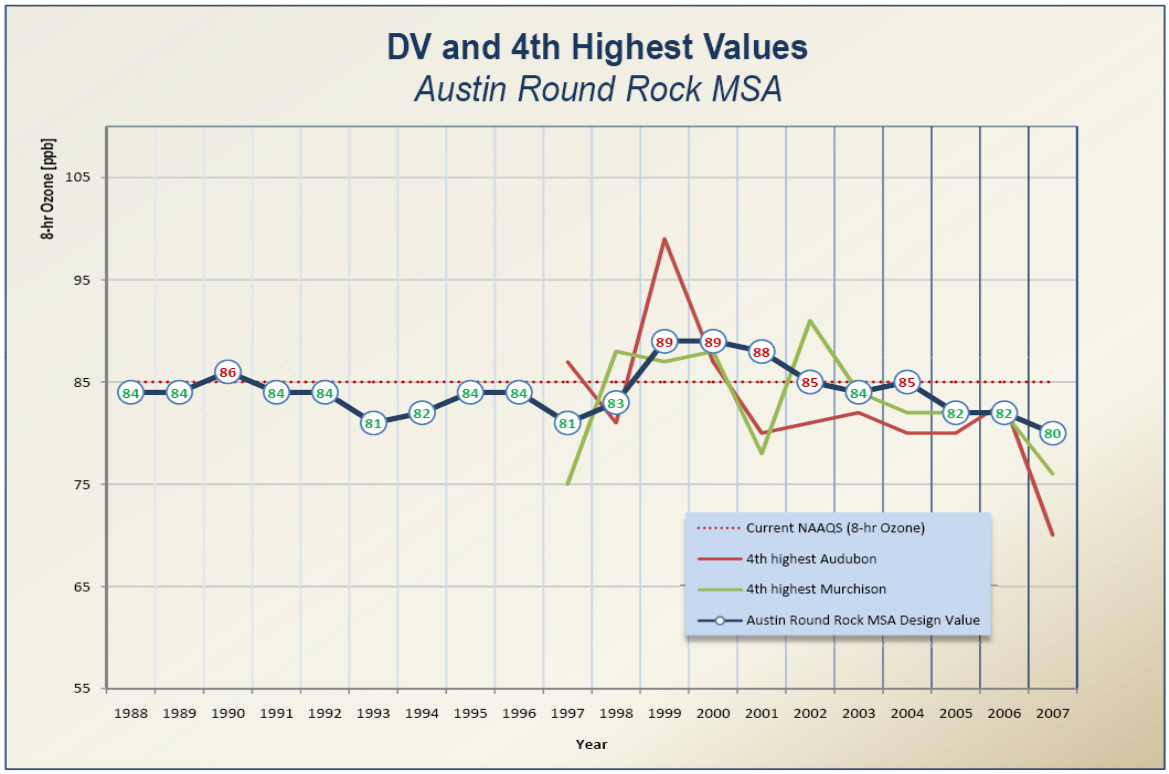


Figure 2.1 Austin Round Rock MSA 8-hr ozone design value historic trend. Note current 8-hr ozone design value is 80 ppb.

Figure 2.2 shows the number of days, from 1993 – 2006, that one or more monitoring stations measured a maximum ozone concentration of 75 ppb or greater. The number of high ozone days varied from a minimum of 6 in 1996 to a maximum of 34 in 1999. The trend in annual high ozone days must be interpreted with caution, as the locations and number of monitoring stations in the Austin monitoring network changed throughout the period. Figure 2.2 also presents the number of high ozone days using only the regulatory monitoring stations at Audubon (C38), and Austin NW / Murchison (C03). Note that the number of high ozone days is the same for all years with the exception of 2003 (13 versus 15) and 2006 (15 versus 18). The years 1995, 1997, 1999, and 2000

were characterized by 33, 23, 34, and 24 high ozone days, respectively. Annual high ozone days for the remaining years varied: they ranged from 6 in 1996 to 18 in 2006 (*Austin Conceptual Model*, UT Austin 2007).

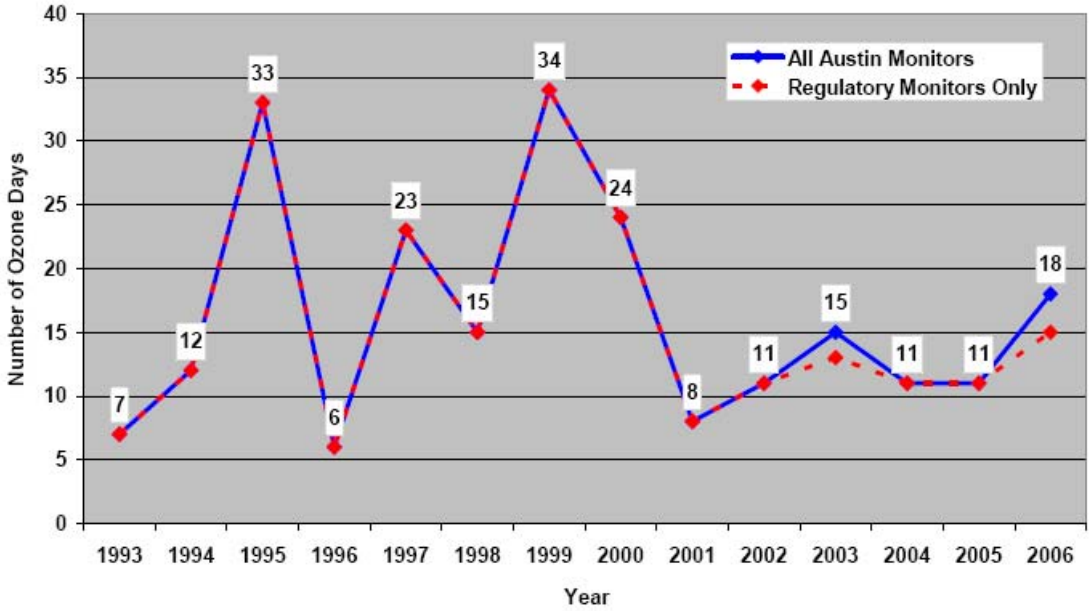


Figure 2.2 Annual number of days characterized by a maximum ozone concentration, averaged over 8 hours, of 75 ppb or greater at one or more Austin monitors, and at regulatory monitors only, during the 1993 through 2006 period.

Figure 2.3 presents the monthly frequency occurrence of high ozone days for 1993 - 2000 and for 2001 - 2006. Note the dramatic reduction in the frequency of occurrence of high ozone days during the July through October period. During 1993-2000, the average annual number of high ozone days in August/September was 11.9, compared to an average of 5.5 days during 2001-2006. In contrast, the May/June period was characterized by a relatively greater number of high ozone days in recent years. During May/June, the annual number of high ozone days for 2001-2006 was 5.5, compared to 2.6 days during 1993-2000. Although not shown, a similar trend was observed for days characterized by maximum ozone concentrations of 85 ppb or greater.

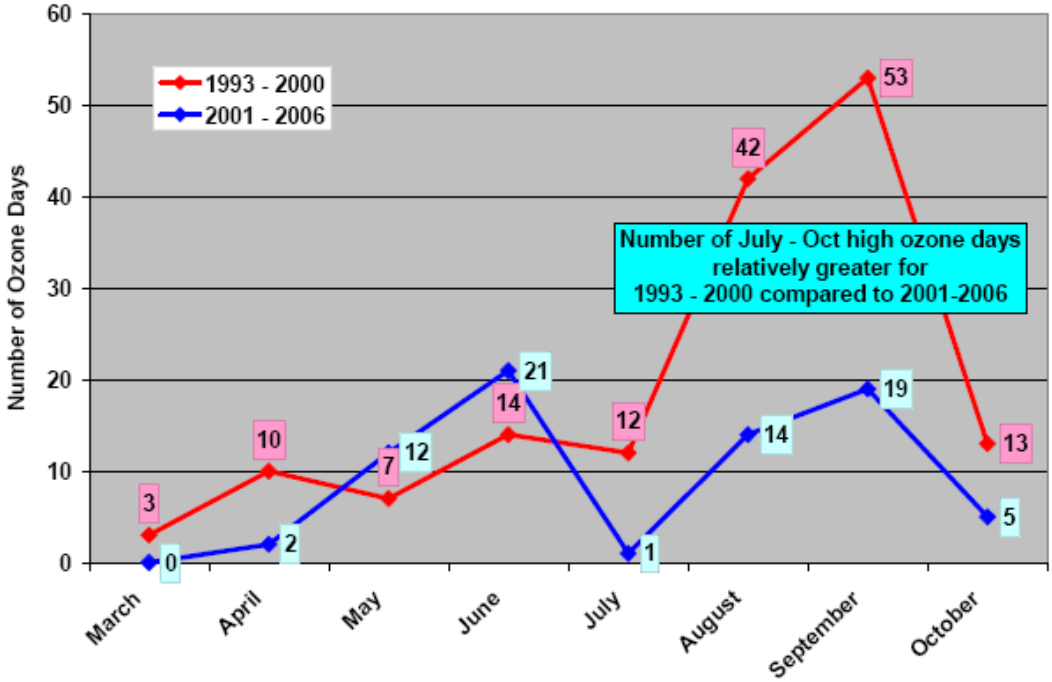


Figure 2.3 Number of days, by month, characterized by a maximum ozone concentration, averaged over 8 hours, of 75 ppb or greater at one or more Austin monitoring stations for the years 1993 - 2000 and for 2001 - 2006.

2.2 Sources of Pollutants

Ozone precursor emissions can result from both anthropogenic and biogenic sources and can be transported over long distances. The traditional emissions inventory (EI) accounts for ozone precursor emissions from point, area, mobile, and biogenic sources within a certain defined area, usually the MSA. The latest EI compiled for the Austin-Round Rock MSA represents emissions for the five-county MSA for the year 2002 (*Austin-Round Rock MSA 2002 Ozone Precursor Emissions Inventory*, Final revision Dec 2006) and is listed in Tables 2.1 & 2.2 for VOC and NO_x emissions respectively. The most recent data on point source emissions for the MSA counties are listed in Table 2.4. Large point sources located outside MSA counties with potential impacts on the area, depending on wind directions, are listed in Table 2.5.

2.2.1 2002 Emissions Inventory

This inventory encompasses the five Austin-Round Rock MSA counties, which includes Travis County, the most populous county of the MSA, and the four surrounding counties of Bastrop, Caldwell, Hays, and Williamson. (see Figure 1.2 for map)

The 2002 Austin-Round Rock MSA emissions inventory comprises five categories of emission sources. These include biogenic sources and four anthropogenic emission source categories: point, on-road mobile, non-road mobile, and area sources.

Tables 2.1 and 2.2 list NO_x and VOC emissions in tons per average ozone weekday for six major source categories represented in each of the five Austin-Round Rock MSA counties.

VOC 2002 Ozone Season tpd Emissions

COUNTY	Area	On-road Mobile	Non-Road Mobile	Point	Biogenic	Total	**Anthropogenic**
BASTROP	6.00	2.16	0.60	0.36	123.89	133.01	9.12
CALDWELL	15.95	1.09	0.54	0.06	80.95	98.59	17.64
HAYS	13.23	4.3	1.70	0.86	49.42	69.51	20.09
TRAVIS	57.22	31.11	20.16	0.99	71.64	181.12	109.48
WILLIAMSON	16.80	9.19	5.01	0.08	68.2	99.28	31.08
Grand Total	**109.21**	**47.85**	**28.02**	**2.35**	**394.1**	**581.51**	**187.41**

Table 2.1: 2002 VOC emissions by source category for each of the counties (all emissions are expressed in tons per day during an average ozone day) (*Austin-Round Rock MSA 2002 Ozone Precursor Emissions Inventory*, Final revision Dec 2006).

NO_x 2002 Ozone Season tpd Emissions

COUNTY	Area	On-road Mobile	Non-Road Mobile	Point	Biogenic	Total	**Anthropogenic**
BASTROP	0.7	3.65	1.68	3.79	2.18	12.00	9.82
CALDWELL	0.72	2.06	1.24	2.46	4.93	11.41	6.48
HAYS	0.71	9.95	5.58	7.15	3.29	26.68	23.39
TRAVIS	3.77	58.33	17.45	6.56	4.78	90.89	86.11
WILLIAMSON	4.8	17.29	7.33	0.1	9.85	39.37	29.52
Grand Total	**10.7**	**91.28**	**33.30**	**20.06**	**25.03**	**180.35**	**155.32**

Table 2:2. 2002 NO_x Emissions by Source Category for Each of the Counties (*Austin-Round Rock MSA 2002 Ozone Precursor Emissions Inventory*, Final revision Dec 2006).

Figures 2.1 and 2.2 provide a graphical comparison of emissions of NO_x and VOC by source category in tons per average ozone day (weekday).

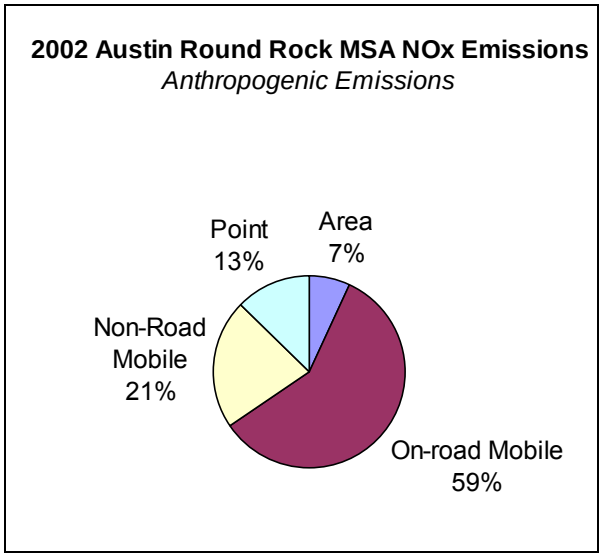


Figure 2.1 Austin-Round Rock MSA emissions inventory pie chart (2002 NO_x emissions) (*Austin-Round Rock MSA 2002 Ozone Precursor Emissions Inventory*, Final revision Dec 2006).

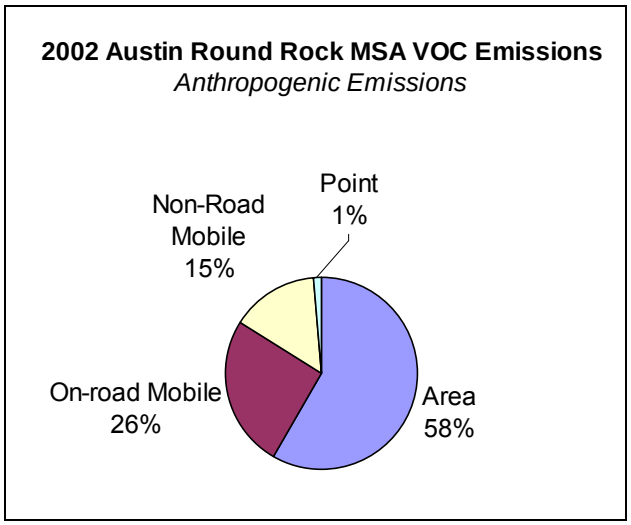


Figure 2.2 Austin-Round Rock MSA emissions inventory pie chart (2002 VOC emissions) (*Austin-Round Rock MSA 2002 Ozone Precursor Emissions Inventory*, Final revision Dec 2006).

The on-road mobile category comprises the vehicles (e.g., cars, trucks, buses) traveling the regional roads and highways. Non-road mobile sources account for the emissions of mobile equipment operated in areas other than public thoroughfares. The non-road category includes farm vehicles, lawn and garden equipment, construction, mining, and industrial equipment, railroad locomotives, aircrafts, and others.

Area sources, such as gasoline stations, dry cleaners, or oil wells, are numerous and individually produce low levels of air contaminants. Identification of discrete sources is untenable because individually these sources do not approach the threshold that triggers reporting requirements. Nevertheless, the cumulative impact of the area source contribution to overall emissions is significant.

Point sources are stationary emitters that produce pollution levels sufficient to warrant a description of each singular source. The TCEQ maintains records of point sources. This category is subdivided into major and minor point sources. Major point sources with actual emissions or the potential to emit over 100 tons per year (tpy) of a criteria air pollutant are subject to TCEQ annual emissions inventory (EI) reporting requirements. Minor point sources, which emit fewer than 100 tpy of a criteria pollutant, only report emissions when specifically required by TCEQ. Since 2002, TCEQ has requested EI reports of point sources in the Austin region emitting 10 tpy of VOC and 25 tpy NO_x. Table 2.3 lists point sources in the Austin-Round Rock MSA and their 2002 emissions. Tables 2.4 and 2.5 show 2005 emissions, collected by TCEQ, for the Austin-Round Rock MSA and surrounding counties respectively.

County	Company Name	TCEQ Acc	NO_x [tpd]	VOC [tpd]	CO [tpd]
Bastrop	Acme Brick Company	BC0059O	0.16	0.13	0.65
	Bastrop Energy Partners (Bastrop Clean Energy)	BC0083R	0.57	0.04	0.19
	GenTex Power Corp and Calpine (lost Pines 1)	BC0082T	0.55	0.03	0.46
	Lower Colorado River Authority	BC0015L	2.46	0.09	0.07
	LCRA Hilbig Gas Storage	BC0057S	-	0.06	-
	Tiffany Brick Company LP	BC0018F	0.04	0.02	0.17
Bastrop Total			**3.78**	**0.37**	**1.54**
Caldwell	JL Davis	CA0011B	0.25	0.03	0.37
	Oasis Pipeline Co TX LP (Prairie Lea Compressor St.)	CA0027J	2.21	0.04	0.15
Caldwell Total			**2.46**	**0.07**	**0.52**
Hays	Texas Leigh Cement Co. (Portland Cement Mfg.)	HK0014M	6.09	0.51	9.52
	SW Texas State Univ. (Central Heating & Utilities)	HK0036C	0.63	0.08	0.24
	Hays Energy Project	HK0108C	0.43	0.26	0.7
Hays Total			**7.15**	**0.85**	**10.46**
Travis	3M Minnesota Mining and Manufacturing	TH0243G	0.12	0.03	0.42
	Austin White Lime Company	TH0010I	1.03	0.01	0.48
	Austin Hot Mix	TH0015V	0.01	0.09	0.05
	Motorola, Inc	TH0065G	0.05	0.14	0.02
	City of Austin Decker Creek Power Plant)	TH0004D	2.51	0.02	0.13
	City of Austin (Holly Power Plant)	TH0006W	0.75	0.001	0.04
	University of Texas at Austin (Hal C Weaver PP)	TH0104V	1.78	0.04	0.53
	Advanced Micro Devices	TH0142N	0.06	0.12	0.05
	Motorola Integrated Circuit	TH0172E	0.05	0.07	0.04
	Samsung Electronics	TH0602A	0.03	0.12	0.02
	Sand Hill Energy	TH0760E	0.1	0.001	0.17
	Koch Pipeline Co	TH0310Q	0.01	0.21	0.03
	Austin Research Laboratory	TH0052P	0.04	0.03	0.05
	Tyco Printed Circuit Group LP	TH0093B	0.01	-	-
	Austin American Statesman	TH0191A	-	-	-
	BFI Waste Systems	TH0232L	0.01	0.04	0.04
	Austin Counter Tops	TH0247V	-	0.04	-
Travis Total			**6.56**	**0.96**	**2.07**
Williamson	Aquatic Industries Inc	WK0116E	-	0.1	-
	Seminole Pipeline Co	WK01480	0.1	0.01	0.07
	Laboratory Tops Inc	WK0171T	-	0.07	-
Williamson Total			**0.10**	**0.18**	**0.07**
TOTAL			**20.05**	**2.43**	**14.66**

Table 2.3 Summary in tons/day of Point Source Emissions for 2002 (*Austin-Round Rock MSA 2002 Ozone Precursor Emissions Inventory*, Final revision Dec 2006)

RN	ACCOUNT	SITE	COUNTY	REGION	SIC	VOC [tpy]	NOX [tpy]
RN102038486	BC0015L	LOWER COLORADO RIVER AUTHORITY	BASTROP	11	4911	31.77	428.02
RN101056851	BC0083R	BASTROP ENERGY CENTER	BASTROP	11	4911	12.89	237.27
RN100723915	BC0082T	LOST PINES 1 POWER PLANT	BASTROP	11	4911	8.30	200.44
RN100225846	BC0059O	ELGIN PLANT	BASTROP	11	3251	47.09	60.35
RN100212034	BC0018F	HANSON BRICK ELGIN FACILITY	BASTROP	11	3251	7.86	26.64
RN102204427	BC0057S	HILBIG GAS STORAGE FACILI	BASTROP	11	1311	23.33	0.64
RN100220177	CA0027J	PRAIRIE LEA COMPRESSOR STATION	CALDWELL	11	4922	38.38	981.30
RN100212018	CA0011B	LULING GAS PLANT	CALDWELL	11	1321	16.19	171.13
RN102597846	HK0014M	TEXAS LEHIGH CEMENT CO.	HAYS	11	3241	198.42	2168.00
RN100221480	HK0036C	CENTRAL HEATING & UTILITI	HAYS	11	8221	22.10	174.42
RN100211689	HK0108C	HAYS ENERGY PROJECT	HAYS	11	4911	15.35	165.49
RN100211945	HK0046W	PARKVIEW METAL PRODUCTS	HAYS	11	3469	27.68	
RN102533510	TH0104V	HAL C. WEAVER POWER PLANT	TRAVIS	11	4911	15.43	693.68
RN100214337	TH0010I	AUSTIN WHITE LIME COMPANY	TRAVIS	11	3274	7.94	647.06
RN100219872	TH0004D	DECKER CREEK POWER PLANT	TRAVIS	11	4911	33.39	518.32
RN100215052	TH0760E	SAND HILL ENERGY CENTER	TRAVIS	11	4911	1.98	283.31
RN100220045	TH0006W	HOLLY POWER PLANT	TRAVIS	11	4911	0.36	241.07
RN100218692	TH0243G	3M AUSTIN CENTER	TRAVIS	11	8731	12.68	50.62
RN101992246	TH0522W	SUNSET FARMS ELECTRIC	TRAVIS	11	4911	5.56	38.63
RN100215938	TH0502F	AUSTIN COMMUNITY RECYCLING AND DISPOSA FACILITY	TRAVIS	11	4953	7.86	19.21
RN102752763	TH0172E	INTEGRATED CIRCUIT MFG	TRAVIS	11	3674	13.77	17.44
RN100723741	TH0142N	ADVANCED MICRO DEVICES	TRAVIS	11	3674	30.81	17.33
RN100843747	TH0065G	ED BLUESTEIN SITE	TRAVIS	11	3674	21.42	15.40
RN100518026	TH0602A	AUSTIN FABRICATION FACILI	TRAVIS	11	3674	43.24	10.17
RN100542752	TH0232L	SUNSET FARMS LANDFILL	TRAVIS	11	4953	17.29	7.60
RN102776994	TH0015V	AUSTIN HOT MIX	TRAVIS	11	2951	30.15	3.06
RN101059673	TH0310Q	AUSTIN TERMINAL	TRAVIS	11	5171	54.43	1.25
RN100805662	TH0093B	AUSTIN DIVISION	TRAVIS	11	3672	2.30	0.16
RN101957769	TH0191A	AUSTIN AMERICAN STATESMAN	TRAVIS	11	2711	0.85	0.01
RN100216746	TH0247V	AUSTIN COUNTER TOPS	TRAVIS	11	3089	25.13	
RN100725712	WK0148O	SEMINOLE PIPELINE COUPLAN	WILLIAMSON	11	4619	2.41	27.62
RN100728179	WK0171T	DURCON LABORATORY TOPS INCORPORATED	WILLIAMSON	11	3821	13.98	3.17
RN100215193	WK0116E	AQUATIC INDUSTRIES INC	WILLIAMSON	11	3088	30.30	

Table 2.4 Point source emissions in tons/year in the Austin Round Rock MSA (data from 2005 Point Source Emissions Inventory; TCEQ)

RN	ACCOUNT	SITE	COUNTY	REGION	SIC	VOC [tpy]	NOX [tpy]
RN100228196	BF0063Q	TEMPLE PLANT	BELL	9	3086	231.44	3.52
RN101612083	BF0129I	FORT HOOD	BELL	9	9711	274.60	72.99
RN100212067	CS0018B	HUNTER PLANT	COMAL	13	3241	52.94	1288.95
RN100552454	CS0020O	BULK MINERAL HANDLING	COMAL	13	3271	5.51	575.94
RN102605375	CS0022K	BALCONES PLANT	COMAL	13	3241	12.54	2060.70
RN100226844	FC0018G	FAYETTE POWER PROJECT	FAYETTE	11	4911	211.77	6834.16
RN100213776	FC0033K	GIDDINGS PLANT	FAYETTE	11	1321	90.99	462.39
RN100215136	FC0051I	LAGRANGE PLANT	FAYETTE	11	1321	11.06	209.10
RN102413689	GL0028H	FURNACE & STEEL MILL	GUADALUPE	13	3312	38.78	158.47
RN100225820	GL0135F	GUADALUPE GENERATING STATION	GUADALUPE	13	4911	5.54	398.61
RN100218742	GL0146A	RIO NOGALES POWER PLANT	GUADALUPE	13	4911	3.40	319.40
RN100221472	MM0001T	ALCOA SANDOW PLANT	MILAM	9	3334	1190.09	7747.99
RN102147881	MM0023J	SANDO STEAM ELECTRIC	MILAM	9	4911	77.49	4779.40

Table 2.5 Large point source emissions in tons/year in the adjacent and upwind counties (data from 2005 Point Source Emissions Inventory; TCEQ)

2.3 Monitoring

2.3.1 Number and locations of air quality monitors

TCEQ has two regulatory monitors (Audubon C38 and Austin NW / Murchison C03) in the Austin-Round Rock MSA. CAPCOG maintains the following additional ozone monitors:

- The Dripping Springs monitor (C614) has been in place since March 2003;
- The San Marcos (C675) and the Round Rock (C674) monitors came on-line in June 2006;
- CAPCOG started maintaining the Fayette County C603 monitor in 2002;
- The McKinney Roughs monitor (C684) came on-line in August 2006; and
- CAPCOG has installed a monitor at the new Lake Georgetown site which started operation in 2008. The Lake Georgetown site replaces the monitoring site at the Pflugerville Wastewater Treatment Plant, which began operations in December 2002 and was deactivated in November 2006.

Data from six of the sites is accessible on-line from TCEQ's Monitoring Operations website:
http://www.tceq.state.tx.us/cgi-bin/compliance/monops/site_info.pl
The locations of the Austin area ozone monitors are shown below:

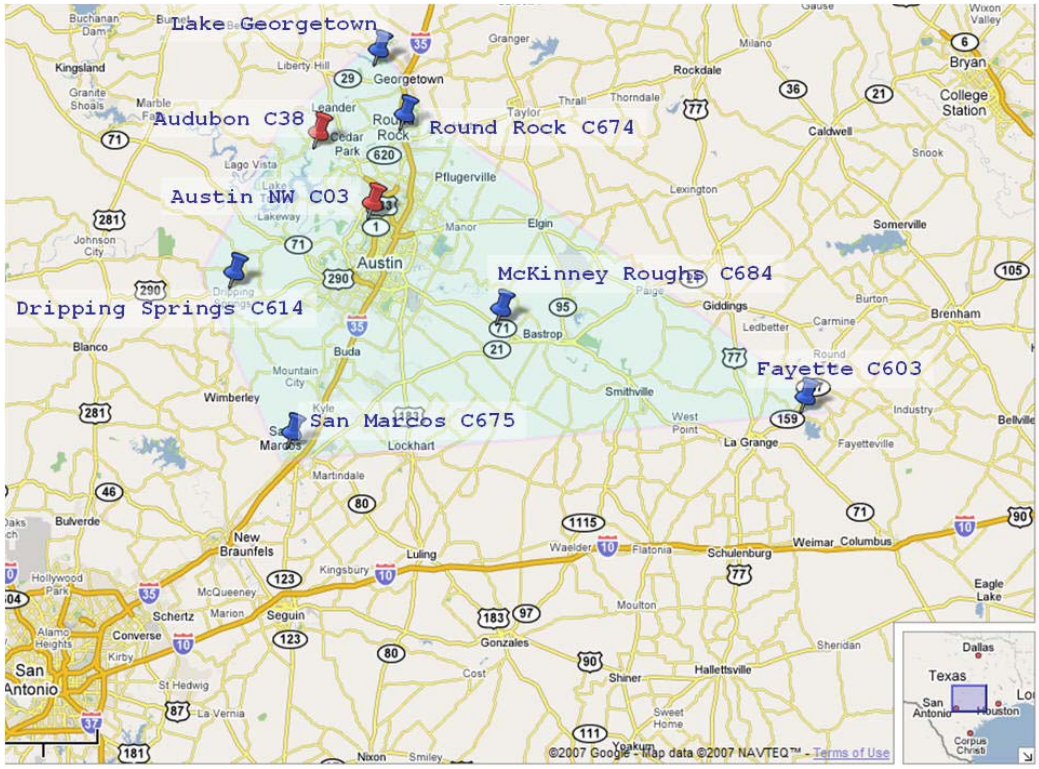


Figure 2.3 Austin Round-Rock MSA ozone monitoring network with regulatory monitors Audubon and Austin NW (red markers) and additional ozone monitors (blue markers)

Figure 2.4 shows readings from all Austin-Round Rock MSA ozone monitors during 2007 ozone season. Note that during the 2007 ozone season the region experienced unusually low ozone readings.

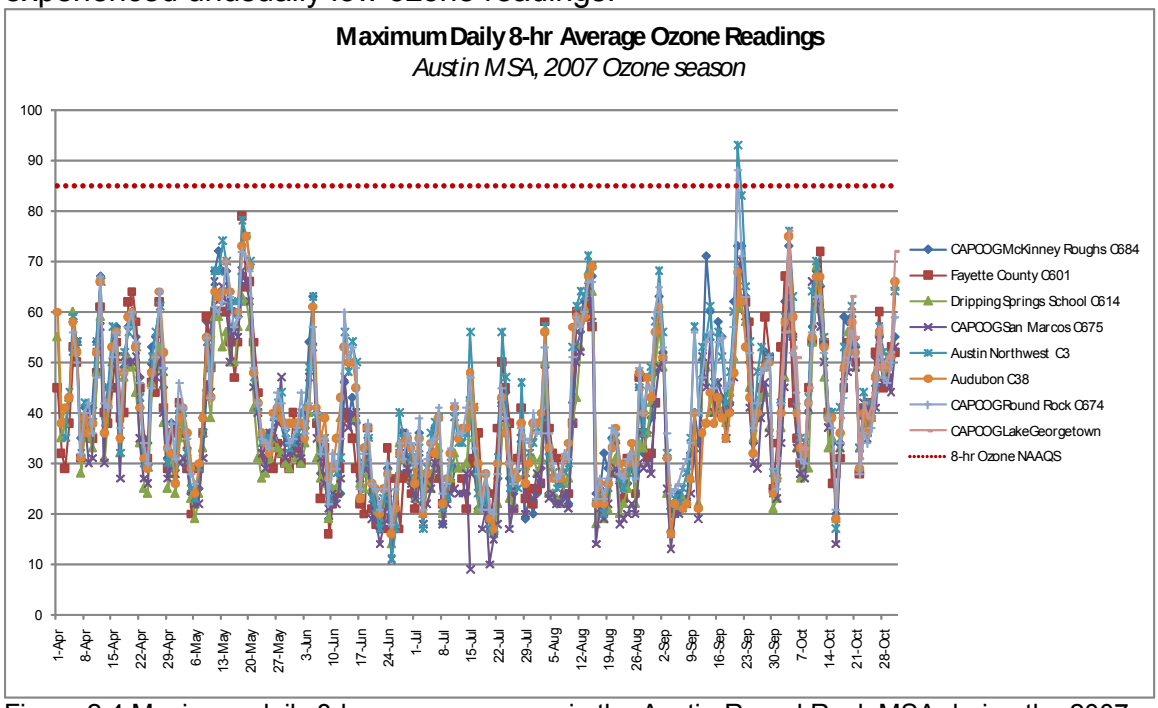


Figure 2.4 Maximum daily 8-hr ozone averages in the Austin-Round Rock MSA during the 2007 ozone season

2.4 Analysis of High Ozone Episodes

The HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory) model was used to investigate the potential source regions of air entering the Austin-Round Rock MSA. HYSPLIT uses meteorological model forecast data from the National Centers for Environmental Prediction (NCEP) archived by Air Resources Laboratory (ARL). Figures 2.5 and 2.6 present the residence time maps for the 20% highest ozone days for June and September based on the maximum ozone concentration at either the Murchison or Audubon monitoring station during the years 2001 through 2005. These back trajectories suggest long-range transport of continental air into the MSA from upwind areas located to the east and northeast of Texas. Multi-day high ozone episodes are often associated with a ridge of high pressure that extends southwestward into Texas. The transport pattern prior to high ozone days is consistent with the large-scale clockwise circulation around this high pressure ridge. This high pressure ridge is often associated with local meteorological conditions that are favorable for the formation and accumulation of ground-level ozone. In addition, the continental air mass transported into the MSA may contain elevated concentrations of ozone and its precursor compounds associated with both biogenic and anthropogenic

emissions from sources located in states and other areas of Texas upwind of the Austin-Round Rock MSA. (*Austin Conceptual Model*, UT Austin, 2007).

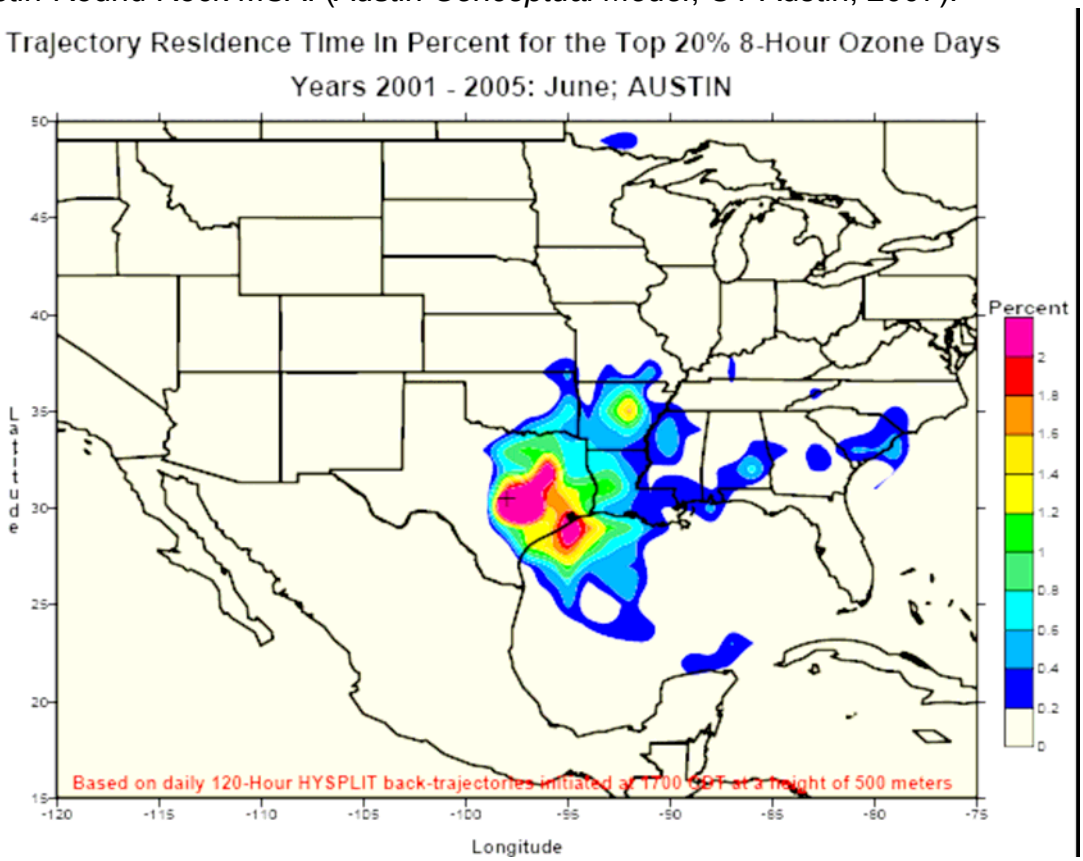


Figure 2.5 Trajectory residence time in percent for the highest 20% ozone days in June from 2001to 2005.

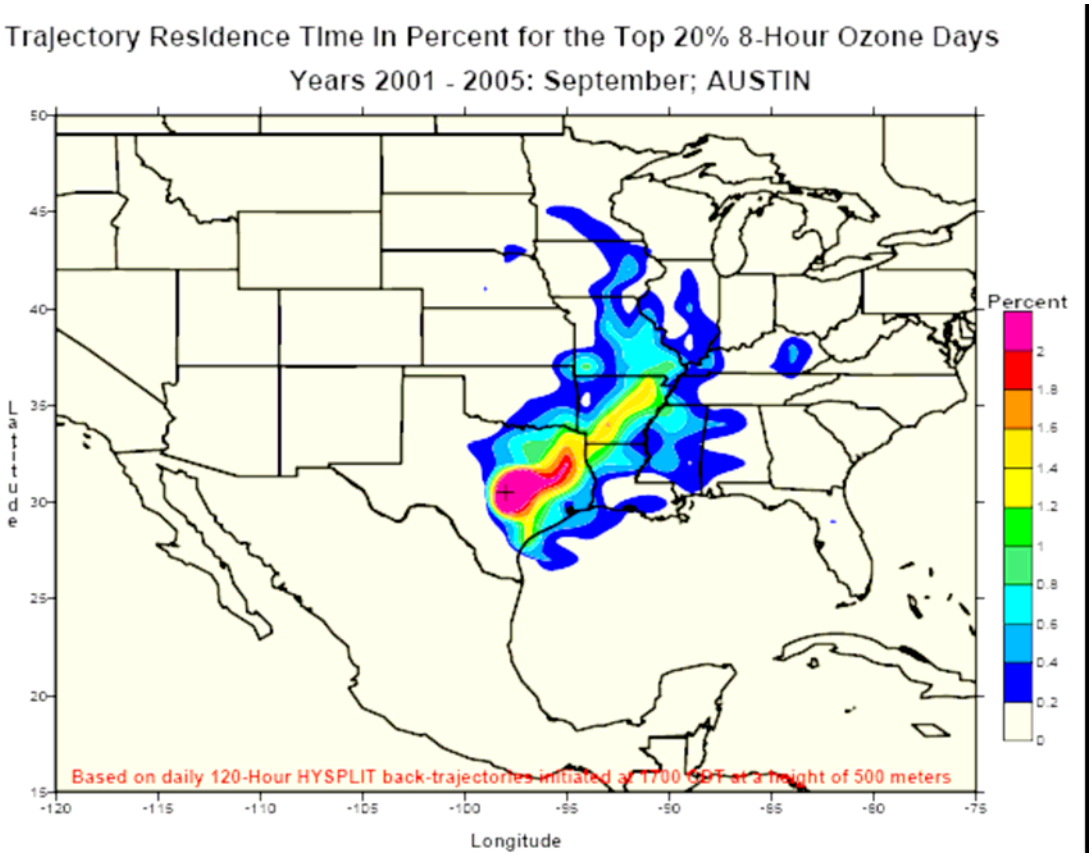


Figure 2.6 Trajectory residence time in percent for the highest 20% ozone days in September from 2001 to 2005.

According to the Austin Ozone Conceptual Model (*The University of Texas at Austin, July 26, 2007),* from 1993 through 2006, one or more monitoring stations measured 75 ppb or greater on 228 days. The number of high ozone days varied from a minimum of 6 in 1996 to a maximum of 34 in 1999. The frequency of occurrence of high ozone days over the course of a typical ozone season is characterized by a bi-modal distribution, with a primary peak in the frequency of high ozone days during the August through early October period and a secondary peak during late May and June. In recent years (2001 through 2006) the average number of late summer high ozone days declined substantially. The frequency of occurrence of high ozone days was equally distributed between the May/June and August/September peaks.

The common meteorological condition occurring with high ozone is a clockwise circulation around a surface ridge of high pressure, often centered over the Central Plains or Ohio/Mississippi River Valleys. It generates northeasterly or easterly wind that transports continental air and haze into eastern Texas. This continental air mass is often characterized by reduced visibility, and may contain elevated concentrations of ozone and its precursor compounds associated with both biogenic and anthropogenic emissions. High ozone concentrations are sometimes measured at monitoring stations throughout the eastern half of Texas.

In the Austin-Round Rock MSA, monitoring data collected during these episodes shows background ozone concentrations of typically 80-85% of the observed local maximum. Based on these analyses, the enhancement of ozone concentrations due to emissions from sources within the Austin-Round Rock MSA generally ranged between 10 ppb and 20 ppb on individual high ozone days, with an average enhancement of 15 ppb. With background concentrations ranging from 65 ppb to 75 ppb, even relatively small contributions of ozone formed from local source emissions in the Austin-Round Rock MSA would have resulted in an exceedance of the 8-hour ozone NAAQS.

2.5 Regional Photochemical Modeling

Over the past eight years, the region has utilized its resources from the Texas Near Nonattainment Areas Grant Program to develop photochemical models for air quality planning. In 2001, Austin collaborated with San Antonio, Victoria, Corpus Christi, and TCEQ to develop a multi-day high ozone episode for photochemical modeling. The September 13-20, 1999 high ozone episode was selected for development with the Comprehensive Air Quality Model with Extensions (CAMx) photochemical grid model. The September 13-20, 1999 modeling episode fulfills both the requirements of the EPA guidance for modeling 8-hour ozone concentrations and the EPA's Protocol for Early Action Compacts.

The Austin and San Antonio areas used the episode to analyze the emission reductions from various control strategies being considered in the development of the EACs. In addition, the Austin, Corpus Christi, San Antonio, and Victoria near-nonattainment areas have used the episode for various air quality planning activities, including work on:

- sensitivity of ozone formation to reductions of VOC and NO_x precursors;
- response of ozone to various VOC and NO_x control strategies;
- comparisons with airborne ozone sampling data;
- comparisons with airborne ozone lidar data;
- development of programs to perform VOC sampling;
- the role of long range point source impacts on local ozone formation; and
- the role of transport on local ozone formation.

In addition to modeling the EAC measures, sensitivity analyses have been run using the 1999 modeling episode to evaluate both potential control strategies and potential sources of emissions growth. Those include runs to investigate the impact from local emission reduction measures included in the State Implementation Plan (SIP). Figure 2.7 demonstrates the emission reductions predicted by the vehicle Inspection and Maintenance program and the Texas Emission Reduction Plan (TERP) projects. Similar modeling analyses were conducted to investigate the impact from potential and new sources in the locations upwind from Austin-Round Rock MSA. Figure 2.8 shows potential ozone impacts related to emissions from the proposed Oak Grove coal-fired

power plant on two days with different wind directions. Note that for neither day does the modeling predict an exceedance of the 1997 8-hour ozone standard at the regulatory monitors.

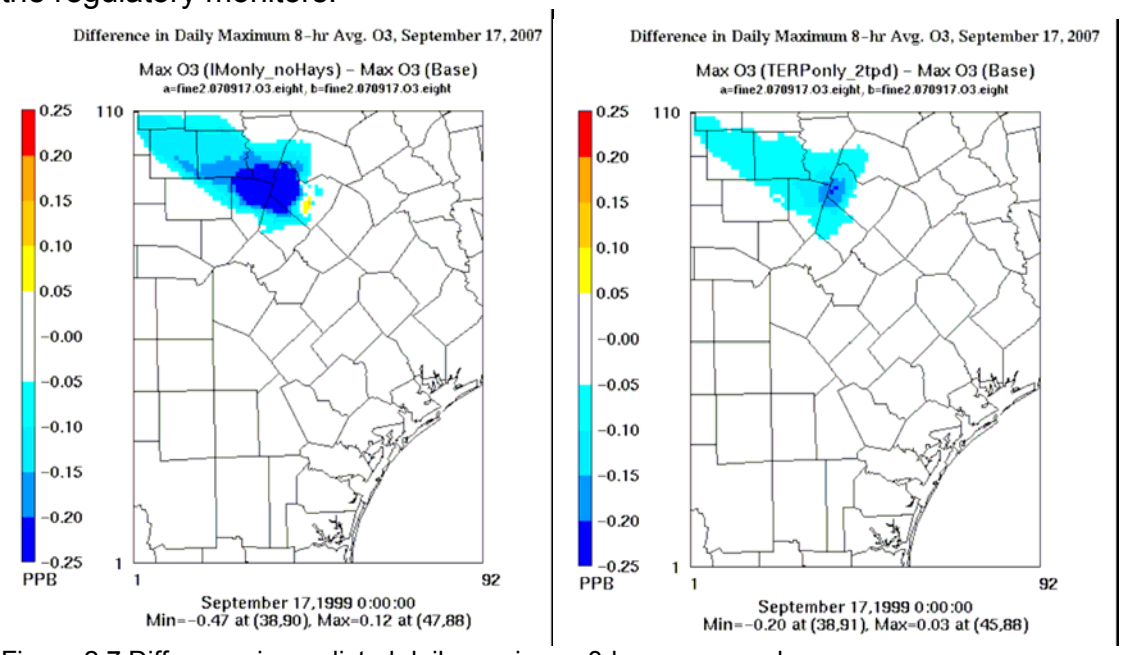


Figure 2.7 Difference in predicted daily maximum 8-hour averaged ozone concentrations on September 17 between the 2007 Future Case with no local controls applied but with I&M programs in Travis and Williamson Counties (left); TERP measures only (right).

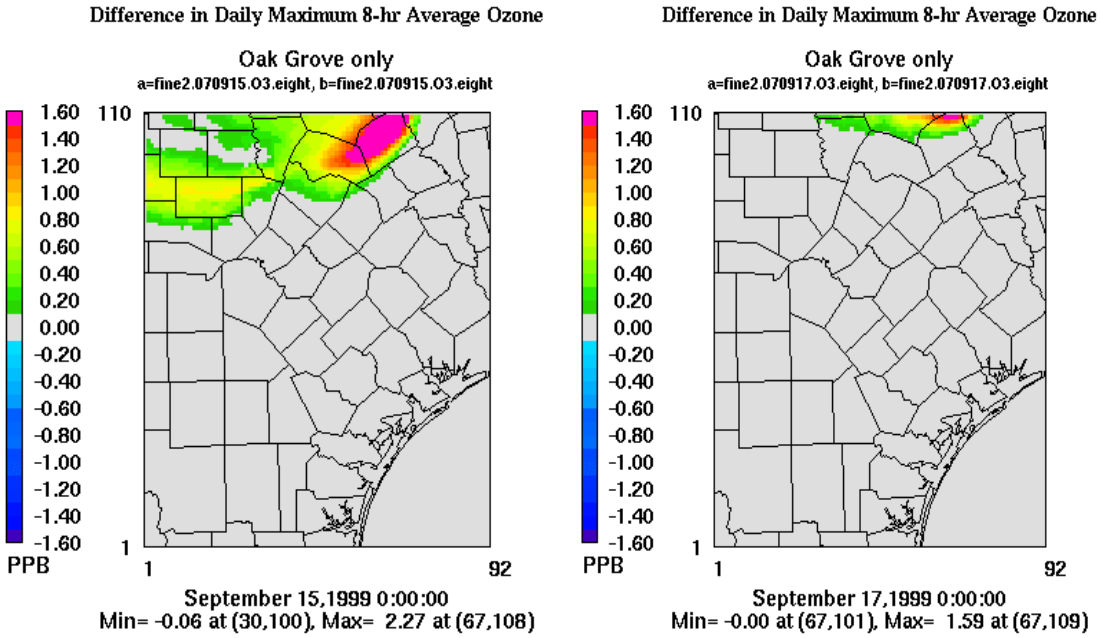


Figure 2.8 Difference in predicted daily maximum ozone concentrations (ground-level) averaged over 8 hours on the 4-km CAMx domain on September 15 and September 17 between Run 7 (Modified 2007 Future Case) and Run 4 (Oak Grove Only).

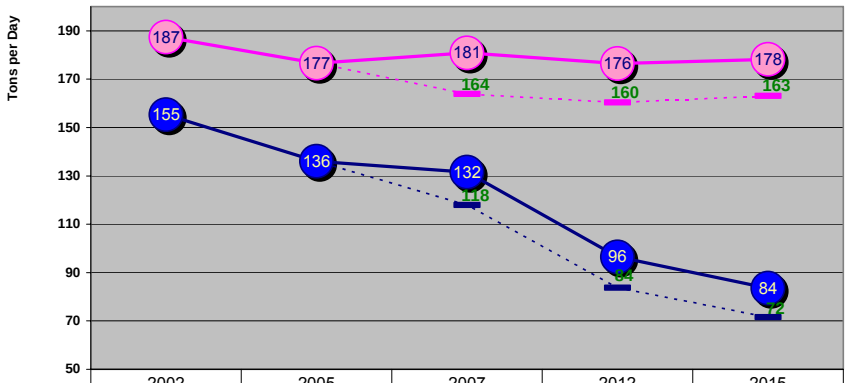
2.6 Trends and Measures of Success

The Austin-Round Rock MSA 2002 – 2015 emissions trend analysis is an upgrade from the 2003 Early Action Compact (EAC) analysis "*Emissions Inventory Comparison and Trend Analysis for the Austin-Round Rock MSA: 1999, 2002, 2005, 2007, & 2012.*" The existing document was upgraded by adding the final year (2015) to the on-road and non-road mobile, area and point source inventories and by adjusting the intermediate year emissions with a new base year (2002).

The 2015 emissions for the on-road mobile sources are from the Texas Transportation Institute (TTI) report: "*Austin Early Action Compact Region On-Road Mobile Source Emissions Inventories: 2007, 2015, And 2030: Revised Emissions Results*", TTI, February 2007. Emissions for 2002, 2005, 2007 and 2012 are from "*Austin/San Marcos Metropolitan Statistical Area On-road Mobile Source Emissions Inventories: 1995, 1999, 2002, 2005, 2007, and 2012*", TTI, August 2003.

Emission trends for the non-road mobile sources were developed by applying newly developed growth factors to the base year inventory (2002). The non-road growth factors were developed by running the US EPA NONROAD model for years 2002, 2005, 2007, 2012 and 2015. The area and point source emission trends were developed by applying growth factors obtained from the 2003 EAC document. The 2015 trends emission trends were developed by using the interpolation method (reference) for both area and point source categories.

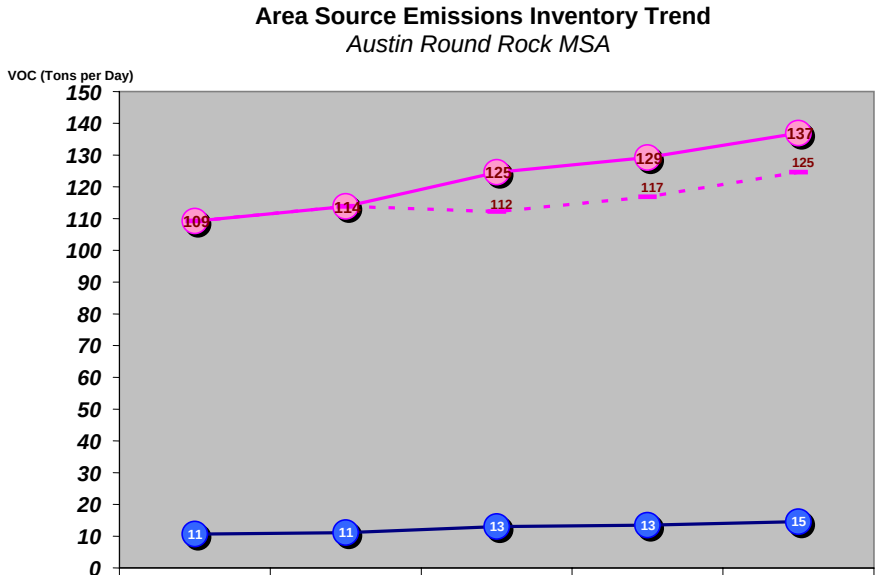
Emissions data were used in the development of air quality trends within the MSA. These emissions are presented in the following categories: area source, non-road mobile source, point source and on-road mobile source. Figure 2.9 shows the total emissions trends of NO_x and VOC in the Austin-Round Rock MSA. Figures 2.10 to 2.13 show separate emission trends of area sources, non-road and on-road mobile sources, and point sources, respectively.



	2002	2005	2007	2012	2015
NOx TREND with *EAC	155.31	136.05	117.94	83.69	71.53
NOx TREND without EAC	155.31	136.05	131.55	96.50	83.53
VOC Trend with *EAC	187.43	176.66	163.85	160.37	163.09
VOC TREND without EAC	187.43	176.66	180.86	176.43	178.19

*State Assisted and Point Source Voluntary Measures Applied

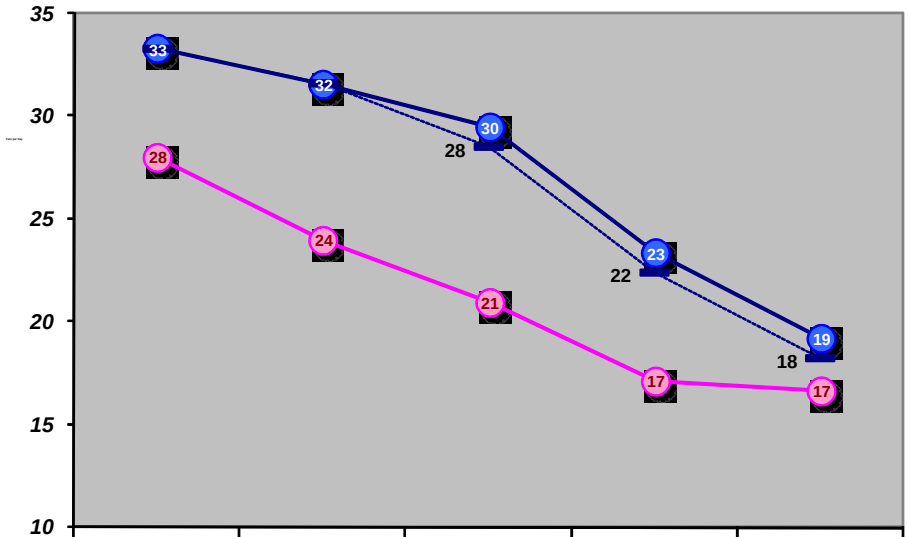
Figure 2.9 Total NO_x and VOC emissions trends in the Austin-Round Rock MSA



	2002	2005	2007	2012	2015
NOx	10.70	11.12	13.04	13.48	14.57
VOC	109.21	113.87	124.58	129.20	136.91
VOC with EAC controls	109.21	113.87	112.22	116.84	124.56

Figure 2.10 Area source emissions trends in the Austin-Round Rock MSA

Nonroad Mobile Source Emissions Inventory Trend
Austin Round Rock MSA

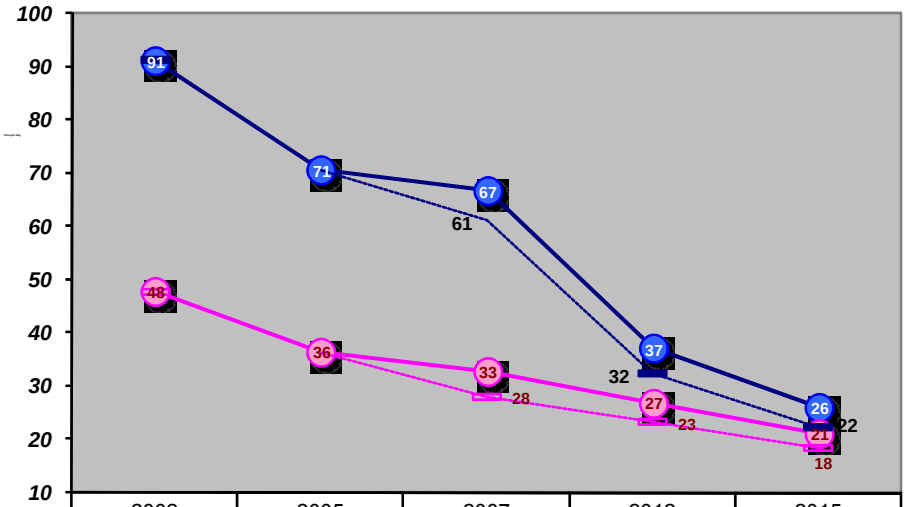


	2002	2005	2007	2012	2015
NOx Trends without EAC	33.30	31.58	29.52	23.39	19.23
VOC Trends without EAC	28.02	23.98	20.92	17.12	16.65
NOx Trends with EAC	33.30	31.58	28.50	22.37	18.21

Figure 2.11 Non-road mobile source emissions trends in the Austin-Round Rock MSA

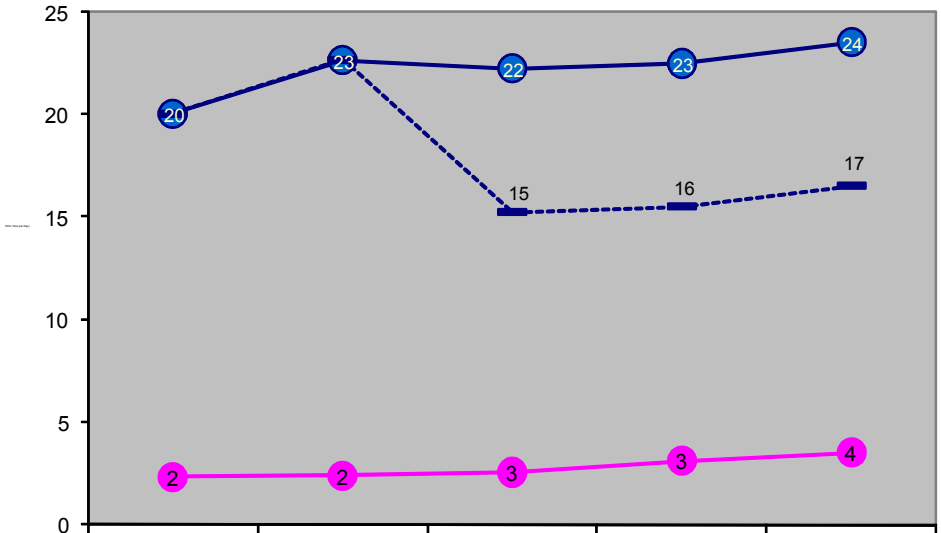
Onroad Mobile Source Emissions Inventory Trend

Austin Round Rock MSA



	2002	2005	2007	2012	2015
NOx Trends without EAC	91.25	70.66	66.75	37.12	26.18
VOC Trends without EAC	47.85	36.43	32.78	26.97	21.09
NOx Trends with EAC	91.25	70.66	61.16	32.34	22.20
VOC Trends with EAC	47.85	36.43	28.12	23.27	18.34

Figure 2.12 On-road mobile source emissions trends in the Austin-Round Rock MSA



	2002	2005	2007	2012	2015
NOx Trends without EAC	20.06	22.69	22.24	22.51	23.54
VOC Trends without EAC	2.35	2.39	2.58	3.14	3.54
NOx trends with EAC	20.06	22.69	15.24	15.51	16.54

Figure 2.13 Point source emissions trends in the Austin-Round Rock MSA

Chapter Three: Action Plan

The action plan charts the course for the MSA's air quality management through 2013. It outlines a collaborative, on-going management process that determines the appropriate response to defined implementation triggers and ensures the response is implemented. The action plan can be revised if necessary. While the action plan focuses on NO_x and VOC emission reductions, many of the measures implemented will also reduce greenhouse gas emissions and petroleum-based fuel use, providing substantial co-benefits.

3.1 Planning Measures

3.1.1 Air Quality Planning Activities

The Capital Area Council of Governments (CAPCOG) is committed to coordinating technical planning activities in support of the local government jurisdictions represented on the Clean Air Coalition, and to providing technically sound science for assessing regional air quality problems. CAPCOG is enabled by the near-nonattainment (NNA) grant contract with TCEQ and uses funding provided by the Texas Legislature.

CAPCOG will continue to monitor the region's ozone levels and develop and refine the technical analysis required to develop successful control strategies. It will monitor control strategy performance and provide technical support for successful implementation of both voluntary and State-assisted measures adopted in the EAC SIP and/or 8-hour O_3 Flex Program. Tasks included in the FY 08-09 NNA contract work plan are summarized as follows:

<u>Monitoring air pollution levels</u>

- Collect ozone concentration and meteorological data within the MSA by operating six ozone monitoring and meteorological data collection stations. Data collected will be reported to TCEQ's LEADS (IPS MeteoStar Leading Environmental Analysis and Display System) to supplement data collected at the two regulatory monitors operated in the area by TCEQ.
- Evaluate the patterns of ozone transport in Central Texas using aircraft-based instrumentation on planned routes to assess transported ozone, significant point sources and locally generated ozone distribution. Variability in ozone concentration and distribution of high ozone readings in the area may also be assessed using a mobile, ground-based monitoring platform.
- Continue VOC sampling program during the ozone season using canisters designed to capture VOCs in early morning ambient air prior to active photochemistry occurring. The data will be used for comparison with the VOC modeling emissions inventory for assessing emissions trends and for evaluating performance of the EAC VOC emission reduction measures.

Emissions Inventory Development

- Update the non-road mobile source emission inventories using the latest Non-road Emission Model and activity data to obtain accurate estimates of non-road emissions, e.g., lawn mowers, agricultural implements, pleasure boats.
- Coordinate with CAMPO and TCEQ to improve and update on-road mobile emissions estimates using the most recent travel demand model and MOBILE input data, including local fuel characteristics.
- Estimate emissions from area sources through a targeted outreach and compliance survey, current population data, or employment data.
- Review and confirm major point source emissions and update minor point source emissions from TCEQ permit files and local business data listings.
- Analyze regional growth trends and land use using data from Envision Central Texas and other studies to project future land uses and employment growth. The rural areas of the CAPCOG region have been transitioning to urban economies over the last decade. Residential and employment growth trends and land use allocations will be used in conjunction with the latest GIS data layers to update and spatially locate 2015 emission inventories, employment, and population projections.

Photochemical Modeling Tasks

- Use ozone monitoring and meteorological data for the 2007 and 2008 ozone seasons to update the conceptual model which characterizes meteorological conditions resulting in high ozone levels in the MSA. Incorporate results of TxAQS II projects and airborne sampling to better characterize emissions source regions and meteorological components contributing to high ozone events in the region. Analyze conceptual model for completeness of the existing photochemical modeling episodes and determine if new episodes are needed for photochemical modeling analysis.
- Work with TCEQ and other near-nonattainment areas to select and develop a joint modeling episode. The episode may be selected from the TxAQS time period since enhanced modeling input data is available. An additional modeling episode is needed to supplement the existing September 1999 episode model in order to evaluate high ozone events which occur earlier in the season, usually June or early July. This episode could also be used in conjunction with the 1999 episode for attainment analysis required if the MSA does not monitor attainment in the future.

Early Action Compact SIP and 8-hour O_3 Flex Program Implementation

- Provide contractor funding to continue existing, local voluntary emission reduction measure program commitments.
- Clean Air Partners Program – a CAPCOG subcontractor, in coordination with the CLEAN AIR Force of Central Texas, administers this program. The program provides guidance to over 100 companies with over 170,000

employees on the implementing measures aimed at reducing commute-related emissions by 10%. Results are provided annually.

- Regional Rideshare Program – CAPCOG, CAMPO, and the Alamo Area Council of Governments selected the GreenRide system developed by Ecology and Environment, Inc. as the framework for a shared regional web-based ride-matching program to reduce emissions from single-occupant vehicles.
- Energy conservation measure outreach efforts – SB 12 includes a requirement for local governments to implement energy conservation measures which will reduce demand for new electric generating units. This task provides staff and subcontractor assistance to member local governments in selecting effective energy conservation measures along with developing effective implementation plans.
- Provide program design and contractor funding assistance to support any enhancements for existing voluntary programs or implementation of new programs required by the 8-hour O_3 Flex program
- Provide updated analysis of the 8-hour O_3 Flex program Action Plan emission reduction measures. These may include analysis of recently developed measures, such as the GreenRide regional rideshare program, increased use of plug-in hybrid vehicles, or new analysis of existing control measures such as the vehicle Inspection and Maintenance (I&M) and remote sensing programs using updated EPA-approved software and/or emission factors. Perform analysis of any additional emission reduction measures for consideration in the 8-hour O_3 Flex program, as needed for contingency measures.
- Provide semi-annual performance analysis of adopted emission reduction measures, verify modeling inputs (particularly growth assumptions), evaluate impacts of transportation trends, collect and assess progress reports from local government 8-hour O_3 Flex program signatories and develop semi-annual reports required by EAC and the subsequent 8-hour O_3 Flex program.
- Monitor permit applications and other sources for proposed new or expanding business or industrial operations in the MSA or adjacent regions. Monitoring consists of identification of new or expanding plants, verification of building schedules with anticipated dates of startup, and conducting emission inventories. Where appropriate, work with identified new or expanding businesses or industries by providing assistance, outreach materials, and information on voluntary control strategies designed to help mitigate proposed emissions increases. This will include, as appropriate, an impact analysis under the proposed revised ozone standard.

<u>Public Outreach – CLEAN AIR Force of Central Texas</u>

- Support matching funding from CAMPO for CLEAN AIR Force of Central Texas program specialist to continue public involvement and public education designed to promote awareness of air quality issues and their solutions.

3.2 Primary Measures

These emission reduction measures are designed to be sufficient to prevent violations of the current 8-hour ozone standard through 2009. Although many of the measures will be implemented through 2013 as part of the 8-hour O_3 Flex program, analysis of anticipated emissions growth indicates additional emission reduction measures may be needed beginning in 2010. The additional 2010 measures are included as maintenance for growth offset measures.

Implementation dates for the primary measures vary; many measures are on-going, while others will be implemented within one year of the effective date of the 8-hour O_3 Flex program. The following state and local measures will be continued through 2013 as part of the 8-hour O_3 Flex program.

3.2.1 On-going Local EAC Measures

These measures include the renewed commitments of local governments and participating organizations to over 100 ongoing EAC emission reduction measures.
The commitment to continue implementation of ongoing EAC measures through 2013 is triggered by the signing of the 8-hour O_3 Flex program Memorandum of Agreement (MOA).

These measures include specific measures implemented by local governments and participating organizations to reduce emissions from their operations and within their communities. Example measures include ozone action day education and response programs, fleet and fuel improvements, employee commute reduction, e-government, and transportation system and land-use improvements. Many of these measures were initially implemented as EAC or 1-hour O_3 Flex measures. These on-going measures are above and beyond those required by state and federal law. Measure specifics vary by jurisdiction, so emission reductions from the on-going local measures have not been quantified or included in the photochemical modeling. The on-going emission reduction measures implemented by local governments and participating organizations are found in Appendix B.

<u>EAC Transportation Emission Reduction Measures (TERMS)</u>
TERMs are transportation projects designed to reduce vehicle use, improve traffic flow, or reduce congested conditions. A transportation project that adds single-occupancy vehicle (SOV) capacity is not considered a TERM. General categories of TERMs include intersection improvements, traffic signal synchronization improvements, bicycle and pedestrian facilities, high-occupancy vehicle lanes, major traffic flow improvements, park and ride lots, intelligent transportation system (ITS) and transit projects.

TERMS are similar to transportation control measures (TCMs) except that TCMs apply to non-attainment areas. TCMs are subject to nonattainment area SIP and transportation conformity requirements while TERMs are not.

Several jurisdictions and organizations committed to and implemented numerous TERMS in various locations in the MSA. Most of these TERMs will continue to reduce emissions past 2007.

2007 Emission Reductions: 0.72 tpd NO_x, 0.83 tpd VOC (in EAC SIP)

Commute Solutions

CAMPO hosts the Commute Solutions Coalition, a regional program to encourage alternatives to the drive-alone commute that will reduce congestion and improve air quality. Coalition members attend numerous events and provide information on commute alternatives. Commute Solutions also offers employers free training for employee transportation coordinators. The program also provides seed money for projects that provide or encourage commute alternatives through the Innovator Grant Program. And every year, Commute Solutions holds the Commuter Challenge, a month long contest where participants log their alternative commutes in order to be eligible for prizes. Commute Solutions also has a website: www.commutesolutions.com.

CLEAN AIR Force of Central Texas

Founded in1993, the CLEAN AIR Force of Central Texas (CAF) is a 501(c)(3) organization of business, government, environmental and community leaders united in the common goal of finding workable solutions for improving air quality in Central Texas. The CAF conducts and coordinates public awareness and education campaigns and implements voluntary programs to reduce emissions. Some of the programs the CAF implements include the High School Public Service Announcement (PSA) Contest, the Electric Lawn Mower Discount Program, the Ozone Action Day Alert Program, the Car Care for Clean Air Program that provides free emission testing and maintenance information, the Clean Air Partners Program, and the Clean School Bus Program. See also: www.cleanairforce.org.

Clean Air Partners Program

The Clean Air Partners Program assists employers in reducing emissions through a variety of strategies, while promoting their clean air success stories to the community. Clean Air Partners is a program of the CLEAN AIR Force of Central Texas (CAF), which helps with its coordination and marketing. By becoming a Partner, employers volunteer to carry out employee clean air programs and other clean business practices to reduce the emissions that contribute to unhealthy air in our region by 10% over three years. Common strategies include employee commute solutions programs (encouraging transit

use, vanpooling, carpooling, teleworking, biking, walking , flexible schedules), use of cleaner fleets, clean energy practices (e.g., GreenChoice), low-emission construction or landscaping activities, water conservation practices, and many other activities that can contribute to cleaner air. Employers report their achievements once a year through an online reporting tool. The Clean Air Partners Program currently consists of 106 Central Texas businesses, organizations and government entities, representing over 170,000 regional employees. See also: www.cleanairpartnerstx.org.

Clean School Bus Program

The Clean School Bus Program is a cooperative partnership among the CLEAN AIR Force of Central Texas, CAPCOG, TCEQ, EPA, and school districts in Central Texas. The program helps school districts reduce schoolchildren's exposure to Particulate Matter (PM) and NO_x from school buses. Emission reductions are achieved by retrofitting, replacing, or re-powering older diesel school buses. The program also encourages policies and practices to eliminate unnecessary school bus idling. See also: www.cleanschoolbus.net.

Clean Cities

Clean Cities is a program designed to assist the United States to use its own renewable fuels and to cut dependence on foreign oil. The Department of Energy is committed to energy use in America's transportation sector that is more efficient, less dependent on foreign oil, less environmentally disruptive, sustainable and safe. By encouraging alternative fuel and vehicle use, the Clean Cities program helps enhance energy security and environmental quality at both the national and local levels.

Respondents to a 2006 survey of Central Texas Clean Cities members reported operating 1804 alternative fuel or clean technology vehicles. Members also reported using 98,527 gasoline gallon equivalents (GGEs) of compressed natural gas (CNG) and 6,178,664 GGEs of liquefied petroleum gas, or propane. Alternative fueled mowers are also encouraged by Clean Cities members. One member reported using 2,450 gallons of alternative fuels to power mowers in 2006. The public can access alternative fuels through the three ethanol (E85), 36 bio-diesel, and 13 propane public fueling stations in the region. See also: www.ci.austin.tx.us/cleancities/.

The Austin Climate Protection Plan

The City of Austin's Climate Protection Plan is an aggressive plan to reduce or eliminate greenhouse gases. Many of the measures to reduce greenhouse gases will also reduce ozone-forming emissions, providing an implementation co-benefit. The Austin Climate Protection Plan uses a five-pronged approach:

- Municipal Plan – Make all City of Austin facilities, fleets and operations 100% carbon-neutral by 2020.
- Utility Plan – Increase efforts in conservation, energy efficiency and renewable energy programs and implement requirements for carbon

neutrality on any new generation. Offset need for 700 MW power plant through energy efficiency and meet 30% of power needs in Austin through renewable energy by 2020.

- Homes and Buildings Plan – Enhance building codes maximize energy efficiency. Implement zero net-energy capable standard for all new home construction and increase energy efficiency by 75% in all other new construction by 2015.
- Community Plan – Develop a comprehensive community plan to reduce greenhouse gas emissions through a network of stakeholders and technical advisors. Form a Climate Action Team to assess greenhouse gas emissions from community activities. Collaborate with stakeholders and technical experts to develop short- and long-term goals.
- "Go Neutral" Plan – Provide tools and resources for individuals and businesses to reduce their carbon footprint to zero. Develop an online carbon footprint calculator and a recognition program for those that achieve carbon neutrality.

See also: www.coolaustin.org

3.2.2 State Rules Implemented Through the EAC

The following emission reduction measures are implemented through state rule as part of the EAC**.** These measures are above and beyond state and federal requirements:

Locally Enforced Idling Limitations – This measure limits idling of gasoline and diesel-powered engines in heavy-duty motor vehicles within the jurisdiction of any local government in the state that has signed a Memorandum of Agreement (MOA) with TCEQ to delegate enforcement to that local government.

The MSA's initial MOA to locally enforce idling limits began with the EAC and expires January 2, 2008. It is scheduled to be renewed through 2013 prior to the beginning of the 2008 ozone season.

- Administrative Code: Title 30, Subchapter J, *Operational Controls for Motor Vehicles, Division 1 Motor Vehicle Idling Limitations*, new Sections §§114.510-114.512, and 114.517

2007 Emission Reductions: 0.67tpd NO_x (in EAC SIP)

Vehicle Emission Inspection and Maintenance – A version of the State vehicle emissions Inspection and Maintenance (I&M) program has been implemented in Travis and Williamson Counties. This version uses on-board diagnostics and a tailpipe test instead of the more expensive dynamometer test required in the Dallas and Houston nonattainment areas. Travis and Williamson counties administer an associated Low Income Repair Replacement Assistance Program (LIRAP).

- Administrative Code: Title 30, Subchapter C, *Vehicle Inspection and Maintenance and Low Income Vehicle Repair Assistance, Retrofit, and Accelerated Vehicle Retirement Program, Division 1 Vehicle Inspection and Maintenance,* Sections §§114.80-114.87

2007 Emission Reductions: 3.22 tpd NO_x, 3.83 tpd VOC (in EAC SIP)

Stage 1 Vapor Recovery - Amendments to existing rules lowered the exemption level for facilities subject to Stage I vapor recovery controls from 125,000 gallons in a calendar month to 25,000 gallons of gasoline in a calendar month.

- Administrative Code: Title 30, Chapter 115, Subchapter C, *Volatile Organic Compound Transfer Operations, Division 2, Filling of Gasoline Storage Vessels (Stage I) for Motor Vehicle Fuel Dispensing Facilities*, Sections §§115.227 and 115.229

2007 Emission Reductions: 4.88 tpd VOC (in EAC SIP)

Degreasing Requirements - Amendments to existing rules extend restrictions on certain solvents.

- Administrative Code: Title 30, Chapter 115, Subchapter E, *Solvent-Using Processes, Division 1, Degreasing Processes*, §§115.412, 115.413, 115.415-115.457, and 115.419

2007 Emission Reductions: 5.55 tpd VOC (in EAC SIP)

Cut-back Asphalt Restrictions - Amendments to existing rules extend restrictions on the use of certain paving substances to the Austin-Round Rock MSA.

- Administrative Code**:** Title 30, Chapter 115, Subchapter F, *Miscellaneous Industrial Sources, Division 1, Cutback Asphalt*, Sections §§115.512, 115.516, 115.517, and 115.519

2007 Emission Reductions: 1.03 tpd VOC (in EAC SIP)

Low Emission Gas Cans – State rule established requirements relating to the design criteria for portable fuel containers and portable fuel container spouts and the sale or distribution of the portable fuel containers.

- Administrative Code: Title 30, Subchapter G, *Consumer-Related Sources, Division 2, Portable Fuel Containers*, Sections §§115.620-115.622, 115.626, 115.627, and 115.629

2007 Emission Reductions: 0.89 tpd VOC (in EAC SIP)

Texas Emission Reduction Plan (TERP) – This existing TCEQ program, created by the State Legislature in 2001, provides grants and other incentives to improve air quality. TERP can provide funding for:

i. Cleaner on- and off-road engines
ii. Cleaner fuels and other infrastructure programs
iii. Research and development of new technologies

A list of approved TERP grants in the MSA is found in Appendix C.

2007 Emission Reductions: 2.26 tpd NO_x (2 tpd in EAC SIP)

The Texas Legislature provided funding for the TERP program through 2013. TCEQ will continue to notify potential TERP participants in the MSA of upcoming funding opportunities through 2013. Governments and businesses in the MSA will continue to apply for TERP grants when available and appropriate. Emission reductions from projects funded during the term of the MOA will be reported in the applicable 8-hour O_3 Flex program progress reports.

Local Power Plant Reductions – Austin Energy, LCRA and UT agreed to specific reductions in their EAC commitments.
2007 Emission Reductions: 1,866 tons per year NO_x, approximately 7 tpd (in EAC SIP)

Other State and Federal Measures - In addition to the state measures listed previously, the following state and federal measures apply to the MSA.

Federal Measures	**Description**
Area and Non-Road Measures	EPA has implemented a series of strategies for area and non-road sources. Some of these include the gas engine rule and marine recreational engine standards.
On-Road Measures	EPA has implemented a series of strategies for on-road vehicles. Tier 1 and Tier 2 vehicle standards, low-sulfur diesel standards, and National Low Emission Vehicle standards
State Measures	**Description**
California Gasoline Engines	California standards for non-road gasoline engines 25 horsepower or larger
Gas-Fired Heaters and Small Boilers	Rule limiting NO_x emissions from these small-scale residential and industrial sources.
Low Reid Vapor Pressure Gasoline	Low RVP gasoline is fuel that is refined to have a lower evaporation rate and lower volatility than conventional gasoline. It also reduces the evaporative emissions generated during vehicle refueling and reduces VOCs.

3.2.3 New Measures for the 8-hour O_3 Flex Program

The region is implementing the following new measures designed to keep ozone levels below the current 8-hour standard. These measures will be implemented within one year of the MOA signing, unless otherwise specified.

The Regional Web-based Rideshare Matching program, described below, will be fully implemented and quantified within the first year of the 8-hour O_3 Flex Program, as required.

Regional Web-based Rideshare Matching Program
The Capital Area Metropolitan Planning Organization (CAMPO) and the Alamo Area Council of Governments are partnering with Ecology and Environment, Inc.

to implement an inter-regional web-based rideshare matching and transportation information system covering 22 counties, including the Austin-Round Rock MSA. This program will help reduce drive-alone commutes in and between Austin and San Antonio, as well as throughout the 22-county region. This will reduce NO_x and VOC emissions in both Austin and San Antonio. Program implementation began in late 2007. At a minimum, the Austin MSA portion of the program will continue through 2013 as part of the 8-hour O_3 Flex Program.

River Cities Rideshare, www.rcride.com, is a web and map-based ridesharing program designed for ease-of-use by commuters and administrators in order to maximize participation and usefulness. After accepting the Terms of Use Agreement, the user can access instant, map-based rideshare matches, as well as bus-route, biking or walking information. The program provides the user with a template email to send to prospective matches and an email notification feature if matches are identified in the future. The program is available in both English and Spanish.

Both the user and the program administrator can track and quantify miles and dollars saved, emissions reduced, and calories burned. The program administrator can use the program's incentive management feature to encourage participation. The amount of NO_x and VOC reduced by the program will depend on participation rates and vary over time. Current daily emission reductions for the Austin-Round Rock MSA are estimated at 1215 grams per day VOC and 1541 grams per day NO_x. This estimate will be updated and reported as part of the 8-hour O_3 Flex program progress report.

Expanded Clean Air Coalition

The Clean Air Coalition (CAC) will invite at least five additional cities in the MSA to join the CAC and implement emission reduction measures appropriate to their circumstances. The invitation will include information on regional ozone and offer support and technical assistance in determining appropriate emission reduction measures. At a minimum, potential members will be encouraged to implement an Ozone Action Day (OZAD) Education and Response Program. The CLEAN AIR Force of Central Texas provides regional support for OZAD program implementation.

The CAC will extend invitations no later than one year after the MOA effective date. New members will implement any emission reduction measures they determine appropriate within one year of joining the CAC. New measure implementation will be quantified to the extent possible and included in the next applicable 8-hour O_3 Flex program progress report.

Ozone Watch and Warning System

The CAC requested TCEQ implement an ozone watch and warning system for the MSA in a letter dated October 2, 2007(see Appendix A). An ozone watch and warning system notifies participants when high ozone levels are expected to occur and sends a warning when high ozone levels are actually occurring. This system would replace the current ozone watch only system and offer extra protection for individuals sensitive to high ozone levels.

The TCEQ will implement the MSA's Ozone Watch and Warning System within one year of the MOA effective date. Once implemented, program status will be included in the next applicable 8-hour O_3 Flex program progress report.

Primary TERMS

Various governments and agencies in the MSA commit to implement TERMS in the 2008 and 2009 timeframe as primary 8-hour O_3 Flex program measures. A list of the primary TERMs is found in Appendix D. The primary TERMs' status and emission reductions will be reported in the 8-hour O_3 Flex program progress report.

AirCheck Texas Local Initiative Projects

The state has authorized funds to be used in counties that have an Inspection and Maintenance program with a vehicle repair and replacement component. These funds can be used to develop and implement new air control strategies designed to assist local areas in complying with state and federal air quality rules and regulations, as well as programs to enhance and improve the AirCheck vehicle inspection and maintenance program. Travis and Williamson Counties, in cooperation with TCEQ, will develop and implement emission reduction measures using these funds. The measures will be implemented as expeditiously as practicable, quantified to the extent possible, and included in the next applicable 8-hour O_3 Flex program progress report.

Paving of Unpaved Roads

An in-use vehicle study conducted by the Texas Transportation Institute indicates that vehicles emit more pollutants on unpaved roads, with other variables held constant. The study is found in Appendix E. Local governments will identify candidate road-paving projects and potential funding sources. Roads will be paved if sufficient funding is secured.

Voluntary Local Measures

In addition to continuing EAC measures, some governments and organizations are committing to implement new measures for the 8-hour O_3 Flex program. For example:

- The City of Austin will implement a carpool matching system for employees to its numerous on-going commitments.

- Travis County will implement a carpool parking incentive and an Ozone Action Day sign program at the County's drive through facilities to its on-going commitments.

One new agency, the Central Texas Regional Mobility Authority, committed to implement voluntary emission reduction measures. (See Appendix B)

Other measures
Other planning or emission reduction measures mutually agreed to by the signatory parties may be implemented. Once implemented, measure status will be included in the 8-hour O_3 Flex program progress report.

3.3 Maintenance for Growth Offset Measures

Implementation of one or more of these measures, intended to address expected emissions growth, will be implemented no later than December 31, 2010. The MOA signatories will evaluate the most recent emissions estimates and other relevant factors to determine the appropriate measure(s) to implement no later than January 1, 2010.

TERP
Local governments and businesses will continue to apply for TERP funding when available and as appropriate. TCEQ will notify the MOA signatories when TERP grant funding is available. Emission reductions from projects funded during the term of the MOA will be reported in the applicable 8-hour O_3 Flex program progress reports.

Maintenance for Growth TERMS
Various governments and agencies in the MSA commit to implement TERMS in the 2010 to 2013 timeframe. The specific 2010 to 2013 TERMs selected as growth offset measures will be determined no later than January 1, 2010. The status and emission reductions from these TERMs will be reported in the 8-hour O_3 Flex program progress report.

Further Expand the Clean Air Coalition
The CAC will invite all cities in the MSA with populations ≥ 10K to join the Clean Air Coalition and implement emission reduction measures appropriate to their circumstances. The invitation will include information on regional ozone and offer support and technical assistance in determining appropriate emission reduction measures. At a minimum, potential members will be encouraged to implement an Ozone Action Day (OZAD) Education and Response Program. The CLEAN AIR Force of Central Texas provides regional support for OZAD program implementation.

Energy Efficiency and Conservation Programs

Measures to reduce energy use through efficiency and conservation programs also reduce NO_x and other pollutants generated as a by-product of energy production. These measures will also reduce greenhouse gases and petroleum fuel use, providing an implementation co-benefit. Local governments, working through the Clean Air Coalition, CAPCOG and the EAC Task Force, will develop an inventory of energy efficiency and conservation programs implemented in the MSA by electric generation and/or distribution companies, state and local government agencies and other entities with available information. At a minimum, the inventory will be evaluated for adequacy, geographic coverage and effectiveness, and the emissions reductions quantified to the extent possible. Local governments may request assistance from TCEQ, the State Energy Conservation Office and the Texas A&M Energy Systems Lab in developing and evaluating the inventory. As part of the evaluation, local governments, working with implementing agencies, stakeholders and other interested parties, will determine whether the implemented measures are sufficient or improvements are needed.

Local governments will share the evaluation findings with implementing agencies, signatory parties, stakeholders and the public and recommend improvements if needed. Local governments will also provide citizens with information on applicable energy efficiency and conservation programs and encourage citizens to reduce energy use. The status of implemented measures will be included in the 8-hour O_3 Flex program progress report beginning with the next applicable report.

Other Measures

Other emission reduction measure not specifically listed may be implemented as emissions growth offset measures if the signatory parties agree to do so. The MOA signatories will identify and evaluate specific measures for consideration by July 1, 2010. Implementation dates and quantification possibilities will vary depending on measure specifics. The status of measures implemented will be included in the 8-hour O_3 Flex program progress report beginning with the first report after the measures are selected.

3.4 Tier I Contingency Measures

In addition to the Maintenance for Growth Offset Measures, which address anticipated increases in emissions due to growth, the MSA has prepared a series of contingency measures for implementation in the event that the MSA's design value reaches specified trigger levels.

Should the MSA's design value reach 84 ppb, the signatory parties will implement one or more of the following Tier I contingency measures. Within 90 days of a regulatory monitor recording a reading that would result in a design

value of 84 ppb, the signatory parties will work cooperatively to determine the cause of the increase and to select a specific Tier I contingency measure(s) that will be implemented. The Tier I measure(s) will be implemented as expeditiously as practicable, but no later than two years from the date of the trigger (i.e., the date that one of the MSA's regulatory monitors records a reading that, if valid, would result in a 3-year design value of 84).

Voluntary Mobile Source Emission Reduction Program (VMEP)
Local governments will implement a VMEP consisting of one or more voluntary mobile source emission reduction measures. VMEP measures that may be implemented as a Tier 1 contingency measure include expanding, upgrading and/or promoting the regional web-based rideshare matching program, www.rcride.com, and/or the Clean Air Partners Program to increase participation and associated emissions reductions. Other VMEP measures may be implemented if mutually agreed upon by the signatory parties. Tier I Contingency VMEP emission reductions will be included in the 8-hour O_3 Flex program progress report.

TERP
Governments and businesses in the MSA will continue to apply for TERP grants when available and as appropriate, although TERP funds are not guaranteed beyond the current funding/fiscal cycle (2008-2009). TCEQ will notify the MOA signatories when TERP grant funding is available. Emission reductions from projects funded during the term of the MOA will be reported in the applicable 8-hour O_3 Flex program progress reports.

NO_x Emissions-Reducing Diesel and/or Diesel Additives
The local government signatories will encourage area fleets, school districts and other businesses with on-road and non-road diesel vehicles to voluntarily use diesel fuel that has been obtained from diesel producers selling or supplying only diesel fuel that has been produced as Texas low emission diesel (TxLED) in compliance with the TxLED regulation applicable to changes in the physical properties of the diesel or through the use of a TCEQ approved alternative diesel formulation.

TERMS
Various governments and agencies in the MSA will commit to implement additional TERMs if the MSA design value reaches 84 ppb or higher. The Tier I contingency TERMs will be additional TERMs not previously committed to the 8-hour O_3 Flex Program as primary TERMs. Governments and implementing agencies will identify Tier I contingency TERMs. Tier I TERMs will be implemented as expeditiously as practicable and according to the implementation schedule. The status and emission reductions from the Tier I contingency TERMs will be reported in the 8-hour O_3 Flex program progress report.

Expand Participation in Locally Enforced Idling Limitations
The CAC will encourage other municipalities in the MSA to enter into a MOA with TCEQ to locally enforce idling limits for gasoline and diesel-powered engines in heavy-duty motor vehicles within their jurisdiction. The CAC will invite new CAC members and other municipalities to consider participating in the MOA. TCEQ will give prompt consideration to locally enforced idling limit MOAs requested by local governments in the MSA.

Other Measures
Other planning or emission reduction measures mutually agreed to by the signatory parties may be implemented. Once implemented, measure status will be included in the 8-hour O_3 Flex program progress report.

3.5 Tier II Contingency Measures

Should the region's design value reach or exceed 85 ppb, the signatory parties will implement one or more of the following Tier II contingency measures. Within 90 days of a regulatory monitor recording a reading that would result in a design value of 85 ppb, the parties will work cooperatively to determine the cause of the increase and to select a specific Tier II contingency measure(s) that will be implemented. The Tier II measure(s) will be implemented as expeditiously as practicable, but no later than two years from the date of the trigger (i.e., the date that one of the region's regulatory monitors records a reading that, if valid, would result in a 3-year design value of 85 ppb or greater).

Tier II contingency measure(s) will be quantified to the extent possible and implementation status will be included in the applicable 8-hour O_3 Flex program progress report.

Additional Tier I Measures
The signatory parties will consider implementing one or more of the Tier I measures that were not previously implemented.

Vehicle Inspection and Maintenance Program
MOA signatories will evaluate the vehicle inspection and maintenance program in Travis and Williamson Counties to determine if the program can reasonably be revised to increase vehicle emission reductions achieved by the program. Program revisions that may be considered include additional remote sensing and testing diesel vehicles. Other program revisions may also be considered.

The program could be expanded to Bastrop, Caldwell or Hays Counties if the county and largest city in the county request that TCEQ include that county in the program.

TERMS
Various governments and agencies in the MSA will commit to implement additional TERMS. The Tier I contingency TERMs will be additional TERMS not previously committed to the 8-hour O_3 Flex program. The specific TERMs selected as Tier 1 contingency measures will be determined as expeditiously as practicable. The status and emission reductions from the Tier I contingency TERMs will be reported in the 8-hour O_3 Flex program progress report.

Other Measures
Other planning or emission reduction measures mutually agreed to by the signatory parties may be implemented. Once implemented, measure status will be included in the 8-hour O_3 Flex program progress report.

If unforeseen circumstances dictate the appropriateness of an emission reduction strategy not found in the plan, the local governments reserve the right to submit the alternative strategy to the TCEQ and the EPA for approval. Should an alternative strategy be submitted, its emission reductions will be equivalent or greater to those of the strategy it replaces.

3.6 Coordination and Public Participation

The CAC established an EAC Task Force (EACTF) composed of staff from signatory jurisdictions, participating agencies, and including representatives of business and advocacy organizations, to develop EAC recommendations. The EACTF continues to meet regularly and to facilitate EAC implementation and reporting. The CAC directed the EACTF to build on the success of the EAC and to prepare recommendations for an 8-hour O_3 Flex program.

The EACTF developed the 8-hour O_3 Flex program elements in consultation with its full membership. The CLEAN AIR Force of Central Texas coordinated a print advertising campaign to introduce the proposed plan and to encourage public comments and suggestions. The newspaper ads ran in all five MSA counties. (See Appendix F)

Each jurisdiction will follow its own standard public involvement process. The complete plan will be posted on the CAF website, as well as on various other regional sites.

The EACTF will continue to assist local governments and participating agencies with implementing, tracking, and documenting the emission reduction measures associated with their jurisdiction's commitments. The Capital Area Council of Governments (CAPCOG) coordinates reporting requirements and quantifies results to the extent possible

3.7 Schedules and Reporting

3.7.1 Schedule of Activities and Milestones

Proposed Central Texas 8-Hour Ozone Flex Program (2008-2013)			
TRIGGER	**LEVEL**	**Implement one or more of the following MEASURE(S)**	**IMPLEMENTATION PERIOD**
Signing of 8 - Hour O3 Flex MOA	Selected Primary Emission Reduction Measures	Continue EAC SIP-Level and Voluntary Emission Reduction Measures	Ongoing, 2008--2013
		Continuation of analysis of measures' effectiveness and emissions growth	Ongoing, 2008--2013
		Continuation of area-wide programs such as Commute Solutions, Clean Cities, Clean School Bus	
		Renewal of Idling MOA	Prior to 2008 ozone season
Signing of 8 - Hour O3 Flex MOA	Primary Emission Reduction Measure(s)	Apply for TERP funding (as available)	Within 24 months
		TERMS	Within 1 year or as scheduled
		Regional RideShare Program	Within 1 year
		Invite 5 or more additional cities to join CAC & become 8-hour O3 Flex Program signatories	Within 1 year
		Request TCEQ implement Watch/Warning ozone alert system	As appropriate
		Implement AirCheck Texas Local Initiative Projects with LIRAP funds	As appropriate
		Pave unpaved roads	As appropriate
		Other measures identified and mutually agreed upon	Within 1 year
January 1, 2010	Maintenance for Growth Offset Measures	Apply for TERP funding (as available)	By December 31, 2010
		Invite all nonparticipating cities in MSA with populations ≥ 10K to join CAC & become 8-hour O3 Flex Program signatories	By December 31, 2010
		TERMS	By December 31, 2010
		Other measures identified and mutually agreed upon	As appropriate
		Energy efficiency and conservation programs	By December 31, 2010
84 ppb Ozone Design Value	Tier I Contingency Measure(s)	Apply for TERP funding (as available)	Within 24 months
		TERMS	Within 24 months
		Invite additional cities to join idling MOU	Within 24 months
		VMEP: Upgrade Regional RideShare Program & Clean Air Partner Program	Within 24 Months of 84 ppb DV
		Other measures identified and mutually agreed upon	As appropriate
		Voluntary use of NO_x emissions-reducing diesel and/or diesel additive to area fleets, school district buses, and/or non-road vehicles	Within 24 Months of 84 ppb DV
85 ppb or Greater Ozone Design Value (Violation)	Tier II Contingency Measure(s)	Tier I Contingency Measures not already implemented	Within 24 months of violation
		At the request of the county and its principal city, expand Inspection & Maintenance Program to Bastrop, Caldwell and/or Hays counties.	Within 24 months of violation
		Request upgrade of I&M Program to include additional remote sensing & inclusion of diesel testing	Within 24 months of violation
		TERMS	Within 24 months of violation
		Other measures identified and mutually agreed upon	Within 24 months of violation

3.7.2 8-hour O_3 Flex Program Progress Report

In accordance with EPA guidance, all signatories and participating organizations will review 8-hour O_3 Flex program activities twice yearly. The progress report will track and document, at a minimum, the latest information on implementation of control measures, ozone monitoring data, and the success of current measures.
CAPCOG has primary responsibility for report generation and will provide appropriately detailed technical analysis.

CAPCOG, or its designee, will file reports with the TCEQ and EPA by June 30 and December 31 of each required reporting year; reporting periods will be from May 1 to October 31, and November 1 to April 30, to allow for adequate public notice and comment.

If, following submittal of the first progress report, the MSA's design value is maintained at 80 ppb or lower, or if the design value is not increasing, or is on the decline each year, the MSA will request EPA approval to submit reports annually.

Chapter Four: Memorandum of Agreement

This Memorandum of Agreement (MOA) is between the governmental entities representing Bastrop, Caldwell, Hays, Travis and Williamson Counties and the cities of Austin, Bastrop, Elgin, Lockhart, Luling, Round Rock and San Marcos (herein after referred to as the local governments) who have approved participation in and signed the MOA, the Texas Commission on Environmental Quality (TCEQ), and the United States Environmental Protection Agency (EPA). The purpose of the MOA is to reduce ground-level ozone concentrations in the Austin-Round Rock Metropolitan Statistical Area (MSA) through implementation of an 8-hour O_3 Flex program as described in this document.

The 8-hour O_3 Flex program emphasizes local flexibility in selecting and implementing emissions reduction measures. Given the varied emissions contributions and differing socioeconomic characteristics within each local government's jurisdictional boundaries, not all measures can or should be implemented region-wide. Rather, each of the local governments will implement the measures that work for its specific jurisdiction and, when added together, work for the region as a whole. Note that certain measures (e.g., Regional Rideshare Program, Watch/Warning Ozone Alert System), would apply region-wide.

4.1 General Provisions

The signatory parties commit to develop, implement and maintain this 8-hour O_3 Flex program according to applicable EPA guidelines and adhere to all terms and conditions stated in the guidelines.

4.2 EPA and TCEQ Responsibilities

4.2.1 Regulations that apply to an MSA would still apply under the 8-hour O_3 Flex program. The 8-hour O_3 Flex program does not shield an MSA from being redesignated nonattainment for the 8-hour ozone standard of 0.08 parts per million (ppm) effective September 1997, if the MSA is in violation of that standard. Should a violation occur, EPA would consider factors in section 107(d)(3)(A) of the Act. These include "air quality data, planning and control considerations, or any other air quality-related considerations the Administrator deems appropriate," including time to allow the implemented contingency measures to work. As long as the 8-hour O_3 Flex program and control measures in its Action Plan are being

fully implemented, EPA would consider that circumstance in exercising its discretion in making a decision to redesignate the area to nonattainment.

4.2.2 The intent of the signatory parties in entering into this MOA is to maintain the MSA's attainment designation and proactively implement and sustain air quality improvement strategies that are tailored to local conditions and are effective, practical and measurable in reducing ground-level ozone concentrations. This MOA should in no way be construed as a strategy to avoid or to defer a regulatory requirement.

4.2.3 EPA and TCEQ commit to informing the local governments of all available options and flexibility, to the extent allowed by the Federal Clean Air Act, in the event that the MSA, or any portion of the MSA, is monitoring exceedances or violations of the 8-hour ozone standard for the duration of this agreement.

4.2.4 EPA supports flexible approaches that account for the complex nature of ozone formation and has provided State Implementation Plan (SIP) credit to MSA's that adopt quantifiable measures for ozone reduction plans that may be required in the future. EPA will, consistent with the Federal Clean Air Act, allow the Austin-Round Rock MSA appropriate SIP credit for eligible strategies implemented under the terms of this Agreement.

4.2.5 Upon receipt of recommendations for implementation of contingency measures under 4.3.7, the TCEQ Executive Director will, subject to commission approval and public comment, initiate a process for proposing a SIP revision regarding contingency measures for the MSA.

4.2.6 This MOA's terms do not abrogate any state or federal legal requirement.

4.3 Local Government Responsibilities

4.3.1 As specified by EPA guidelines, the 8-hour O_3 Flex program developed by the MSA contains sections describing the MSA's air quality; an action plan; existing control measures; contingency measures; coordination and public participation process; schedules and reporting; and an MOA with signature and date page. These sections and

associated appendices further define the commitments and actions of the local governments.

4.3.2 The local governments may continue to conduct photochemical modeling to the extent that it informs and allows the MSA to better target contingency measures. However, there is no EPA requirement for photochemical modeling in support of or as a condition of participation in the 8-hour O_3 Flex program.

4.3.3 The local governments will continue to develop and regularly update area emissions inventories through the Capital Area Council of Governments. Note that, after consultation with TCEQ and EPA, the base year 2002 will be used for emissions inventories and for future emissions projections

4.3.4 The MSA is an Early Action Compact (EAC) area. Therefore, in order to participate in the 8-hour O_3 Flex program, the local governments agree to continue their existing EAC requirements. Specifically, the local governments agree to keep the "Maintenance for Growth" requirement in place through 2012 as agreed to in the "Austin Area Early Action Compact State Implementation Plan Revision" adopted by TCEQ on November 17, 2004.

4.3.5 The local governments have detailed in an Action Plan the events that will trigger a requirement to implement one or more contingency measures and have specified when those measures will be implemented. The local governments commit to revise or update these contingency measures if state/tribal or federal laws change during the MOA period.

4.3.6 The local governments agree to implement one new, voluntary emissions reduction measure within one year of the signing of the MOA.

4.3.7 If the MSA's design value reaches or exceeds 85 ppb, the local governments will select one or more of the Tier II contingency measures and notify the Clean Air Coalition (CAC). The CAC will forward the local government recommendations to TCEQ to consider for inclusion in the SIP.

4.4 Expected Memorandum of Agreement Duration

The last signature date of this MOA is the start date of the agreement's term. This agreement remains in effect until December 31, 2013.

4.5 Conditions for Modification or Early Termination

This MOA may be modified or terminated by mutual consent of all signatory parties.

4.5.1 Any signatory party may withdraw from the MOA.

4.5.2 Failure to abide by the terms of the MOA, should violation of the 8-hour standard occur, could lead to redesignation as nonattainment for the 8-hour standard.

4.5.3 The signatory parties may review and modify this MOA as they deem necessary.

4.6 Signatures and Date

Executed in multiple copies by the signatory parties to this MOA. The representatives of the signatory parties executing this MOA represent their authority to sign the MOA and to bind the signatory party they represent to the terms of this MOA.

Signatory Parties to the Austin/Round Rock Metropolitan Statistical Area
8-Hour Ozone Flex Program
Memorandum of Agreement

Judge Ronnie McDonald
Bastrop County
Date:

Mayor Will Wynn
City of Austin
Date:

Judge H.T. Wright
Caldwell County
Date:

City Manager Michael H. Talbot
City of Bastrop
Date

Judge Elizabeth Sumter
Hays County
Date:

Mayor Gladys Markert
City of Elgin
Date:

Judge Samuel T. Biscoe
Travis County
Date:

Mayor James Bertram
City of Lockhart
Date:

Judge Dan Gattis, Sr.
Williamson County
Date:

Mayor Mike Hendricks
City of Luling
Date:

Buddy Garcia, Chairman
Texas Commission on Environmental Quality
Date:

Mayor Alan McGraw
City of Round Rock
Date:

Richard E. Greene,
Regional Administrator
US Environmental Protection Agency, Region 6
Date:

City Manager Rick Menchaca
City of San Marcos
Date:

Appendix A Correspondence

Appendix B Emission Reduction Measures

Appendix C TERP

Appendix D TERMS

Appendix E TTI Study

Appendix F Public Participation

Appendix A
Correspondence

Capital Area Council of Governments
PO Box 17848, Austin, TX 78760
512.916.6000 ~ Fax 512.916.6001
www.capcog.org

Clean Air Coalition:

Chairman
Mayor Will Wynn
City of Austin

Vice-Chair
Judge Samuel Biscoe
Travis County

Commissioner Clara Beckett
Bastrop County

Mayor James Bertram
City of Lockhart

Commissioner Ron Morrison
Williamson County

Mayor Mike Hendricks
City of Luling

Mayor Gladys Markert
City of Elgin

Mayor Pro Tem Alan McGraw
City of Round Rock

Mayor Susan Narvaiz
City of San Marcos

Commissioner Karen Ford
Hays County

Mayor Tom Scott
City of Bastrop

Judge H. T. Wright
Caldwell County

October 2, 2007

Mr. Steve Spaw
Director, Monitoring Operations Division
Texas Commission on Environmental Quality
P.O. Box 13 087
Austin, TX 78701

Dear Mr. Spaw,

The Central Texas Clean Air Coalition (CAC) is a bi-partisan organization of elected officials from the five-county Austin metro region, including officials representing the five counties and the seven most populous cities in those counties. As Mayor of Austin, I serve as current chairman of the CAC.

The CAC and its member governments have worked over the past several years to implement measures intended to maintain the area's compliance with the federal ozone standard. While we have been successful in achieving emission reductions, we believe the region will continue to be challenged in meeting the ozone standard, especially if the EPA proposed new standards are adopted. We have therefore expressed our intent to submit an 8-hour O3 Flex plan to keep existing measures in place while considering additional proactive steps than can reasonably be taken to protect the health of our citizens. One of the additional steps recently considered and supported by a vote of the CAC is to ask TCEQ to implement an ozone watch and warning system similar to the ones in Dallas and San Antonio. I am hopeful that this request will meet with the TCEQ's favorable approval, and that such a system, based on regional monitoring and meteorological data can be implemented by the next ozone season.

We look forward to our continued work with the TCEQ on safeguarding our air resources, and want to offer our thanks to your staff in particular for all the assistance they have provided to improve our regional air quality monitoring initiatives.

Regards,

Will Wynn
Chairman
Central Texas Clean Air Coalition

Central Texas Clean Air Coalition

Bastrop County • Caldwell County • Hays County • Travis County • Williamson County
City of Austin • City of Bastrop • City of Elgin • City of Lockhart • City of Luling
City of Round Rock • City of San Marcos

December 20, 2006

Richard E. Green
Regional Administrator
U.S. EPA Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Subject: 8-hour Ozone Flex Program Letter of Intent

Dear Administrator Greene;

On behalf of the Central Texas Clean Air Coalition (CAC), I would like to thank EPA for its approval of the 8-hour Ozone Flex Program and for its release of program guidance. The Austin/Round Rock (A/RR) MSA has a long-standing commitment to air quality and is grateful for the opportunity to participate in this timely new program.

The A/RR MSA currently monitors attainment of the 8-hour ozone standard. We believe that the region's attainment status is due, in large part, to the emission reductions achieved under the MSA's Early Action Compact and 1-hour Ozone Flex Plan.

Please consider this letter our notice of intent to participate in the 8-hour Ozone Flex Program. We anticipate a plan that includes, at minimum, the emission reduction measures implemented under our Early Action Compact and 1-hour Ozone Flex Plan. We will consider additional measures as we develop and finalize our plan.

Thank you for this opportunity. We are look forward to our continued partnership in securing the clean, healthy air that is the birthright of every American.

With best regards,

Will Wynn
Mayor, City of Austin
Chair, Central Texas Clean Air Coalition

The CTCAC is supported by the Early Action Compact Task Force and by staff of the
Capital Area Council of Governments (CAPCOG)
Air Quality Planning Division
PO Box 17848, Austin, TX 78760

Kathleen Hartnett White, *Chairman*
Larry R. Soward, *Commissioner*
H. S. Buddy Garcia, *Commissioner*
Glenn Shankle, *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

July 3, 2007

The Honorable Will Wynn, Chair
Central Texas Clean Air Coalition
P. O. Box 17848
Austin, Texas 78760

Dear Mayor Wynn and Members of the Central Texas Clean Air Coalition:

I'm writing in response to the letter that the Central Texas Clean Air Coalition provided to the Texas Commission on Environmental Quality (TCEQ) on April 17, 2007, in which six requests were made of the agency regarding the development of an Eight-Hour Ozone Flex Program. Following are the requests and the agency's responses.

1) Will the existing Early Action Compact (EAC) State Implementation Plan (SIP) measures remain in place for the duration of the Eight-Hour Ozone Flex Program (a five-year term with renewal options)?

The Austin-Round Rock EAC State Implementation Plan (SIP) adopted on November17, 2004, by the Commission includes a commitment to maintain controls through 2012. The EAC plan was required to have "a component to address emissions growth at least five years beyond December 31, 2007, ensuring the area will remain in attainment of the eight-hour standard during that period." The TCEQ does not have any plans to discontinue the state's measures - two-speed idle (TSI) and onboard diagnostic (OBD) based vehicle Inspection and Maintenance (I/M) program in Travis and Williamson Counties; Low-Income Vehicle Repair Assistance Program (LIRAP) in Travis and Williamson Counties; portable fuel container statewide requirements; Stage 1 Vapor Recovery requirements; solvent using processes; and cutback asphalt restrictions. In regards to participation in the Texas Emission Reduction Plan (TERP), the TCEQ has met the two tons per day commitment agreed upon in the EAC. However, if grants are available in the Austin-Round Rock area in the future, we encourage prospective participants in the Austin-Round Rock area to apply.

Idling restrictions on heavy-duty diesel vehicles (14,000 pounds or more) are also a component of the EAC. However, the Memorandum of Agreement (MOA) with the TCEQ and local entities expires January 2, 2008. If the local area wishes to continue this program, the MOA will need to be renewed by all parties.

2) Can we get an updated list of state and federal measures in place or expected to be in place during the Eight-Hour Ozone Flex Program MOA timeframe?

A list of current state and federal initiatives in place in the Central Texas area is enclosed. We cannot predict what the commission or the federal government may require in the future. You are encouraged to participate in future development of state-level control strategies.

3) Will the TCEQ be able to commit a specified amount of Texas Emission Reduction Plan (TERP) money to the Austin-Round Rock region?

   TERP money distribution is determined by the Commissioners, and I cannot predict where future funding will be allocated. Legislative changes from the 80th session will also require revisions to the TERP rules which may affect where TERP funding will be dedicated in the future. Therefore, a commitment to a specified level of TERP funding cannot be made at this time for the Eight-Hour Ozone Flex Program.

4) If the region reaches a trigger that requires inclusion of a contingency measure in the SIP, can the TCEQ ensure that the SIP revision will be accomplished within 24 months?

   The current commission cannot commit to future rulemaking for a future commission. Therefore, the commission cannot commit to future rulemaking for an enhanced inspection and maintenance program or requiring Texas Low Emission Diesel (TxLED). However, the commission will assess the situation and determine the appropriate strategy with the local area.

5) Can the TCEQ accommodate the propose timeline?

   The TCEQ is prepared to meet the proposed timeline for the Eight-Hour Ozone Flex Program. However, agency approval is only one element of the timeline and it will be imperative for the local organizations, as well as the EPA to maintain their timeline commitments for the Eight-Hour Ozone Flex Program MOA to go to agenda in March 2008.

6) Does the TCEQ have additional ideas for measures that it would like our region to consider?

   At this time, the agency does not have any additional ideas for implementation under the Eight-Hour Ozone Flex Program that you have proposed. Staff will continue to work with your organization and make any new information available.

The TCEQ commends the Central Texas Clean Air Coalition's continuing efforts to maintain clean air in Central Texas. The area continues to take every opportunity to maintain its attainment status. The TCEQ supports your efforts in developing the Eight-Hour Ozone Flex Program with the revisions provided. If you have any questions or need any assistance, please feel free to contact Susana M. Hildebrand, P.E., at 512/239-4699.

Sincerely,

Glenn Shankle, Executive Director
Texas Commission on Environmental Quality

Enclosure

Federal and State Control Measures Applicable in the Central Texas Area

Federal Measures	Descriptions
Federal Area/Non-Road Measures	EPA has implemented a series of strategies for area and non-road sources. Some of these include the gas engine rule and marine recreational engine standards.
Federal On-Road Measures	EPA has implemented a series of strategies for on-road vehicles. Tier 1 and Tier 2 vehicle standards, low- sulfur diesel standards, National Low Emission Vehicle standards, and reformulated gasoline.
State Measures	**Descriptions**
California Gasoline Engines	California standards for non-road gasoline engines 25 horsepower or larger.
Gas-Fired Heaters and Small Boilers	Rule limiting nitrogen oxide (NO_X) emissions from these small-scale residential and industrial sources.
Texas Low Emission Diesel – TxLED	Requires all diesel for both on-road and non-road use to have a lower aromatic content and a higher cetane number.
Texas Emission Reduction Plan – TERP	TERP provides grant funds for heavy-duty diesel engine replacement/retrofit. Replaces construction restrictions and Tier 2 and Tier 3 accelerated purchases.
Portable Fuel Containers Rule	Establishes new design "no spill" criteria requirements for portable fuel containers sold, offered for sale, manufactured, and/or distributed in Texas.
Inspection and Maintenance – I/M	I/M requires the regular inspection of vehicles 2–24 years old in Travis and Williamson Counties. Vehicles must be inspected through Department of Public Safety–certified inspection stations for emissions of nitrogen oxide (NO_X), volatile organic compounds (VOCs) and carbon monoxide (CO).
Low-Income Vehicle Repair Assistance Program – LIRAP	Low-Income Vehicle Repair Assistance, Retrofit, and Accelerated Vehicle Retirement Program (LIRAP) in Travis and Williamson Counties
Low Reid Vapor Pressure Gasoline – Low RVP	Low RVP gasoline is fuel that is refined to have a lower evaporation rate and lower volatility than conventional gasoline. It also reduces the evaporative emissions generated during vehicle refueling and therefore decreases the emissions of volatile organic compounds (VOCs) and other ozone-forming emissions.

Stage I Vapor Recovery for stations with greater than or equal to 25,000 gallon per month output	Stage I vapor recovery is a control strategy to capture gasoline vapors that are released when gasoline is delivered to a storage tank. The vapors are returned to the tank truck as the storage tank is being filled with fuel, rather than released to the ambient air.
Solvent Using Processes – Degreasing	Volatile organic compound (VOC) control strategy for solvent-cleaning operations in batch-loaded cold cleaners, open-top vapor degreasers, conveyorized degreasers, and air-tight and airless cleaning systems.
Cutback Asphalt Restrictions	Volatile organic compound (VOC) solvents used in conventional cutback asphalt for the paving of roadways, driveways, or parking lots is restricted to no more than 7.0 percent of the total annual volume averaged over a two-year period. This applies to asphalt used by or specified by any state, municipal, or county agency that uses or specifies the type of asphalt application from April 16 – September 15.
Idling Restrictions on Heavy-Duty Vehicle Engines	Limits heavy-duty motor vehicle idling to five consecutive minutes from April through October within the political jurisdiction of any local government that has signed a memorandum of agreement with the commission to delegate enforcement to a local enforcement agency.

Appendix B
Emission Reduction Measures

Appendix B

Local Government 8-Hour O3 Flex Program Emission Reduction Measures

Emission Reduction Measure	City of Austin	Travis County	City of Round Rock *	Williamson County	City of San Marcos *	Hays County *	City of Bastrop *	City of Elgin *	Bastrop County *	City of Lockhart *	City of Luling *	Caldwell County *
Access Management							X	X		X		
Airport Clean Air Plan, includes:												
• ABIA Airside Incentives have infrastructure in place at airport for use by airside tenants	X											
• Alternative fuels for shuttle buses	X											
• Alternative fuels available for Aviation Fleet landside users.	X											
• ABIA alternative fuel infrastructure available at airport for landside users	X											
Alternative Commute Infrastructure	X						X	X				
Alternative Fuel Vehicles	X	X	X									
Business Evaluation of Fleet Useage, Including Operations and Right Sizing		X	X	X								
Cleaner Diesel		X	X	X		X	X	X	X			
Commute Solutions Programs, may include	X									X		
• Compressed Work Week	X	X	X						X		X	
• Flexible Work Schedule	X	X	X									
• Carpool or Alternative Transportation Program, may include incentive	X	X										
• Transit Pass Subsidized by Employer	X											
• Teleworking (full time)	X											
• Teleworking (part time)	X		X									
Contractor provisions for high ozone days	X											
Direct Deposit	X	X	X	X	X	X	X		X	X		X
Drive-Through Facilities on Ozone Action Days		X								X		
e-Government and/or Available Locations	X	X	X	X	X	X						
Electric utility investments in energy demand management programs	X											
Environmental dispatch of power plants	X											

Emission Reduction Measure	City of Austin	Travis County	City of Round Rock *	Williamson County	City of San Marcos *	Hays County *	City of Bastrop *	City of Elgin *	Bastrop County *	City of Lockhart *	City of Luling *	Caldwell County *
Expedited permitting for mixed use, transit oriented or in-fill development							X	X				
Fueling of Vehicles in the Evening	X	X	X	X		X			X	X	X	X
Landscaping voluntary start at noon on high ozone days (education program)										X		
Low Emission Vehicles	X	X	X	X						X		X
Low VOC Asphalt		X	X									
Low VOC Roadway Striping Material	X	X	X	X		X	X	X		X		
Open Burning Restrictions			X				X	X				
Ozone Action Day Program, includes:	X	X	X	X	X	X	X	X	X	X	X	X
• Employee Education Program	X	X	X	X	X	X	X	X	X	X	X	X
• Public Education Program	X	X	X	X	X	X	X	X	X	X	X	X
• Ozone Action Day Notification Program	X	X	X	X	X	X	X	X	X	X	X	X
• Ozone Action Day Response Program	X	X	X	X		X						X
Resource Conservation	X	X	X	X	X	X					X	
Shaded Parking	X	X										
Shift the electric load profile	X											
Texas Low Emission Diesel (TxLED) Equivalent for Fleets	X	X										
Transit-Oriented Development	X											
Transportation Emission Reduction Measures (TERMs)	X	X	X		X		X	X				
Tree Planting	X	X	X	X	X	X	X	X		X		
Urban Heat Island/Cool Cities Program	X											
Vehicle Maintenance	X	X	X	X	X	X			X			X

* Denotes local government EAC commitments continued for the 8-hour O3 Flex Program, contingent on local government confirmation.

Appendix B
8-Hour O3 Flex Program Participating Agency Emission Reduction Measures

Emission Reduction Measure	Capital Metro	CAMPO	TxDOT Headquarters*	TxDOT Austin*	TCEQ	CAPCOG	LCRA	CTRMA
Transportation Emission Reduction Measures (TERMs)	X			X				
Access Management				X				
Low VOC Striping Material	X			X				X
Tree Planting				X			X	X
Commute Alternatives, including:								
• Compressed Work Week	X	X		X	X			
• Flexible Work Schedule	X	X		X	X	X		
• Carpool or Alternative Transportation, may include incentives	X				X		X	
• Employer Subsidized Transit	X	X						
• Teleworking (full time)								
• Teleworking (part time)		X		X	X			
• Bicycle and Pedestrian Facilities							X	
Direct Deposit	X	X		X	X	X	X	X
e-Government and/or Available Locations	X	X			X	X		
Fueling of Vehicles in the Evening	X			X				X
Resource Conservation	X	X		X	X	X	X	X

Emission Reduction Measure	Capital Metro	CAMPO	TxDOT Headquarters*	TxDOT Austin*	TCEQ	CAPCOG	LCRA	CTRMA
Ozone Action Day Education Program, includes:								
Employee Education Program	X	X		X	X	X	X	X
Public Education Program	X	X		X	X			X
Ozone Action Day Notification Program	X	X		X	X	X	X	X
Ozone Action Day Response Program								
Alternative Fuel Vehicles	X			X	X			
Right Sizing	X							
5-minute Limit on Diesel Idling	X						X	
Cleaner Diesel	X		X				X	
Vehicle Maintenance	X				X		X	
Vapor Recovery on Pumps	X							
Low VOC Asphalt	X							
Low-Emission Vehicles	X		X		X		X	
TERP (Texas Emission Reduction Program)	X		X					
Transit-Oriented Development	X							X
Shaded Parking					X			X

* Denotes agency EAC commitments continued for the 8-hour O3 Flex Program, contingent on agency confirmation.

Appendix C
TERP

Aplicant	Area	Aproved Amount	Total Projected NOx Reduction	Tons per Day NOx Reduced	Projected cost per ton	Category	Description
Capital Excavation Company	Austin	$ 130,911	11.20	0.007	$ 11,687	Non-Road	PURCHASE (1) MOTOR GRADER AND LEASE (4) EXCAVATORS
Jimmy Evans Company, Ltd	Austin	$ 42,361	3.57	0.003	$ 11,857	Non-Road	PURCHASE (1) WHEEL LOADER, (1)MOTOR GRADER
Del Webb Corporation	Austin	$ 14,450	1.85	0.002	$ 7,807	Non-Road	LEASE (1) WHEEL LOADER
Capital Metropolitan Transportation Authority	Austin	$ 92,181	24.79	0.099	$ 3,718	On-Road	TXLED
JC Evans Construction Holding, Inc. (dba JC Evans)	Austin	$ 47,278	3.99	0.003	$ 11,837	Non-Road	Lease 2 Non-Road Graders
K & K Enterprises	Austin	$ 17,480	2.50	0.002	$ 7,000	Non-Road	REPLACEMENT OF 1 JOHN DEERE 655C TRACK LOADER
B & B Truck Tractor & Parts	Austin	$ 13,045	1.86	0.001	$ 7,000	On-Road	REPLACEMENT OF 1 KENWORTH T300
Texas Landfill Management, LLC	Austin	$ 160,625	23.01	0.018	$ 6,979	Non-Road	REPLACEMENT OF 1 SCRAPER AND 1 COMPACTOR
Texas Lehigh Cement Company, LP	Austin	$ 57,407	8.66	0.007	$ 6,626	Non-Road	REPOWER OF 1 LOADER
Texas Lehigh Cement Company, LP	Austin	$ 455,254	95.63	0.055	$ 4,761	Non-Road	REPLACEMENT OF 3 TRUCKS
BFI Waste Systems Of North America, Inc.	Austin	$ 204,000	29.19	0.023	$ 6,989	Non-Road	REPOWER OF 9 DOZERS AND SCRAPERS
Dean Word Company, Ltd.	Austin	$ 331,000	47.42	0.027	$ 6,981	Non-Road	REPLACEMENTS OF 6 DOZERS AND GRADERS
Texas Landfill Management, LLC	Austin	$ 36,398	7.35	0.006	$ 4,955	Non-Road	DOZER
Elgin Butler Brick Company	Austin	$ 65,380	9.34	0.007	$ 7,004	Non-Road	REPLACEMENT OF VOLVO L150E AND DRESSER 520B
Centex Materials, LLC	Austin	$ 141,411	17.79	0.014	$ 7,949	Non-Road	REPOWER OF 2 LOADERS AND 1 DOZER
Yarrington Road Materials LP	Austin	$ 98,000	14.00	0.008	$ 6,998	Non-Road	REPLACEMENT OF 2 LOADERS
Austin Engineering Company, Inc.	Austin	$ 9,310	1.33	0.001	$ 7,023	Non-Road	REPLACEMENT OF 1 CAT 930
KBJ Partnership	Austin	$ 48,826	6.98	0.005	$ 7,000	Non-Road	REPLACEMENT OF 1 EXCAVATOR
KBJ Partnership	Austin	$ 6,000	2.25	0.002	$ 2,665	Non-Road	REPLACEMENT OF 1 BACKHOE LOADER
K & K Enterprises	Austin	$ 21,394	3.06	0.002	$ 7,000	Non-Road	REPLACEMENT OF 1 CAT 953C
Cunningham Constructors & Associates, Inc.	Austin	$ 22,878	3.27	0.002	$ 7,000	Non-Road	REPLACEMENT OF 1 KOMATSU PC200LC-7
K & K Enterprises	Austin	$ 24,001	3.43	0.003	$ 7,000	Non-Road	REPLACEMENT OF 1 CAT 225B
Centex Materials, LLC	Austin	$ 22,533	3.22	0.003	$ 7,000	Non-Road	REPLACEMENT OF 1 MICHIGAN 75E WHEEL LOADER
Texas Lehigh Cement Company, LP	Austin	$ 96,670	13.81	0.011	$ 7,000	Non-Road	REPLACEMENT OF 1 SHUTTLEWAGON RAIL CAR MOVER
Dean Word Company, Ltd.	Austin	$ 396,000	56.62	0.032	$ 6,994	Non-Road	REPLACEMENT & REPOWER OF 10 EXCAVATORS
Schroeder Construction Company, Ltd	Austin	$ 38,805	4.65	0.004	$ 8,341	Non-Road	REPLACEMENT OF 2 EXCAVATORS
Ella Contracting' Inc.	Austin	$ 112,381	16.05	0.013	$ 7,000	Non-Road	REPLACEMENT OF 4 DOZERS
Odeen Hibbs Trucking Company	Austin	$ 292,740	41.83	0.033	$ 6,998	On-Road	REPLACEMENT OF 8 TRUCKS
Texas Aggregates, LP	Austin	$ 463,000	66.21	0.053	$ 6,993	Non-Road	REPLACEMENT OF 1 DRAGLINE, 2 TRUCKS AND 1 BACKHOE
ID/Guerra L.P.	Austin	$ 30,407	4.37	0.002	$ 6,966	Non-Road	REPLACEMENT OF 1 EXCAVATOR
Aguado Stone, Inc.	Austin	$ 49,377	7.05	0.006	$ 7,000	Non-Road	REPLACEMENT OF 1 KOMATSU WA250 WHEEL LOADER
Haegelin Construction Company, Ltd	Austin	$ 81,970	10.86	0.009	$ 7,550	Non-Road	REPLACEMENT OF 3 EXCAVATORS
Austin White Lime Company	Austin	$ 594,096	84.87	0.049	$ 7,000	Non-Road	Replace 1 Non-Road Bore/Drill Rig, 2 Non-Road Forklifts, 2 Non-Road Off-Highway Trucks, 2 Non-Road Rubber Tire Loaders
Austin White Lime Company	Austin	$ 112,104	16.84	0.013	$ 6,657	Non-Road	REPOWER OF 2 HAUL TRUCKS
Cemex Construction Materials, LP	Austin	$ 149,730	21.42	0.012	$ 6,990	On-Road	REPLACEMENT OF 11 INTERNATIONAL 5600I CEMENT MIXERS
Shumaker Enterprises, Inc.	Austin	$ 45,913	6.56	0.005	$ 7,000	Non-Road	REPLACEMENT OF 1 KOMATSU PC 400-5 EXCAVATOR
Shumaker Enterprises, Inc.	Austin	$ 208,950	29.87	0.017	$ 6,995	Non-Road	REPLACEMENT OF 2 LOADERS
Schroeder Construction Company, Ltd	Austin	$ 28,431	4.06	0.002	$ 7,000	Non-Road	REPLACEMENT OF 1 KOMATSU PC200LC-6 EXCAVATOR
Black Sheep Independ Dba Denvers Towing	Austin	$ 7,366	1.05	0.001	$ 7,000	On-Road	REPLACEMENT OF 1 FORD F350 TRUCK
S & M Business, Inc. Dba Austin Land Service	Austin	$ 71,924	10.27	0.006	$ 7,000	Non-Road	REPLACEMENT OF 1 LOADER
Weisman Equipment Company, Ltd.	Austin	$ 10,272	1.47	0.001	$ 7,000	Non-Road	REPOWER OF 1 LOADER
Weisman Equipment Company, Ltd.	Austin	$ 92,540	13.22	0.008	$ 6,999	Non-Road	REPLACEMENT OF 3 GRADERS
Weisman Equipment Company, Ltd.	Austin	$ 81,694	11.75	0.006	$ 6,954	Non-Road	REPLACEMENT OF 12 PAVER, LOADERS, DOZERS
Cashway Building Materials	Austin	$ 7,490	2.16	0.001	$ 3,468	Non-Road	Replace 1 Non-Road Forklift
Capitol Beverage	Austin	$ 7,900	1.58	0.001	$ 5,000	Non-Road	Replace 1 Non-Road Forklift
Capitol Beverage	Austin	$ 12,670	2.54	0.002	$ 4,988	Non-Road	Replace 1 Non-Road Forklift
Capitol Beverage	Austin	$ 7,490	1.50	0.001	$ 4,993	Non-Road	Replace 1 Non-Road Forklift
Capitol Beverage	Austin	$ 12,960	2.59	0.002	$ 5,004	Non-Road	Replace 1 Non-Road Forklift
Capitol Beverage	Austin	$ 6,730	1.79	0.001	$ 3,760	Non-Road	Replace 1 Non-Road Forklift
Stark's Welding	Austin	$ 4,750	0.95	0.001	$ 5,000	Non-Road	Replace 1 Non-Road Forklift
Taylor Compress	Austin	$ 8,290	1.66	0.001	$ 4,994	Non-Road	Replace 1 Non-Road Forklift
Taylor Compress	Austin	$ 3,010	0.60	0.000	$ 4,992	Non-Road	Replace 1 Non-Road Forklift
Southeastern Freight Lines, Inc.	Austin	$ 10,590	2.12	0.002	$ 4,996	Non-Road	Replace 1 Non-Road Forklift
Southeastern Freight Lines, Inc.	Austin	$ 6,620	1.33	0.001	$ 4,992	Non-Road	Replace 1 Non-Road Forklift
Texas Lehigh Cement Company, LP	Austin	$ 259,185	41.72	0.024	$ 6,212	Non-Road	Replace one 1989 CAT Rubber Tire Loader with a 2005 CAT Rubber Tire Loader
BFI Waste Services of Texas, LP	Austin	$ 60,778	13.51	0.008	$ 4,500	On-Road	Replace 6 On-road Trucks
City of Austin	Austin	$ 205,000	29.30	0.017	$ 6,996	On-Road	Slow Fill & Fast Fill CNG Refuling Station For City Refuse Trucks, Replace 6 On-Road Trucks

Martin A. Hernandez	Austin	$ 114,408	13.83	0.008	$ 8,272	On-Road	Replacement of 1989 Peterbilt with 2005 Peterbilt
Capital Metropolitan Transportation Authority	Austin	$ 428,852	85.80	0.049	$ 4,998	On-Road	Re-power 36 Urban Busses
Joe L Cook	Austin	$ 70,263	8.27	0.007	$ 8,500	On-Road	Replacement Of 1982 Ford With 2005 Peterbuilt
Louis Vasquez Gutierrez	Austin	$ 105,961	12.47	0.007	$ 8,500	On-Road	Replacement Of 1990 Frieghtliner With 2006 Frieghtliner
Kathleen S. Bush	Austin	$ 128,843	16.44	0.009	$ 7,836	On-Road	Replacement Of 1989 International With 2005 International
Rocking C Trucking	Austin	$ 46,974	5.53	0.003	$ 8,500	On-Road	Replacement Of 1993 Frieghtliner With 2004 Kenworth
Houshang Ostadian	Austin	$ 82,635	9.72	0.006	$ 8,500	On-Road	Replacement Of 1981 International With 2005 Freightliner
Blair Trucking, Inc.	Austin	$ 100,370	14.34	0.011	$ 7,000	On-Road	Replace 3 Trucks
K B J Partnership	Austin	$ 30,805	4.47	0.004	$ 6,894	Non-Road	Replace One Wheel Loader
Dean Allen Sauer	Austin	$ 68,500	12.59	0.008	$ 5,442	On-Road	Replacement Of 1989 Peterbilt With 2002 Peterbilt
Jackson Trucking	Austin	$ 89,000	18.84	0.015	$ 4,724	On-Road	Replace 1 On-road Truck
Ray McEachern	Austin	$ 99,000	24.66	0.020	$ 4,015	On-Road	Replace 7 On-road Trucks
K & K Enterprises	Austin	$ 42,403	6.15	0.005	$ 6,894	Non-Road	Replace 3 Wheel Loaders
Austin Engineering Company, Inc.	Austin	$ 23,833	3.46	0.003	$ 6,894	Non-Road	Replace 1 Wheel Loader
Leonardo Avila	Austin	$ 34,015	9.60	0.006	$ 3,543	On-Road	Replacement Of 1988 Kentworth With 1999 Flt
Robert Juarez	Austin	$ 96,779	11.39	0.009	$ 8,500	On-Road	Replacement Of 1989 Freightliner With 2005 Mack
Hays Consolidated Independent School District	Austin	$ 79,345	11.33	0.006	$ 7,000	On-Road	Replace 11 School Busses (Verification Forms Are Signed By Authorized Official Of The Application; Certification Forms Have See Attached)
Austin Bridge & Road, LP	Austin	$ 71,122	14.42	0.012	$ 4,931	Non-Road	Replace 1 Cold Milling Machine
Eugene R Kinde, Dba Minn Tex Transportation	Austin	$ 94,438	15.83	0.009	$ 5,967	On-Road	Replacement Of 1987 Kenworth With 2004 Peterbilt
Charles Dirk Talbot	Austin	$ 108,277	12.74	0.007	$ 8,500	On-Road	Replace 1 On-Road Truck
Coors of Austin, LP	Austin	$ 73,783	10.54	0.006	$ 7,000	On-Road	Replace 10 Trucks
Trans Global Solutions, Inc.	Austin	$ 1,090,000	206.78	0.109	$ 5,271	Locomotive	Retro-fit Of 5 Switcher Locomotives
Juan R. Berberena	Austin	$ 51,386	8.53	0.005	$ 6,026	On-Road	Replace 1 Truck
Ester Marshall dba Marshall Trucking	Austin	$ 95,200	12.97	0.007	$ 7,342	On-Road	Replace 1 On Road Truck
Robert M. Sullivan, Jr.	Austin	$ 84,758	12.49	0.007	$ 6,784	On-Road	Replace 1 On Road Truck
Pablo Jaimes Martinez	Austin	$ 67,200	9.45	0.005	$ 7,112	On-Road	Replace 1 On Road Truck
Oscar L. Barnes	Austin	$ 103,200	14.55	0.008	$ 7,092	On-Road	Replace 1 On Road Truck
Eladio Jaimes	Austin	$ 67,148	8.64	0.007	$ 7,768	On-Road	Replace 1 On Road Truck
TXI Operations, LP (Austin Green S & G)	Austin	$ 45,700	12.37	0.007	$ 3,694	Non-Road	Repower 2 Non Road Truck Engines
Edward Rogers	Austin	$ 103,200	12.96	0.007	$ 7,965	On-Road	Replace 1 On Road Truck
La Fuente Trucking	Austin	$ 82,275	18.51	0.011	$ 4,445	On-Road	Replace 1 On Road Truck
Moises Rosales	Austin	$ 104,598	17.52	0.010	$ 5,972	On-Road	Replace 1 Dump Truck
Arnold T. Sanchez	Austin	$ 62,833	12.58	0.007	$ 4,997	On-Road	Replace 1 Truck
J.D. Abrams, LP	Austin	$ 8,748	2.45	0.002	$ 3,577	Non-Road	Repower 1 Crane Engine
Darral G. Henderson	Austin	$ 91,558	16.90	0.014	$ 5,418	On-Road	Replace 1 Truck
Jose F. Solorzano	Austin	$ 95,597	12.09	0.007	$ 7,909	On-Road	Replace 1 Truck
Liberty Excavation	Austin	$ 102,185	22.87	0.013	$ 4,469	On-Road	Replace 1 Haul Truck And 1 Dump Truck
Jose B. Pedroza	Austin	$ 80,091	16.17	0.009	$ 4,954	On-Road	Replace 1 Truck
Carlos Garcia	Austin	$ 77,000	14.44	0.008	$ 5,333	On-Road	Replace 1 Truck
M & M Trucking (Henry Medel)	Austin	$ 69,000	12.93	0.007	$ 5,335	On-Road	Replace 1 Truck
M & M Trucking (Henry Medel)	Austin	$ 69,000	13.10	0.007	$ 5,266	On-Road	Replace 1 Truck
Edwin Clay Polasek	Austin	$ 89,786	17.03	0.010	$ 5,271	On-Road	Replace 1 Truck
Edwin Clay Polasek	Austin	$ 89,786	17.32	0.010	$ 5,183	On-Road	Replace 1 Truck
Thomas P. Strazza	Austin	$ 80,000	15.24	0.009	$ 5,248	On-Road	Replace 1 Truck
Alfonso Orocio	Austin	$ 62,000	12.64	0.007	$ 4,906	On-Road	Replace 1 Truck
Feliciano Mendoza	Austin	$ 63,000	12.03	0.007	$ 5,236	On-Road	Replace 1 Truck
Roy Paredes Trucking	Austin	$ 70,000	13.47	0.008	$ 5,195	On-Road	Replace 1 Truck
Ramiro Hernandez	Austin	$ 69,062	14.44	0.008	$ 4,784	On-Road	Replace 1 Truck
Sergio Nino	Austin	$ 81,000	16.56	0.009	$ 4,891	On-Road	Replace 1 Truck
Capital Metropolitan Transportation Authority	Austin	$ 357,234	72.90	0.042	$ 4,900	On-Road	Re-Power 34 Buses
Capital Metropolitan Transportation Authority	Austin	$ 209,204	42.69	0.024	$ 4,900	On-Road	Re-Power 28 Busses
Sammie J. Kellough	Austin	$ 148,000	27.94	0.016	$ 5,297	On-Road	Replace 2 Trucks
Raymond Vallejo, Jr.	Austin	$ 73,000	14.01	0.008	$ 5,210	On-Road	Replace 1 Truck
Wright Distributing Company	Austin	$ 67,500	13.45	0.008	$ 5,019	On-Road	Replace 4 Delivery Trucks
Bobby D. Alba	Austin	$ 80,000	17.11	0.010	$ 4,677	On-Road	Replace 1 Truck
Bobby D. Alba	Austin	$ 90,000	16.89	0.010	$ 5,330	On-Road	Replace 1 Truck
Bobby D. Alba	Austin	$ 90,000	17.40	0.010	$ 5,173	On-Road	Replace 1 Truck
Bobby D. Alba	Austin	$ 90,000	17.11	0.010	$ 5,261	On-Road	Replace 1 Truck
Adam Melendrez	Austin	$ 80,949	15.29	0.009	$ 5,296	On-Road	Replace 1 Truck
Dirk McCune Trucking	Austin	$ 172,728	32.46	0.022	$ 5,321	On-Road	Replace 3 Trucks
Leon Kellough, Jr.	Austin	$ 72,000	13.47	0.008	$ 5,344	On-Road	Replace 1 Dump Truck
Juan DeAnda, Jr.	Austin	$ 69,000	13.34	0.008	$ 5,173	On-Road	Replace 1 Truck
Babette's Trucking	Austin	$ 73,650	20.41	0.012	$ 3,608	On-Road	Replace 1 Truck
Isidoro A. Martinez	Austin	$ 77,000	14.56	0.008	$ 5,289	On-Road	Replace 1 Dump Truck
Gloria Crowder	Austin	$ 74,000	17.58	0.010	$ 4,208	On-Road	Replace 1 Truck
Isidoro A. Martinez	Austin	$ 77,000	14.86	0.008	$ 5,181	On-Road	Replace 1 Dump Truck
Miguel Negrete	Austin	$ 76,000	17.96	0.010	$ 4,231	On-Road	Replace 1 Truck
Tex Mix Partners, Ltd. (dba Tex Mix Concrete)	Austin	$ 15,250	3.47	0.002	$ 4,400	On-Road	Replace 1 Truck
R.T.I. Hot Mix, Ltd.	Austin	$ 105,649	22.31	0.016	$ 4,734	Non-Road	Repower 1 Off-HighwayTruck and 1 Eagle Portable Rock Plant
Schwab Excavation, Inc.	Austin	$ 386,718	75.49	0.043	$ 5,123	On-Road	Replace 3 on-road tractors and 1 non-road grader
I Bar Enterprises, Ltd.	Austin	$ 69,492	18.34	0.010	$ 3,789	On-Road	Replace 1 Truck
Centex Materials, LLC	Austin	$ 1,683,000	348.00	0.199	$ 4,836	Non-Road	Replace 5 Off-Highway Trucks, Replace 4 Wheel Loaders
V&G Luna Construction, LLC (dba L&L Construction)	Austin	$ 68,995	12.74	0.007	$ 5,416	On-Road	Replace 1 Truck

Centex Materials, LLC	Austin	$ 747,000	143.42	0.082	$ 5,209	On-Road	Replace 18 Cement Trucks
Texas Aggregates, LP	Austin	$ 399,894	83.02	0.047	$ 4,817	Non-Road	Replace 1 Dragline & 2 Off Highway Truck
Douglas R. Wiggins, Jr.	Austin	$ 84,000	17.96	0.010	$ 4,676	On-Road	Replace 1 Truck
Trans Global Solutions, Inc.	Austin	$ 896,000	199.13	0.078	$ 4,500	Locomotive	Retrofit/Add-On 4 Switchers
GH Contracting, Inc.	Austin	$ 24,016	4.80	0.003	$ 5,000	Non-Road	Replace 1 Excavator
McKinney Drilling Company	Austin	$ 1,303,535	275.67	0.158	$ 4,729	Non-Road	Repower 1 Haul Truck, Replace 6 Compressors, Repower 11 Cranes, Repower 20 Drilling Rigs, Repower 1 Water Truck, Repower 1 Pump, Repower 1 Welder
Leander Independent School District	Austin	$ 19,466	6.47	0.004	$ 3,010	On-Road	Replace 5 School Busses
BPM Leasing, LLC	Austin	$ 48,808	8.87	0.005	$ 5,500	On-Road	Replace haul truck
BPM Leasing, LLC	Austin	$ 49,443	8.99	0.005	$ 5,500	On-Road	Replace haul truck
Bedrock Stone & Design, Inc.	Austin	$ 49,443	8.99	0.005	$ 5,500	On-Road	Replace flatbed truck
Blair Trucking, Inc.	Austin	$ 76,513	13.91	0.008	$ 5,500	On-Road	Replace haul truck
Genaro Guerrero	Austin	$ 50,712	9.22	0.005	$ 5,500	On-Road	Replace dump truck
Daniel Briseno	Austin	$ 50,289	9.14	0.005	$ 5,500	On-Road	Replace dump truck
Ray Crain Trucking	Austin	$ 74,119	13.48	0.008	$ 5,500	On-Road	Replace haul truck
Ray Crain Trucking	Austin	$ 73,820	13.42	0.008	$ 5,500	On-Road	Replace haul truck
Ray Crain Trucking	Austin	$ 73,820	13.42	0.008	$ 5,500	On-Road	Replace haul truck
Ray Crain Trucking	Austin	$ 77,410	14.07	0.008	$ 5,500	On-Road	Replace haul truck
Ray Crain Trucking	Austin	$ 74,119	13.48	0.008	$ 5,500	On-Road	Replace haul truck
P.C.W. Construction, Inc.	Austin	$ 55,854	10.16	0.006	$ 5,500	On-Road	Replace dump truck
P.C.W. Construction, Inc.	Austin	$ 55,220	10.04	0.006	$ 5,500	On-Road	Replace dump truck
Hence W. Irby, Jr.	Austin	$ 70,766	13.42	0.008	$ 5,272	On-Road	Replace haul truck
Jose J. Cancino (dba Estrella Trucking Co., Inc.)	Austin	$ 19,639	3.57	0.002	$ 5,500	On-Road	Replace dump truck
Alberto Carrillo	Austin	$ 49,443	8.99	0.005	$ 5,500	On-Road	Replace dump truck
Vera's Trucking	Austin	$ 73,521	13.37	0.008	$ 5,500	On-Road	Replace haul truck
William Marshal Copeland	Austin	$ 73,521	13.37	0.008	$ 5,500	On-Road	Replace dump truck
Poldrack Grain & Cattle	Austin	$ 58,379	11.41	0.007	$ 5,117	On-Road	Replace haul truck
James R. Brown	Austin	$ 76,513	13.91	0.008	$ 5,500	On-Road	Replace haul truck
Eduardo Bustillos	Austin	$ 76,513	13.91	0.008	$ 5,500	On-Road	Replace dump truck
Felix P. Loza	Austin	$ 55,576	10.10	0.006	$ 5,500	On-Road	Replace dump truck
Greg D. Werchan	Austin	$ 50,289	9.14	0.005	$ 5,500	On-Road	Replace dump truck
Simon P. Macias	Austin	$ 53,672	9.76	0.006	$ 5,500	On-Road	Replace haul truck
Balli Trucking, Inc.	Austin	$ 73,820	13.42	0.008	$ 5,500	On-Road	Replace haul truck
David Fenske	Austin	$ 73,521	13.37	0.008	$ 5,500	On-Road	Replace haul truck
Don Farmer	Austin	$ 79,504	14.46	0.008	$ 5,500	On-Road	Replace haul truck
H & H Foradory Construction, Inc.	Austin	$ 73,521	13.37	0.008	$ 5,500	On-Road	Replace haul truck
TOTAL/AVERAGE		**$ 20,332,917**	**3684.30**	**2.26**	**$ 5,934**	**# of PROJECTS**	**165**

Appendix D
TERMS

Appendix D Primary Terms

Traffic Signal Improvements

SPONSORING AGENCY	PROJECT NAME	PROJECT DESCRIPTION	PROJECT LOCATION	IMPLEMENTATION. DATE	# SIGNALIZED INTERSECTIONS
City of Austin	Signal Synchronization	* Annual synchronizations include an average of 250 signals, within 30 to 35 signalized segments or segment groups.	Various	2008	250
City of Austin	Signal Synchronization	* Annual synchronizations include an average of 250 signals, within 30 to 35 signalized segments or segment groups.	Various	2009	250
City of Round Rock	Signal Improvement	Install New Traffic Signals	Various	2008	3
TxDOT	Signal improvements	Install New Traffic Signals	Various	2008	3

Intersection Improvements

SPONSORING AGENCY	PROJECT NAME	PROJECT DESCRIPTION	PROJECT LOCATION	IMPLEMENTATION. DATE	# INTERSECTIONS
City of Round Rock	Sam Bass Rd.	Construct new thru lane	At IH 35 SB frontage	2008	1
City of Round Rock	Sam Bass Rd.	Construct RT Lane and 2 LT lanes	At Chisolm Trail	2008	1
TxDOT	FM 973	Construct continuous LT lane	From SH 71 to Pearce Ln.	2008	2
TxDOT	IH 35	Frontage Road Improvements & Turn Arounds	At RM 620 to S of McNeil	2008	1
TxDOT	US 183	Construct Grade Separation Structure	@ FM 672 in Caldwell County	2008	1
TxDOT	IH 35	Construct Turn Arounds	At SH 29 in Williamson County	2008	1

Bicycle and Pedestrian Projects

SPONSORING AGENCY	PROJECT NAME	PROJECT DESCRIPTION	PROJECT LOCATION	IMPLEMENTATION. DATE	PROJECT LENGTH (miles)
City of Round Rock	CR 122/Red Bud Lane	Construct sidewalks	From US 79 to Gattis School Rd.	2008	1.44

Intelligent Transportation System (ITS)

SPONSORING AGENCY	PROJECT NAME	PROJECT DESCRIPTION	PROJECT LOCATION	IMPLEMENTATION. DATE	PROJECT LENGTH (miles)
TxDOT	US 290	Install Conduit and Detection and Freeway Transportation Mgmt. System	From SPRR To US 183	2009	2.7
TxDOT	US 183	Complete Conduit and Detection and Freeway Transportation Mgmt System	From Lakeline Blvd to Travis County line	2009	4.5

Appendix E
TTI Study

Emissions Comparison Between Dirt Roads and Paved Roads Using Portable Emissions Measurement Systems

By

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Contract No. R08-4/05-TTI-01

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July 2005

EXECUTIVE SUMMARY

The overall goal of this study was to determine the possible increase in vehicular emissions as a result of traveling on a dirt road versus a paved road. The approach followed in the study was to use portable emissions measurement system (PEMS) equipment onboard two light-duty vehicles (2000 Ford Explorer and 1998 For F150) that have extensive dirt road mileage and to perform several tests on a dirt road and a paved road while the vehicles were equipped with both dirty and clean air filters. A consistent drive cycle was used and emissions were collected on a second-by-second basis. A distance measurement instrument (DMI) with special driver assistance software was used to enable the driver to follow a consistent drive cycle. Comparisons were made between the emissions of vehicles with dirty and clean air filters and vehicles driving on the paved and dirt roads, while controlling for the vehicle type and drive cycle. The study concluded the following:

- The dirt road resulted in higher emissions than the paved road for all the pollutants tested.
- Emissions from the older Ford F-150 were consistently higher than those from the newer Ford Explorer for all pollutants.
- The dirty air filter resulted in higher NOx and CO_2 emissions than the clean air filter for all the scenarios and vehicles tested.
- The dirty air filter resulted in lower VOC emissions for all the scenarios and vehicles tested (due to the “open loop effect” from high engine loads placed by the selected drive cycle).
- In 16 of the 20 scenarios, the dirty air filter resulted in higher emissions than the clean air filter for CO and PM (the four counter intuitive CO and PM results are due to measurement error).
- Fuel consumption appears to be higher with a dirty air filter than with a clean air filter and higher on a dirt road than on a paved road, particularly for older vehicles (based on CO_2 emissions).

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INTRODUCTION

Rural counties and cities across the U.S. typically have large percentages of dirt roads as compared to more urbanized counties and cities (*1*). In addition to the well documented safety concerns related to dirt roads (propensity for potholes, reduced visibility due to dust, reduced traction, and reduced geometric standards), there has been recent discussion to also consider the air quality aspects related to dirt roads. Dirt roads generate fugitive dust due to traffic. This dust contains a broad range of particulates including fine particulate matter (PM). In addition to concerns about dust, there are questions concerning the possible negative impacts of dirt roads on tailpipe emissions of vehicles extensively using such roads (*2*).

Caldwell County, which is located south of Austin, Texas is an example of a county that is not only concerned about the PM emissions due to the dust caused by its dirt roads, but also the possible negative impact that these dirt roads have on the tailpipe emissions of the vehicles that use them on a regular basis. To examine these concerns, the Capital Area Council of Government (CAPCOG) commissioned the Texas Transportation Institute (TTI) to analyze the possible negative impacts of dirt roads on tailpipe emissions from light-duty gasoline vehicles.

The overall approach followed in the study was to use portable emissions measurement system (PEMS) equipment onboard two light-duty vehicles that have extensive dirt road mileage and to perform several tests on a dirt road and a paved road while the vehicles were equipped with both dirty and clean air filters. A consistent drive cycle was used and emissions were collected on a second-by-second basis. A distance measurement instrument (DMI) with special driver assistance software was used to enable the driver to follow a consistent drive cycle. Comparisons could be made between the emissions of vehicles with dirty and clean air filters and vehicles driving on the paved and dirt roads, while controlling for the vehicle type and drive cycle.

The paper is divided into the following five sections. The first section contains the introductory remarks. The second section describes the approach used in this study. The third section describes the results of the study. The fourth section contains the concluding remarks and the fifth section contains recommendations for future research in this area.

APPROACH

The following sections provide a more detailed description of the various components of this study.

Test Sites

This study was conducted in Caldwell County where the city of Lockhart is the county seat. Lockhart has a population of approximately 12,500 and is located approximately 25 miles south of Austin, Texas. This county has 360 lane miles of paved roads and 506 lane miles of dirt roads (*3*). The relatively high percentage of dirt roads (almost 60%) is typical of rural Texas. For testing purposes, the study team selected a two-mile stretch of a typical dirt road (FM 179) and a two-mile stretch of typical paved road (FM1185). Care was taken to select test sections that were fairly level and straight with very little traffic. The dirt road is covered with pit run gravel, which has a fine dust that is distributed into the air under traffic conditions.

Test Vehicles

The study team used two light-duty gasoline vehicles with considerable mileage on the county's dirt roads as test vehicles. The first test vehicle was a 2000 model year Ford Explorer with 4.0L engine and 95,480 accumulated miles. This vehicle is used by the county as a 911 dispatch vehicle and is often driven on the dirt roads. The second test vehicle was a 1998 model year Ford F-150 pickup truck with a 4.6L engine and 130,523 accumulated miles. This vehicle is used by the county for transporting people and materials and is often driven on the dirt roads. The county's maintenance department performs the maintenance on these vehicles replacing the air filters on these vehicles every 3,000 miles. The county maintenance department indicated that at the time of the study both vehicles had accumulated approximately 3,000 miles on their current air filters. Figure 1 shows a picture of the test vehicles on the dirt road.

Test Dates

The testing was performed from Thursday, June 16 to Tuesday, June 21, 2005. These testing dates could be considered as typical summer days in central Texas. The conditions were mostly dry and sunny with temperatures in the mid 90 degrees Fahrenheit, resulting in very dusty driving conditions along the dirt road.

Drive Cycle

There are numerous drive cycles available that were developed for different purposes. The most famous drive cycle is the so-called Federal Test Procedure (FTP) that was

established in the 1960s to represent urban driving behavior (*4*). Other examples of modern drive cycles are the Highway Fuel Economy Driving Schedule (HWFET), New York City Cycle (NYCC), and LA92 Dynamometer Driving Schedule, often called the Unified driving schedule (*5*). These drive cycles each have unique applications that are not necessarily consistent with the focus of this study. Specifically, the study team sought a drive cycle that would be representative of driving conditions on a rural dirt road and at the same time be simple enough to replicate easily.

The United Nations Economic Commission for Europe (UN/ECE) Part 1 and Part 2 drive cycles developed in Europe showed the most potential for achieving the criteria set for the ideal drive cycle (*5*). The study team used these drive cycles as a basis and developed a new rural dirt road drive cycle for this study. Figure 2 shows a graph of this drive cycle, which includes typical driving behaviors that can be expected on a rural dirt road including acceleration, deceleration, cruising, and idling. The drive cycle also is simple enough so that it can be replicated through actual driving conditions, especially considering that it only takes approximately six minutes to drive and covers a distance of 2.04 miles.

Test Equipment

Portable Emissions Measurement System

The PEMS unit used in this study was the OEM-2100 “Montana” system manufactured by Clean Air Technologies International, Inc. and is shown in Figure 3. The OEM-2100 system is comprised of a gas analyzer, a PM measurement system, an engine diagnostic scanner, a global positioning system (GPS), and an on-board computer. The gas analyzer measures the volume percentage of oxides of nitrogen (NOx), hydrocarbons (HC), carbon monoxide (CO), carbon dioxide (CO_2), and oxygen (O_2) in the vehicle exhaust. The PM measurement capability includes a laser light scattering detector and a sample conditioning system. The engine scanner is connected to the data link of electronically controlled vehicles, from which engine and vehicle data can be downloaded during vehicle operation (*6*). Intake airflow, exhaust flow, and mass emissions are estimated using a method reported by Vojtisek-Lom and Cobb (*7*).

DMI

A DMI was used to track the drive cycle of the test vehicles as they were driven on the test roads. A sensor of the electronic DMI is attached to a test vehicle’s transmission where it receives consecutive pulses while the vehicle is in motion. A DMI typically can provide distances and instantaneous speeds up to every 0.5 seconds. This detailed travel time information can be downloaded automatically to a portable computer in an easy-to-use data format (*8*).

The study team used the RAC 200 DMI system from JAMAR, Inc. for this study. Ridge Engineering developed a custom-designed software program to enable the driver of a test

vehicle to follow a pre-selected drive cycle. The driver assistance software was installed on a laptop computer and connected to the RAC 200. The laptop computer would display a graph and a table with the desired speeds for each second of the drive cycle. While the test vehicle is driven, the actual speeds would be shown in conjunction with the desired speeds on both graphical and tabular formats. A person seated in the passenger seat of the test vehicle can observe this output and provide verbal instructions to the driver about the correct acceleration, deceleration, speeds, and cruising to most accurately track the desired drive cycle. Figure 2 shows an example of the screen provided by the DMI and customized software as well as data where the drive cycle is being tracked during actual driving conditions.

A follower vehicle with a yellow flashing light on its roof was used to follow the test vehicle to ensure that it did not get rear ended by vehicles not expecting the fairly erratic driving of the test vehicle being driven according to the drive cycle.

Test Protocol

The study team developed a test protocol that would provide the best opportunity to test the emissions differences as a result of prolonged driving on dirt roads versus paved roads. The effect of dirt road driving was captured in two ways:

- the test vehicles were driven with air filters that had not been changed for approximately 3,000 miles as well as with brand new air filters; and
- the test vehicles were driven on both the paved and dirt test routes.

Each test scenario was driven four times and the emissions, engine, and speed data was collected on a second-by-second basis. The four test runs in each case were divided between two runs in each direction to reduce the possibility of directional bias. Figure 4 shows a flow diagram illustrating the test protocol used in this study. Each test scenario was repeated four times resulting in 32 test runs.

RESULTS

Drive Cycle

By using the DMI and the customized software described above, the driver was provided with continuous instructions from a passenger on how to most accurately follow the pre-selected drive cycle. Figure 5 shows a comparison between the pre-selected drive cycle with the actual speed profile superimposed on the pre-selected drive cycle. Figure 5 illustrates how, with the aid of the DMI and the customized software, the driver was able to follow the pre-selected drive cycle.

To determine the deviation between the desired and actual speeds over time, the mean absolute speed difference (MASD) metric was used. Equation 1 shows how the MASD metric was calculated.

$$MASD = \frac{1}{N}\sum_{i=1}^{n_i}\left[\left|V_{di} - V_{ai}\right|\right] \qquad (1)$$

Where:

N	=	Total number of observations (number of seconds over time period);
V_{di}	=	Desired speed at time interval *I*; and
V_{ai}	=	Actual speed at time interval *i*.

It was found that the MASD ranged from 1.7 to 4 mph for the various runs with an average of approximately 2 mph. Considering that the average speed of the drive cycle is almost 20 miles per hour, it can be determined that the average driving error is approximately 10 percent, which is within reasonable bounds for a study of this nature.

Emissions

Accumulated Emissions

Emissions were collected under the various scenarios as outlined in Figure 4 using the PEMS equipment while the driver followed the pre-selected drive cycle. Pollutants of NOx, VOC, CO, PM, and CO_2 were collected with the PEMS equipment on a second-by-second basis. Table 1 shows the accumulated emissions results for the various scenarios. The sample mean of the four runs were taken and the standard deviations and coefficients of variations were calculated in each case. The coefficient of variation is defined as the standard deviation divided by the sample mean and is used as a metric to show the relative stability of the individual samples.

In Table 1, the coefficients of variations are, in almost all cases, less than one (standard deviations are less than the sample mean). This result shows some data stability even though the sample sizes were very small. The relative differences between the various scenarios can be compared by examining the sample means. However, a clearer picture can be obtained by examining Figures 6, 7, and 8. These figures show the comparison between the dirty air filter and the clean air filter as well as the dirt road and paved road for the two test vehicles and for all the pollutants tested. The CO_2 emissions are shown separately in Figure 8 because it is not a criteria pollutant. The following can be concluded from these figures.

<u>Overall Findings</u>

- The emissions of the older Ford F-150 are higher than that of the Ford Explorer for all the pollutants tested. This result is as expected because newer vehicles are subject to more stringent emissions standards.

- The dirt road resulted in higher emissions than the paved road for all the pollutants tested. This is due to the fact that there is less traction on a dirt road causing the vehicle's engine to work harder to follow the same drive cycle. Driving on the dirt road is also more difficult than on a paved road possibly causing more use of the breaks and the accelerator causing more strain on the engine. Finally, due to the lower geometric standards on dirt roads it is possible to have more grade changes on such roads even though they might not easily be noticeable.
- In 16 out of the 20 scenarios the dirty air filter resulted in higher emissions than the clean air filter.

NOx Emissions

Both the Explorer and the F-150 recorded higher NOx emissions with the dirty air filter versus the clean air filter on both the dirt road and paved road. Both vehicles had higher emissions on the dirt road than the paved road.

VOC Emissions

Both the Explorer and the F-150 had higher VOC emissions with the clean air filter versus the dirty air filter on the dirt road, whereas higher VOC emissions were recoded with the dirty air filter on the paved road. Both vehicles recorded higher emissions on the dirt road than on the paved road. The lack of a clear pattern and the slightly intuitive results with the VOC emissions can be attributed to the operation of the oxygen censors under different load conditions. The selected drive cycle requires acceleration to 50 mph in a short period of time, placing a very high load on the engine. Under these conditions, the oxygen censor is bypassed and the engine moves into the "open loop mode" where a large amount of fuel is provided for combustion to reach the required power levels (*9*). Under this open loop mode, the level of VOC emissions is very high and unpredictable, resulting in very inconsistent readings between the various scenarios.

CO Emissions

Both the Explorer and the F-150 recorded higher CO emissions with the dirty air filter on the paved road versus the clean air filter. In the dirt road scenario, the F-150 produced slightly higher CO emissions with the clean air filter than with the dirty air filter. The slightly higher CO emissions for the F-150 with the clean filter on the dirt road are possibly due to measurement errors. Both vehicles had higher emissions on the dirt road than the paved road.

PM Emissions

Both the Explorer and the F-150 recorded higher PM emissions with the dirty air filter versus the clean air filter on the dirt road. In the paved road scenario, the Explorer produced slightly higher PM emissions with the clean air filter than with the dirty air filter. The difference is again small, and it should be noted that gasoline-powered vehicles do not typically emit PM and the levels detected by the PEMS equipment are, therefore, extremely low resulting in the possibility of finding slightly counter intuitive results. Both vehicles produced higher emissions on the dirt road than the paved road.

CO_2 Emissions

Both the Explorer and the F-150 produced higher CO_2 emissions with the dirty air filter versus the clean air filter on both the paved road and on the dirt road. Both vehicles recorded higher emissions on the dirt road than the paved road. Research has shown that there is a very strong correlation between CO_2 emissions and fuel consumption (*10*). This result shows that the fuel consumption is higher with a dirty filter than with a clean filter and higher on a dirt road than on a paved road, particularly for older vehicles.

Emission Patterns

Dirty Air Filter versus Clean Air Filter

Figure 9 shows the NOx and VOC emissions rate comparisons between dirty and clean air filters on the dirt road, whereas Figure 10 shows the same comparison on the paved road. In addition to the emissions, these figures also show the mean speed profile driven by the test vehicles. In Figure 9, the emissions for NOx and VOC are generally higher when the dirty air filter is in place for both test vehicles. The VOC emissions difference is most prevalent on the Ford Explorer. Notably, the emissions generally track the speed profile, i.e., increase when the test vehicle accelerates and decrease when the test vehicle decelerates. Consistent driving therefore would result in lower total emissions.

Dirt Road versus Paved Road

Figure 11 shows the NOx and VOC emissions rate comparisons between dirt and paved roads using the dirty air filter, whereas Figure 12 shows the same comparison using the clean air filter. Figure 11 shows that the emissions for NOx and VOC are generally higher on the dirt road versus the paved road. The difference is again most prevalent for VOC emissions from the Explorer. The same trend is noticed in Figure 12 with the dirt road generally resulting in higher emissions.

CONCLUSIONS

This study was one of the first of its kind and resulted in interesting findings in terms of the methodology as well as the results. The following could be concluded from this study.

- The dirt road resulted in higher emissions than the paved road for all the pollutants tested.
- The dirty air filter resulted in higher NOx and CO_2 emissions than the clean air filter for all the scenarios tested.
- The dirty air filter resulted in lower VOC emissions for all the scenarios tested (due to the "open loop effect" from high engine loads placed by the selected drive cycle).
- In 16 of the 20 scenarios, the dirty air filter resulted in higher emissions than the clean air filter for CO and PM (the four counter intuitive CO and PM results resulting from measurement error).
- The dirty air filters used in the testing have accumulated only 3,000 miles each, which could be lower than for air filters used in most vehicles traveling on dirt roads in Caldwell County. The observed effect of dirty air filters is therefore probably conservative (i.e., less than would occur in actual conditions).
- As expected, the emissions of the older Ford F-150 were consistently higher than that of the newer Ford Explorer for all pollutants.
- Based on the CO_2 emission results it could be inferred that the fuel consumption is higher with a dirty air filter than with a clean air filter and higher on a dirt road than on a paved road, particularly for older vehicles.

FUTURE RESEARCH

Following are ideas for future research in this area.

- A larger sample size (on the order of 10 to 15 runs per scenario) will ensure much greater stability and possibly statistical significance of the results.
- A broader range of vehicle types should be tested to assess the possible impact of different vehicle types.
- The possibility of using tape or other means to manually clog the air filter and thereby creating constant air filter flow between the tests should be considered.
- Other vehicle and engine parameters that might be impacted by driving on dirt roads should be investigated.
- The selected drive cycle should be simplified even further to make it easier to replicate in real driving conditions.
- The acceleration, deceleration, cruising, and idling sections of the simplified drive cycle should be isolated and analyzed separately to develop more accurate emissions profiles per driving mode.
- In addition to tailpipe emissions, the ambient air quality should also be monitored at the time of emissions testing.

ACKNOWLEDGEMENTS

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Table 1. Accumulated Emissions Results (grams).

Pollutant	Parameter	Ford Explorer				Ford F-150			
		Dirt Road		Paved Road		Dirt Road		Paved Road	
		Dirty Filter	Clean Filter	Dirty Filter	Clean Filter	Dirty Filter	Clean Filter	Dirty Filter	Clean Filter
NOx	Mean	709	443	345	219	1,991	1,359	1,576	1,050
	Stdev*	404	150	388	341	295	402	223	270
	CV**	0.6	0.3	1.1	1.6	0.1	0.3	0.1	0.3
VOC	Mean	115	173	120	118	241	275	313	142
	Stdev	45	100	54	54	182	170	115	73
	CV	0.5	0.4	0.5	0.5	0.8	0.6	0.4	0.5
CO	Mean	2,581	1,975	1,416	1,206	25,659	27,706	18,116	9,740
	Stdev	725	577	1,101	693	20,366	23,862	9,480	7,298
	CV	0.3	0.3	0.8	0.6	0.8	0.9	0.5	0.7
PM	Mean	0.6	0.3	0.3	0.4	3.2	2.2	1.1	0.9
	Stdev	0.2	0.2	0.4	0.1	3.1	1.8	0.9	0.4
	CV	0.4	0.8	1.2	0.2	1.0	0.8	0.8	0.4

* Standard Deviation
** Coefficient of Variation

Figure 1. Photo of Test Vehicles on Dirt Road.

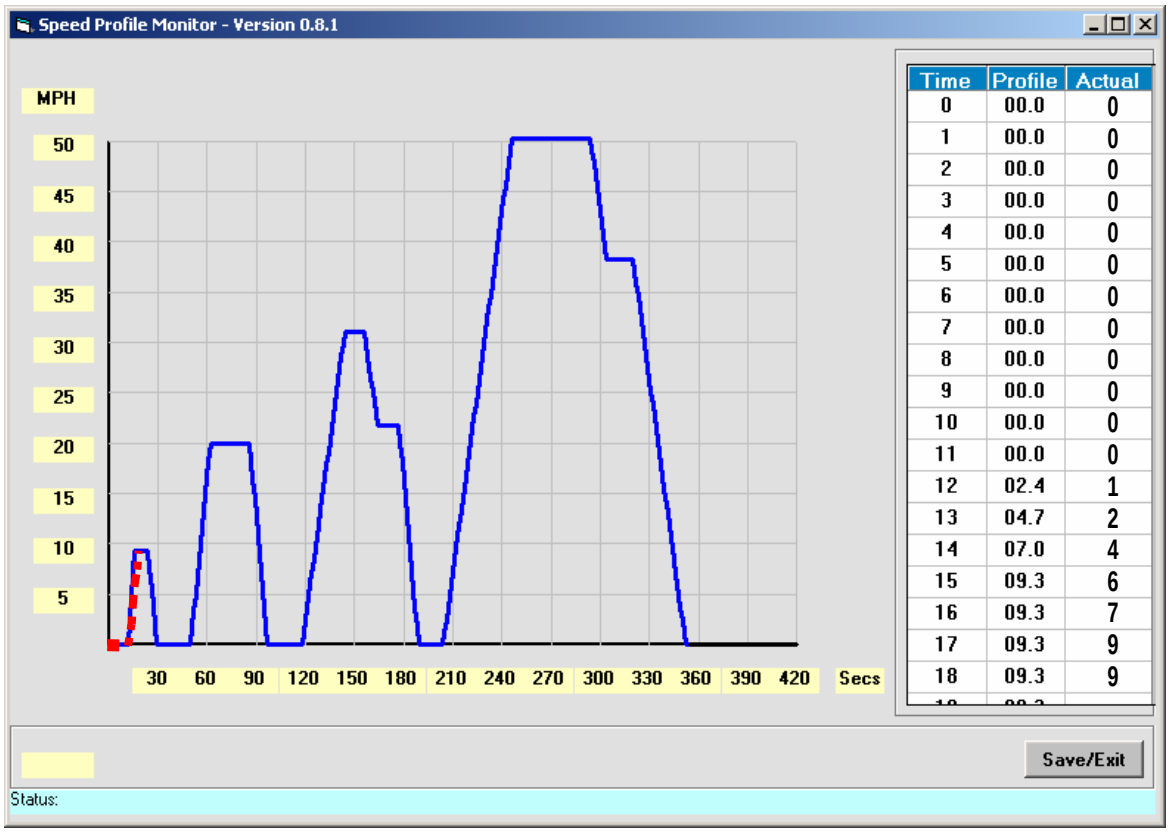


Figure 2. Screen Shot Created By the DMI and Customized Software.

Figure 3. Photos of PEMS Equipment Connected to Test Vehicle.

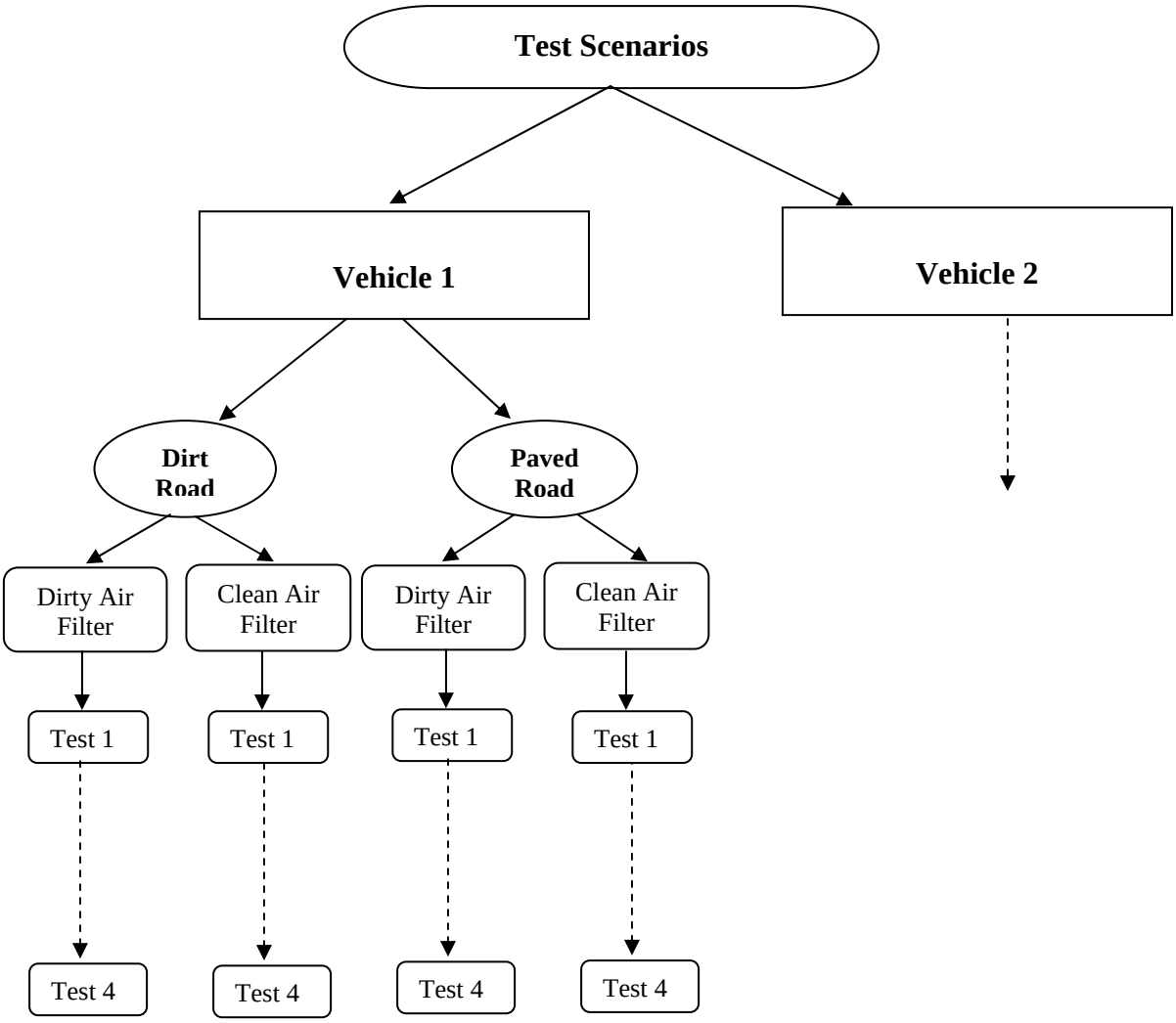


Figure 4. Flow Chart of the Test Protocol.

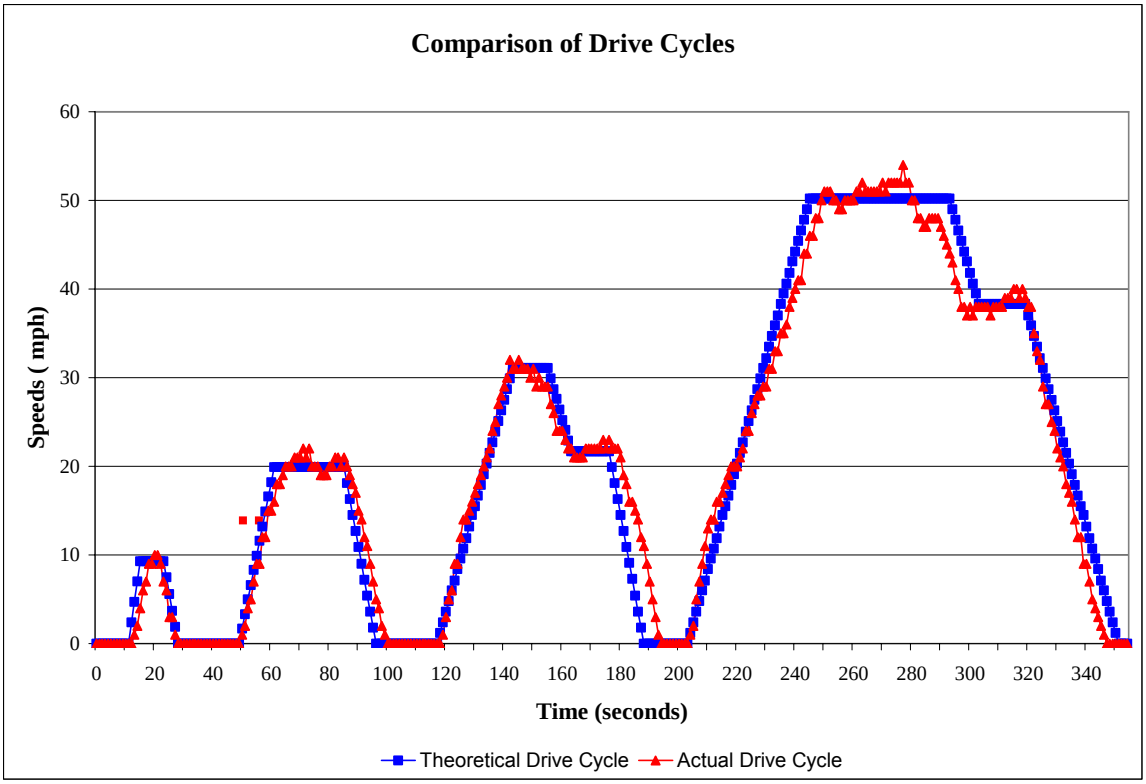
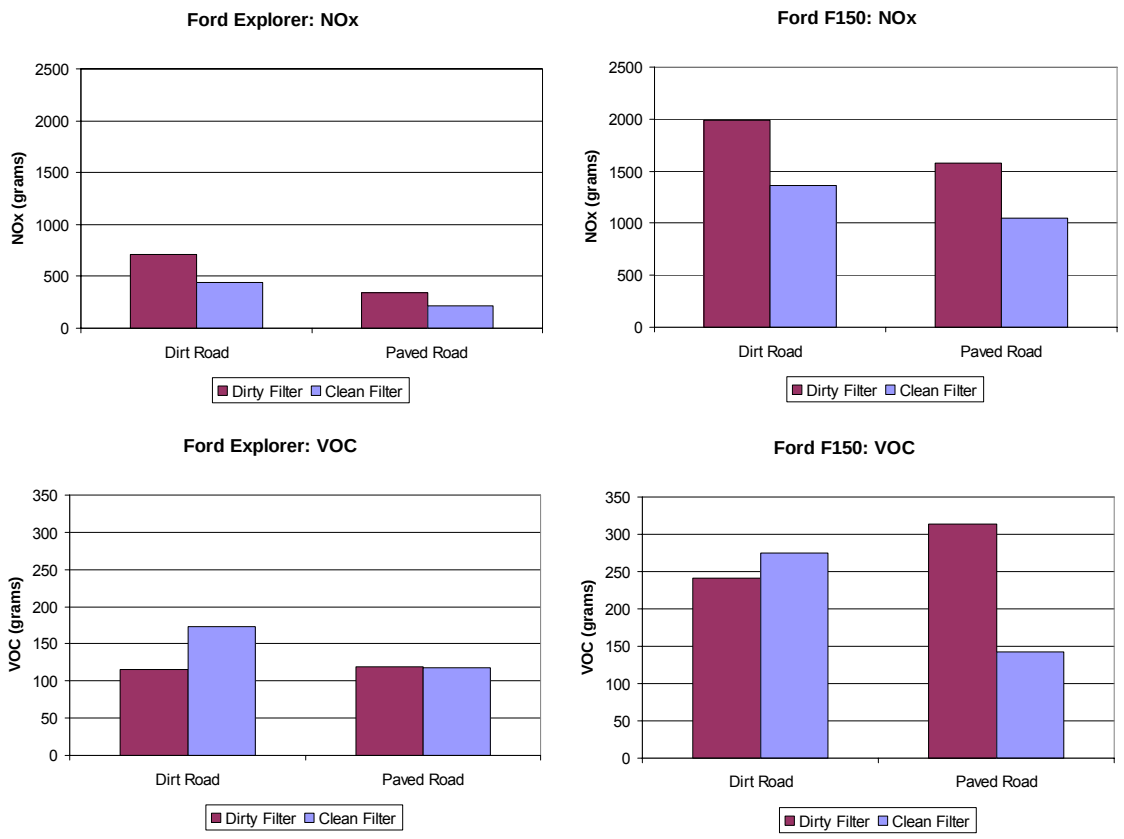


Figure 5. Comparison Between the Pre-Selected Drive Cycle and Actual Driving.



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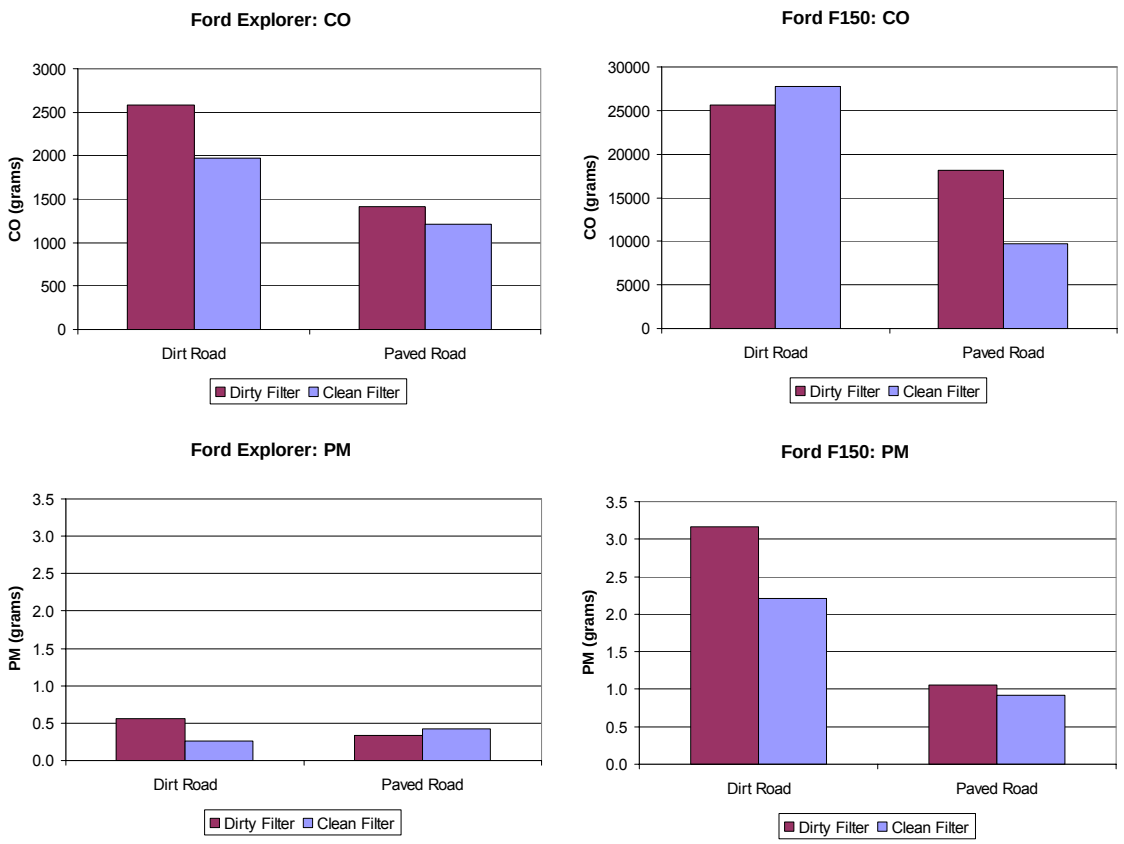


Figure 7. Comparisons of Mean Accumulated Emissions for CO and PM.

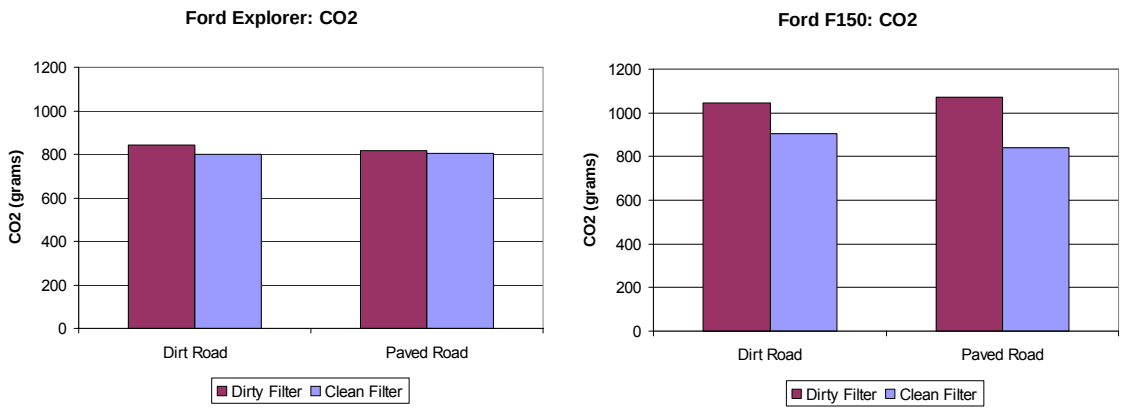


Figure 8. Comparisons of Mean Accumulated Emissions for CO_2.

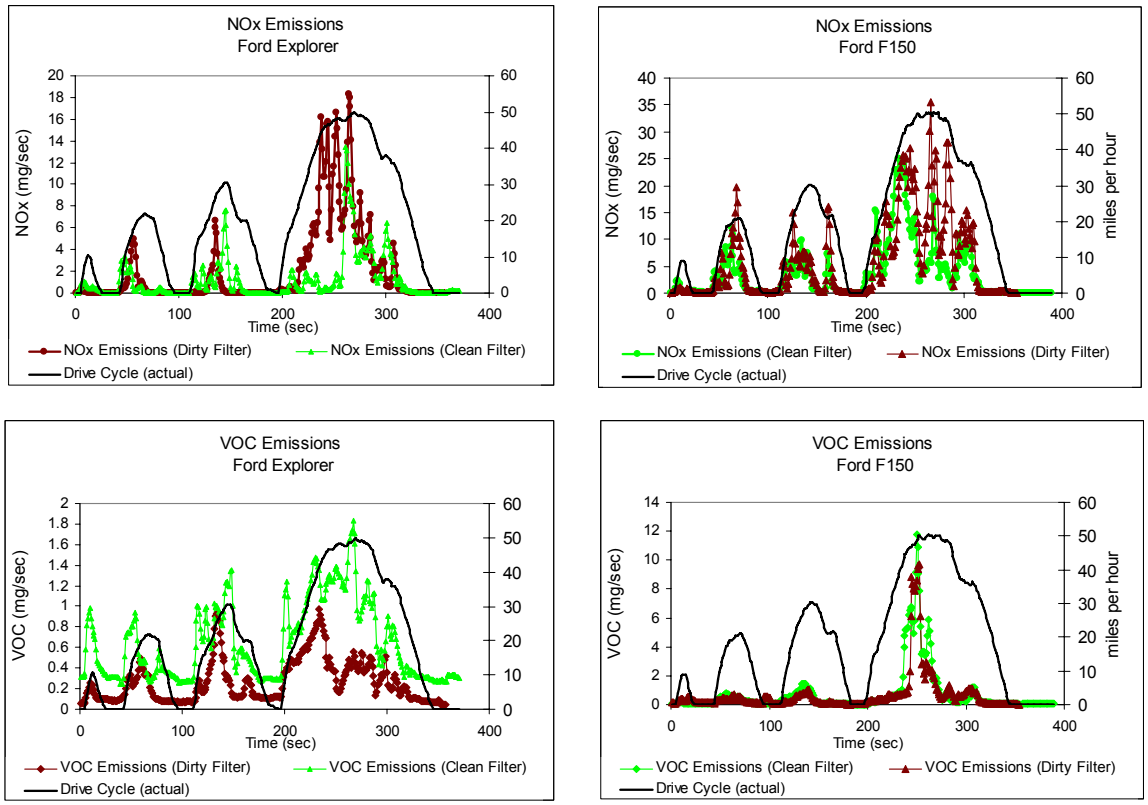
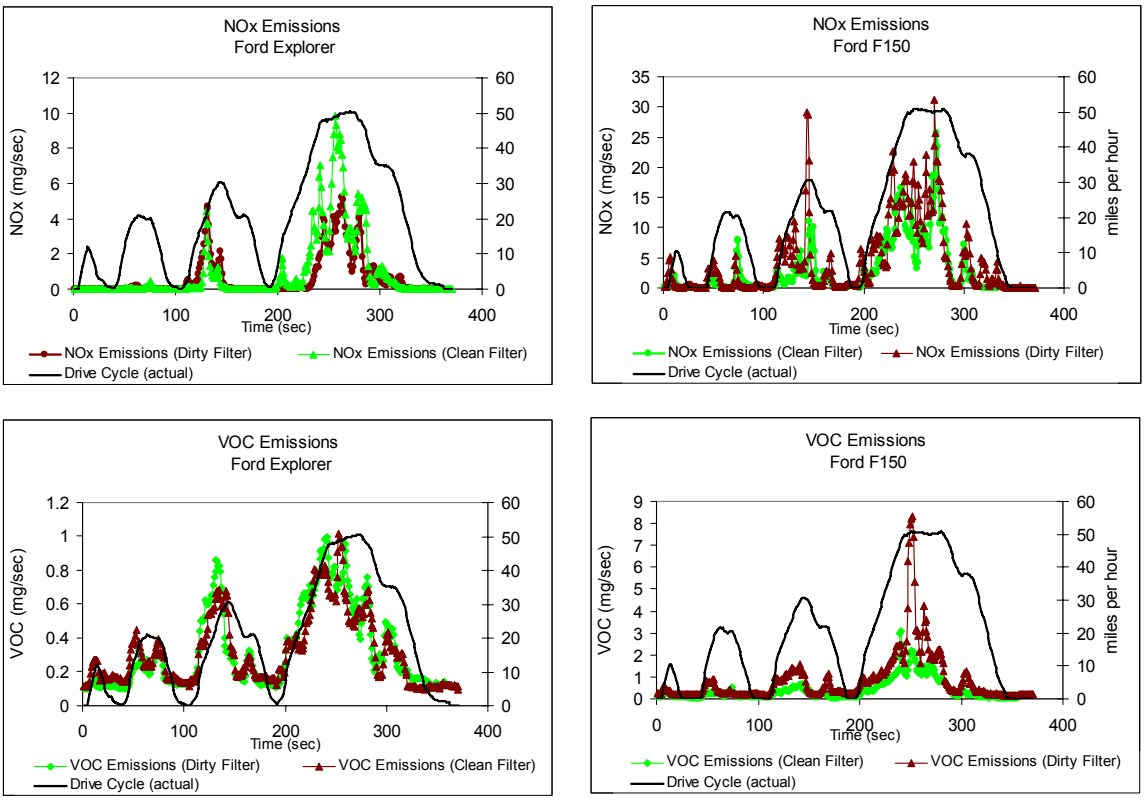


Figure 9. Emission Rate Comparisons between Dirty and Clean Air Filters on Dirt Road.



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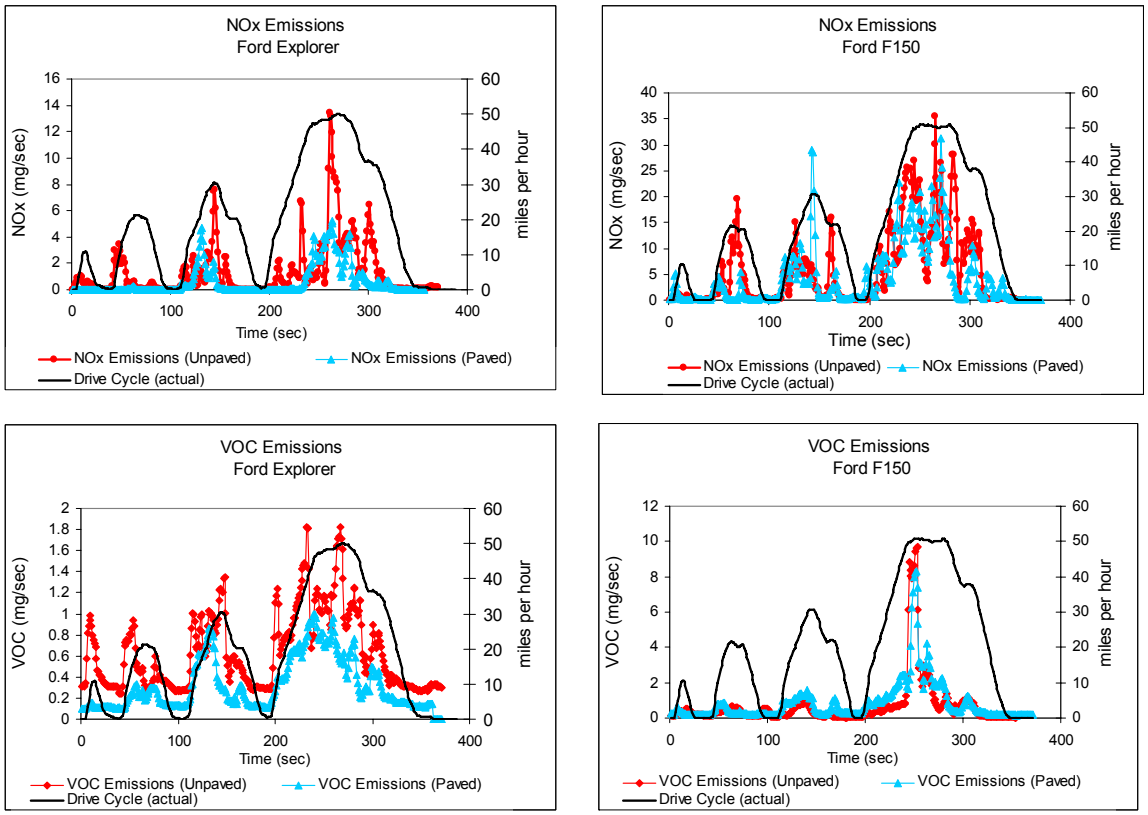

Figure 11. Emission Rate Comparisons between Dirt and Paved Road with Dirty Air Filters.

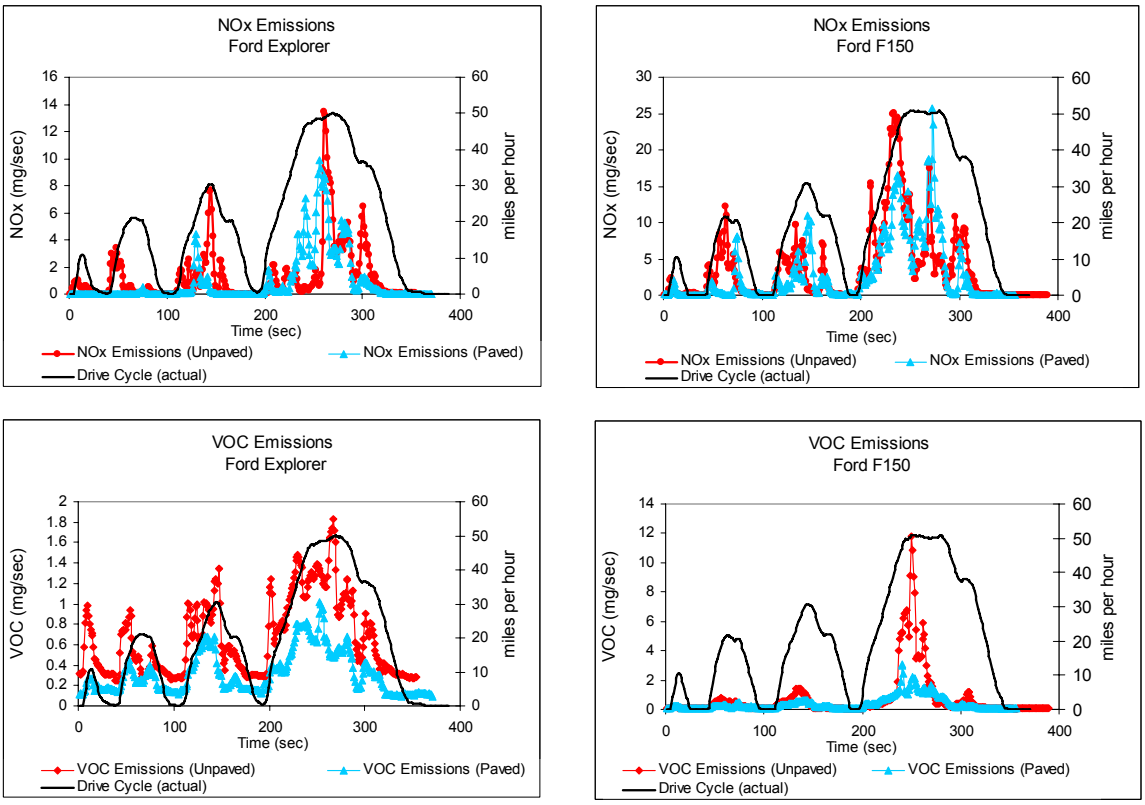

Figure 12. Emission Rate Comparisons between Dirt and Paved Road with Clean Air Filters.

Appendix F
Public Participation

8-Hour O3 Flex CAF News Ad Campaign Comments
October 25th, 2007

Travis County	**Dale Bulla**- -no idle zones at schools -install wind turbines and/or solar panels on school grounds -bio-diesel for buses -"walking days" encouraging students to walk to school -plant school gardens -outdoor butterfly garden
Travis County	**Colleen Brush-** -provide a tax incentive for reducing miles driven in a given time period, possibly annually
Travis County	**Marcus Fry-** -more right turn lanes on roadways
Travis County	**Robert Baker-** -incentives for pumping gas after dark -penalties on Ozone Action days i.e. higher gas prices, a surcharge -large incentives for alternative fuels/electric lawn equipment -signs at ALL drive through encouraging people to cut their engines
Hays County	**William Bentley-** -sky shielding of outdoor lighting
Travis County	**Dieter Grether-** -mandatory for all air ducts in both residential and commercial buildings be located inside conditioned space so as to not lose the temperatured air in transit to its location
Williamson County	**Brian Lilly-** -CART offer free/reduced fares on Ozone Action Days
Travis County	**Peter Shen-** -greatly enforce anti-idling
Travis County	**Pat Armstrong-** -focus on ways to evolve more people and companies into greener living and working practices -weekly newspaper spot dedicated to reader's ideas-possibly a contest, involve local schools as well as provide recognition/prize for winning ideas as well as additional commentary on how this winning idea will have an impact environmentally

Got a new idea?

Be a Part of the Solution.

Share your ideas on how we can improve **Air Quality**. The Clean Air Coalition of Central Texas needs your help updating the air quality plan for Bastrop, Caldwell, Hays, Travis and Williamson counties.

Visit **www.cleanairforce.org** to see the proposed plan, share your comments, and offer new ideas.

Everyone who submits comments or ideas by November 8th will receive a 15 Watt Compact Fluorescent bulb for their participation!

CLEAN AIR FORCE

03 Flex Ads

	Distribution	Cost	Run Date	Copy Deadline
Austin American Statesman	Bastrop, Caldwell, Hays, Travis, Williamson	$1,803.38	Thursday October 25th	Tuesday October 23rd
Round Rock Leader	Williamson	$255.15	Thursday October 25th	10am Monday October 22nd
Pflugerville Pflag	Williamson	$255.15	Thursday October 25th	"
Lake Travis View	Travis	$255.15	Thursday October 25th	"
Westlake Picayune	Travis	$255.15	Thursday October 25th	"
Bastrop Advertiser	Bastrop	$255.15	Thursday October 25th	"
San Marcos Record	Hays	$303.98	Thursday October 25th	12pm Tuesday October 23rd
Lockhart Post-Register	Caldwell	$220.50	Thursday October 25th	Tuesday October 23rd
TOTAL COST		**$3,603.61**		