The Alamo Area Council of Governments

2005 Emission Inventory for the Alamo Area Council of Governments Region

April 30, 2008

Funded in part by Texas Commission on Environmental Quality

Title: 2005 Emission Inventory for the Alamo Area Council of Governments Region

Report Date: April 2008

Authors: Natural Resources/Transportation Department

Type of Report: Technical Report

Performing Organization Name & Address:
Alamo Area Council of Governments
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Period Covered: 2005

Sponsoring Agency Name & Address:
Texas Natural Resources Conservation Commission and San Antonio - Bexar County Metropolitan Planning Organization

Supplementary Notes: N/A

Reference No.:

Abstract: The 2005 Emissions Inventory (EI) produced by the Alamo Area Council of Governments (AACOG) is an extensive database listing the quantities and emission rates of volatile organic compounds, nitrous oxides, and carbon monoxides released by all major sources within the twelve county AACOG region. The 2005 EI includes a full accounting of the methodologies and models employed, data sources reviewed, and surveys analyzed to complete each of the unique EI categories reported. There are six major categories of sources included in the 2005 EI: non-road, military/aircraft, area, biogenic, point, and on-road.

Related Reports: 1996 Emission Inventory for the Alamo Area Council of Governments Region;
1999 Emission Inventory for the Alamo Area Council of Governments Region
2002 Emission Inventory for the Alamo Area Council of Governments Region

Distribution Statement:
Alamo Area Council of Governments, Natural Resources/Transportation Department

Permanent File:
Alamo Area Council of Governments, Natural Resources/Transportation Department

Executive Summary

The 12 counties included in this emissions inventory are Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina and Wilson. In analyzing air quality, three critical pollutants were inventoried: Volatile Organic Compounds (VOC), Oxides of Nitrogen (NOx), and Carbon Monoxide. The sources of these pollutants are broken into six major categories for this report: non-road mobile, military/airports, area, biogenic, point, and on-road mobile.

Non-road mobile sources consist of all vehicles and equipment not routinely operated on streets and highways. These include recreational boats, recreational vehicles, railroad locomotives, agricultural equipment, construction equipment, mining equipment, quarry equipment, logging equipment, lawn and garden equipment, and commercial and industrial equipment. These account for 16.6 tons per day of VOC, 261.3 tons per day of CO, and 23.4 tons per day of NOx in Bexar County. Chapter 2 lists the methodologies for estimating emissions for each subcategory in non-road mobile sources.

Military/airport sources include both public and military aircraft, as well as military groundside emissions and airport support vehicles. Military/airport emissions also include on-road emissions generated on base and non-road mobile source emissions. Significant military activity is found in three counties within the AACOG region: Bexar, Comal, and Medina counties. Both of the large civilian airports included in the inventory, San Antonio International Airport and Stinson Municipal Airport, are located in the Bexar County. Also, there are 18 small private or civilian airports in the AACOG 12 county region. These sources account for 2.5 tons per day of VOC, 24.5 tons per day of CO, and 4.6 tons per day of NOx in the Bexar County. Chapter 3 contains the methodologies used in the calculation of the inventory emissions for military and airport sources.

Area sources encompass a large number of diverse sources--everything from bakeries and breweries to asphalt paving and degreasing operations. These sources include facilities whose individual emissions do not qualify them as point sources (each facility emits less than 100 tons of VOC or NOx per year) however; collectively they can release significant quantities of pollutants. Area sources emit 47.9 tons per day of VOCs, 9.0 tons per day of CO, and 11.2 tons per day of NOx in the Bexar County. These methodologies used for estimating emissions from area sources varied by subcategory. These can be found individually in the Chapter 4 of the emission inventory report.

Biogenic sources are emissions from natural sources such as vegetation and microbial activity. This is the only category that is from a non-anthropogenic source. Some example sources include trees, grasses, and emissions from natural soil microbes. This category accounts for 63.6 tons per day of VOCs, 15.4 tons per day of CO and 3.8 tons per day of NOx in the Bexar County. The methodology used for this category is described in the Chapter 5 of the emissions inventory report.

Point source emissions are from stationary sources such as electrical generating plants and other industrial facilities. These sources are well documented, in accordance with TNRCC rules, and emit over 100 tons of NOx or 100 tons of VOC per facility each year. This category contributes 4.7 tons of VOCs per day, 8.6 tons per day of CO, and 55.8 tons per day of NOx to the inventory of emissions in the Bexar County. The Chapter 6 contains the data for point sources by company and county.

On-road mobile sources consist of vehicles operated on the streets and highways. The vehicles are divided into gasoline and diesel powered vehicle classes. This emission category represents the largest source of emissions from non-stationary sources, producing 40.8 tons per day of VOCs, 449.7 tons per day of CO, and 90.3 tons per day of NOx in the AACOG region. The methodology used for calculating these emissions and the results of the emissions calculations are provided in the Chapter 7.

A number of agencies contributed information to this inventory, making the preparation of this document possible. Population data for 2005 were obtained from the Texas Water Development Board and are based on the "Most Likely Scenario." Employment figures were taken from the Texas Workforce Commission Third Quarter 2004 Report. The Texas Department of Transportation (TxDOT) supplied highway vehicle registration data and developed vehicle miles traveled (VMT) estimates and vehicle travel parameters, which were used as input data for the MOBILE6.2 emission factors model. Texas Transportation Institute provided on-road emissions estimates for the 12 county-region. The Texas Commission on Environmental Quality (TCEQ) provided data for a number of categories including point source emissions, the location of aboveground and underground storage tanks, and auto body shop emissions methodology. This emission inventory is based on the annual and average ozone seasonal data for countywide estimation of the emissions.

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CHAPTER 1 – INTRODUCTION

The Clean Air Act is the comprehensive federal law that regulates airborne emissions across the United States.[1] This law authorizes the U.S. Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment. Of the many air pollutants commonly found throughout the country, the EPA has recognized six "criteria" pollutants that can injure health, harm the environment, or cause property damage. The EPA refers to these pollutants as criteria air pollutants because health-based criteria (science-based guidelines) are the basis for setting the permissible levels of regulation. The NAAQS are a listing of the threshold levels, concentration values above which human health is put at risk, for each criteria pollutant.

In 1997, air quality monitors began to compile the three-year set of eight-hour average ozone readings required by the amended National Ambient Air Quality Standards (NAAQS). This amendment, upheld by the Supreme Court,[2] sets a stricter standard intended to more aggressively protect human health and the environment. As a consequence, air quality considerations take on increased importance as regions develop plans for meeting the revised ozone standard.

The compilation of the 2005 emissions inventory (EI) for the AACOG Region required extensive research and analysis, providing a vast database of regional pollution sources, their emissions, and emission rates. By understanding these varied sources that create ozone precursor pollutants, planners, political leaders, and common citizens can work together to protect heath and the environment.

An initial step in developing an EI is delineating the coverage area. This inventory encompasses the 12 AACOG counties, which include Bexar, the most populous county of the region, and the 11 surrounding counties of Atascosa, Bandera, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina and Wilson (Figure 1-1). The 2005 AACOG EI comprises six categories of emission sources. These include biogenic sources and five anthropogenic emission sources: non-road, airport/military, area, point, and on-road, as described below:

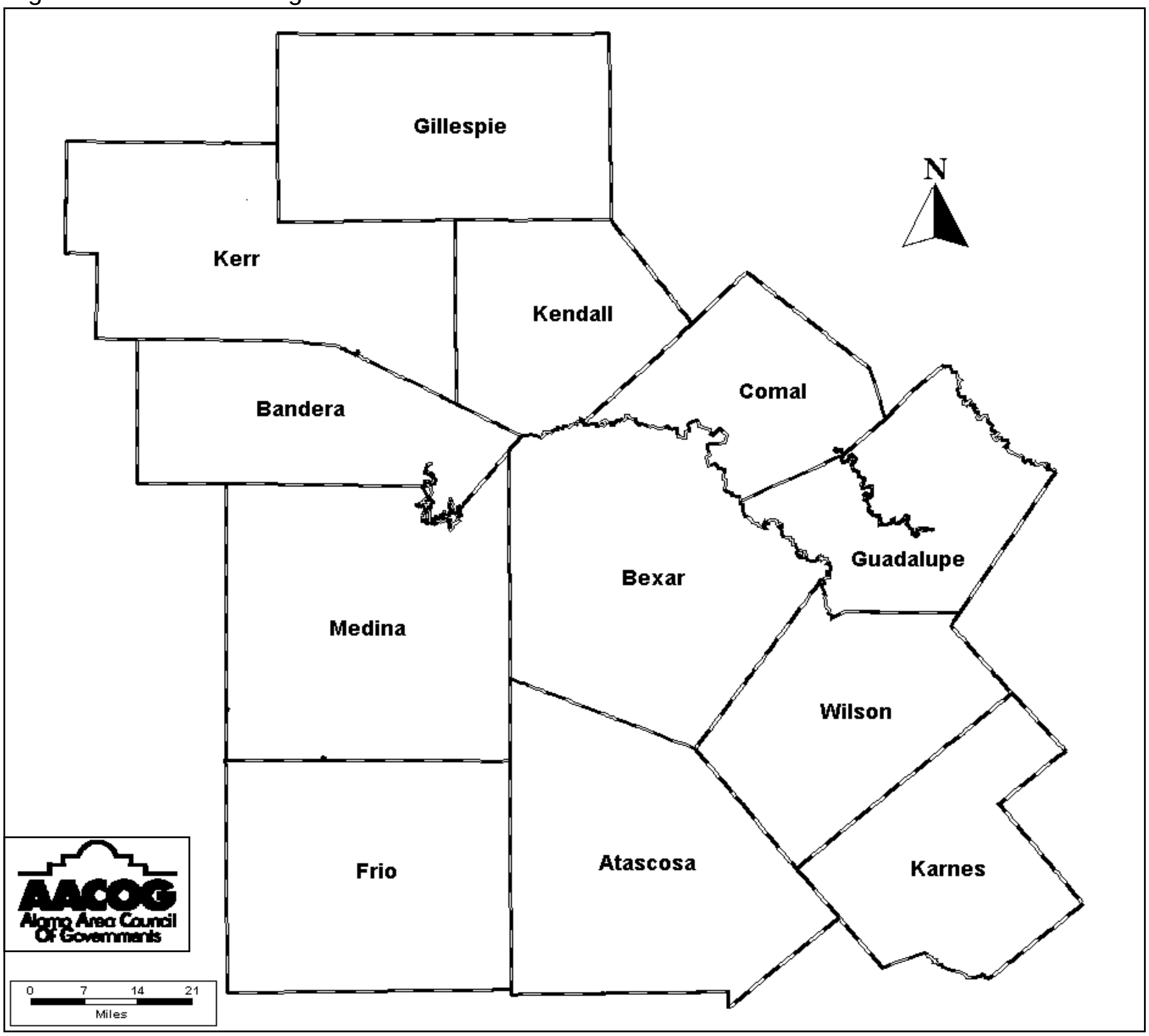
- Non-road sources account for the emissions of equipment that are operated in areas other than public thoroughfares. The non-road category includes such sources as farm vehicles, construction, mining, commercial equipment, industrial equipment, railroad locomotives, and other equipment.
- Airports and military installations combined constitute a fairly significant source of pollutants. These facilities are unique in the number and variety of equipment, such as aircraft, ground support equipment, ground transportation vehicles, lawn and garden equipment, and refueling stations that contribute to the EI. Because of the significance of their emission contribution and the many similarities of military and airport EI techniques, the 2005 EI presents these emissions as a separate category from non-road, area, point, and on-road sources. The airport/military source includes emissions from San Antonio International Airport, smaller regional airports, and six military installations: Brooks City Base, Camp

[1] US Congress, 1990. Clean Air Act. Available online: http://www.epa.gov/air/caa/
[2] US Supreme Court, February, 2001. Case of Whitman v. American Trucking Assoc. Available online: http://www.ciel.org/Publications/Whitman_American_Trucking.pdf

Bullis, Canyon Lake Recreational Center, Fort Sam Houston, Lackland Air Force Base and Kelly Air Field, and Randolph Air Force Base.

- Area sources are sources that are so numerous and individually sites emit low levels of emissions. These sources include fertilizer, pesticides, asphalt, bakeries, dry cleaners, surface coating, degreasing, gas cans, gasoline distribution, consumer solvents, oil and gas wells, etc.
- Biogenic sources include emissions due to vegetation and associated biology.
- Point sources are those stationary emitters individually producing enough pollution that a description of each source emissions is required. The state of Texas, through the Texas Commission on Environmental Quality (TCEQ), maintains records of point sources.
- The on-road category is a self-descriptive term referring to the many vehicles, cars, trucks, buses, and motorcycles, traveling the regional roads and highways.

Figure 1-1. AACOG Region



Ozone forms from the chemical reactions of air pollutants – volatile organic compounds (VOC), nitrous oxides (NOx) and, to a lesser extent, carbon monoxide (CO) – in the presence of sunlight (ultraviolet radiation). Therefore, the intent of this EI is to identify and quantify ozone precursor emissions as completely and accurately as possible. To accomplish this, EPA guidance was consulted and, whenever time or other constraints permitted, EPA's preferred methodology was used to develop emission estimations. This methodology typically requires the use of site-specific data, primarily obtained from surveys. Although surveying is a costly and time-consuming process, it ensures that specific production, operation and/or employment figures are used in the emission calculation process.

Once data is obtained through either the use of surveys or alternative methods, emissions are estimated and inventoried by category. Figures 1-2 through 1-7 provide a graphical comparison of VOC, NOx and CO emissions by source category in tons per average ozone weekday. Bexar County source categories are provided in one set of pie charts and emissions from the surrounding eleven counties are consolidated in the other set. Tables 1-1 through 1-3 list VOC, NOx and CO emissions in tons per average ozone weekday by major category for each of the 12 AACOG counties.

One of the conclusions that can be drawn from these tables is that, in the AACOG region, on-road sources are the largest contributor of VOC, NOx and CO anthropogenic emissions. In Bexar County for example, on-road sources generate 90.29 tons of NOx emissions on a typical ozone summer day. The next highest anthropogenic contribution comes from point sources with 55.84 tons per day, followed by non-road sources with 23.45 tons per day, area sources with 11.19 tons per day, and military/airport sources with 4.42 tons per day. With regards to anthropogenic VOC emissions, area sources produce 47.93 tons per typical ozone season day, while on-road sources produce 40.80 tons per day, non-road sources generate 16.61 tons per day, point sources produce 4.74 tons per day, and airport / military sources generate 2.52 tons.

The following chapters describe in detail the methodology used to determine emissions from the numerous sources of VOC, NOx and CO in the AACOG region. In addition, the chapters provide the results of the emission calculations for each source category in tons per year and tons per ozone season day.

Figure 1-2. 2005 Bexar County VOC Emissions

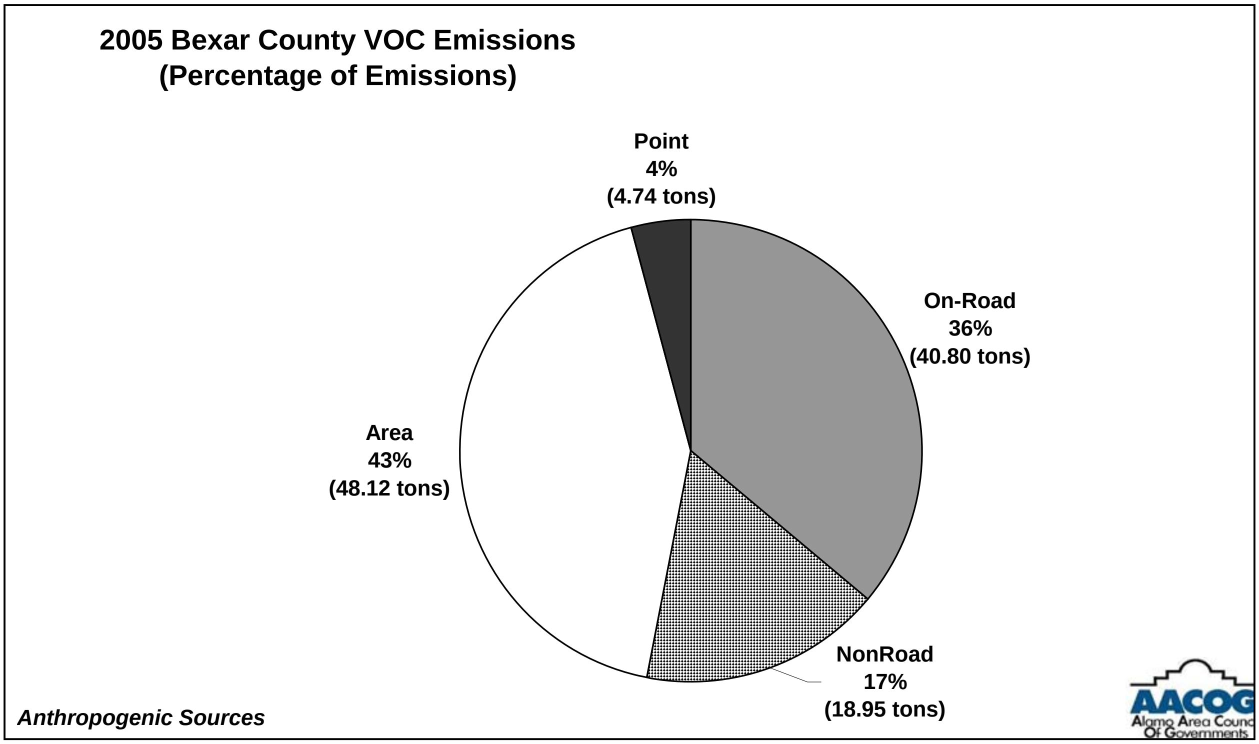


Figure 1-3. 2005 Surrounding Counties VOC Emissions

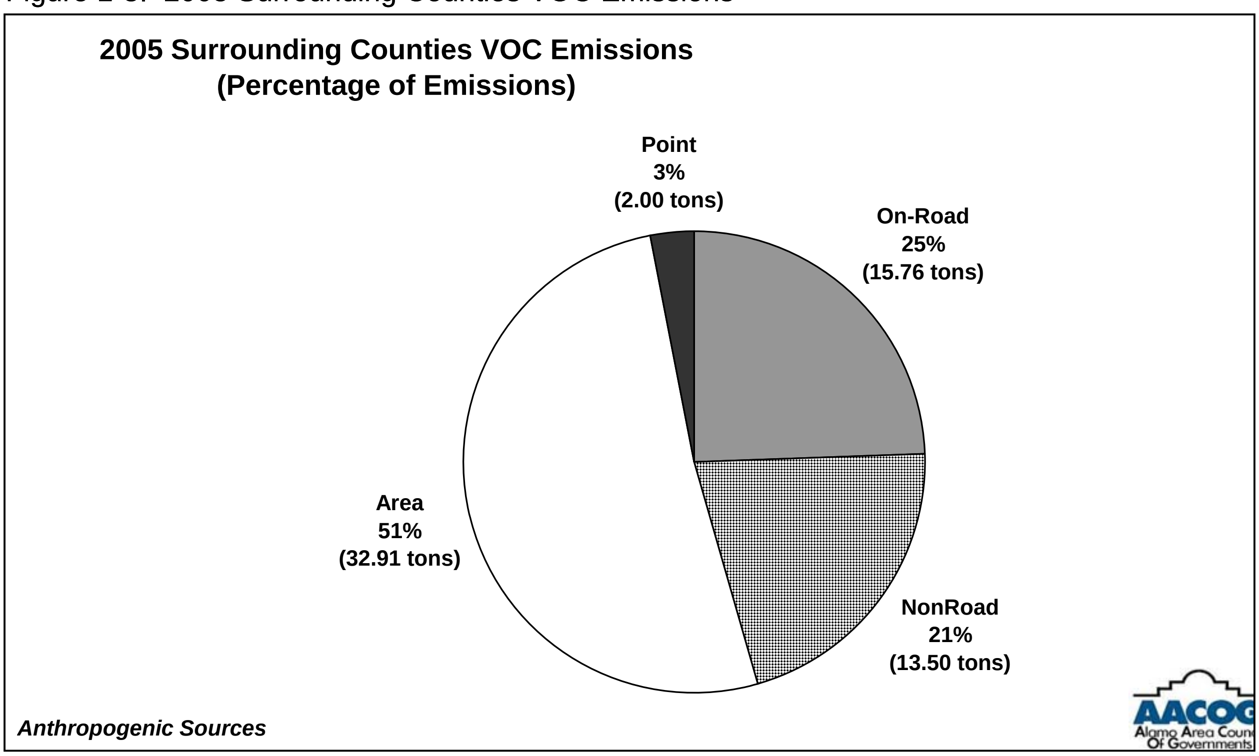


Figure 1-4. 2005 Bexar County NOx Emissions

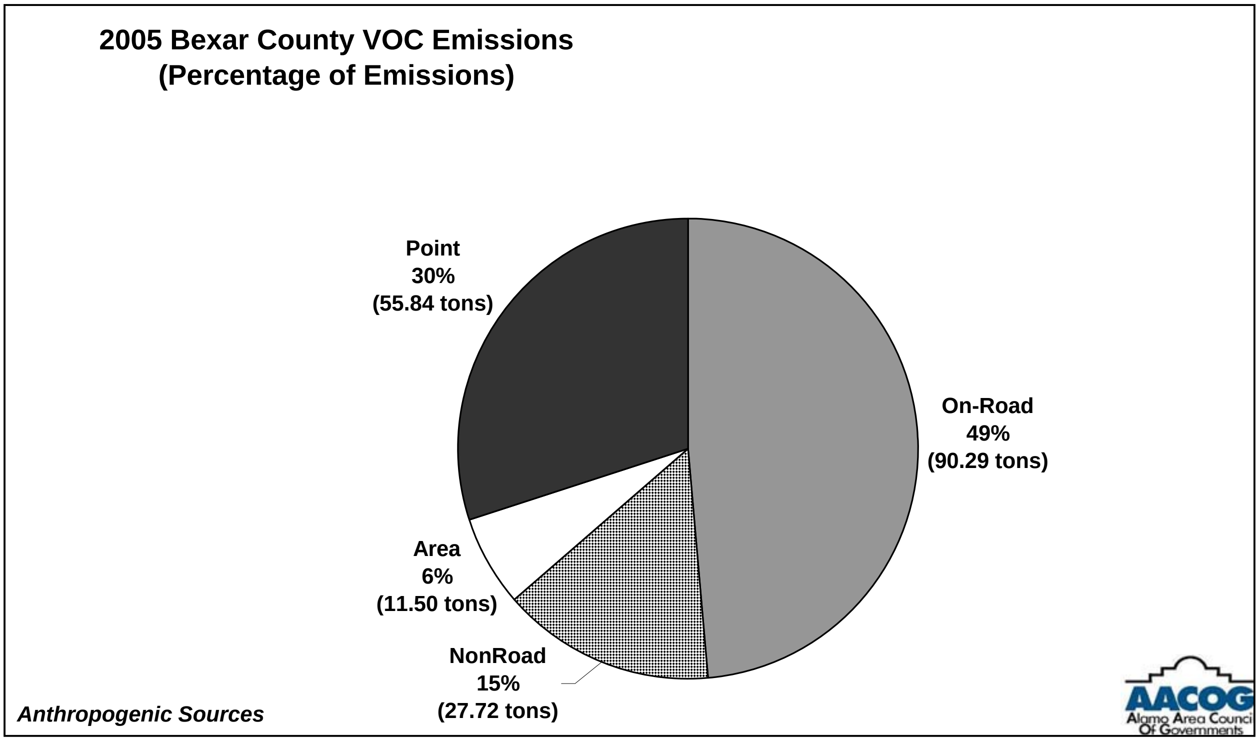


Figure 1-5. 2005 Surrounding Counties NOx Emissions

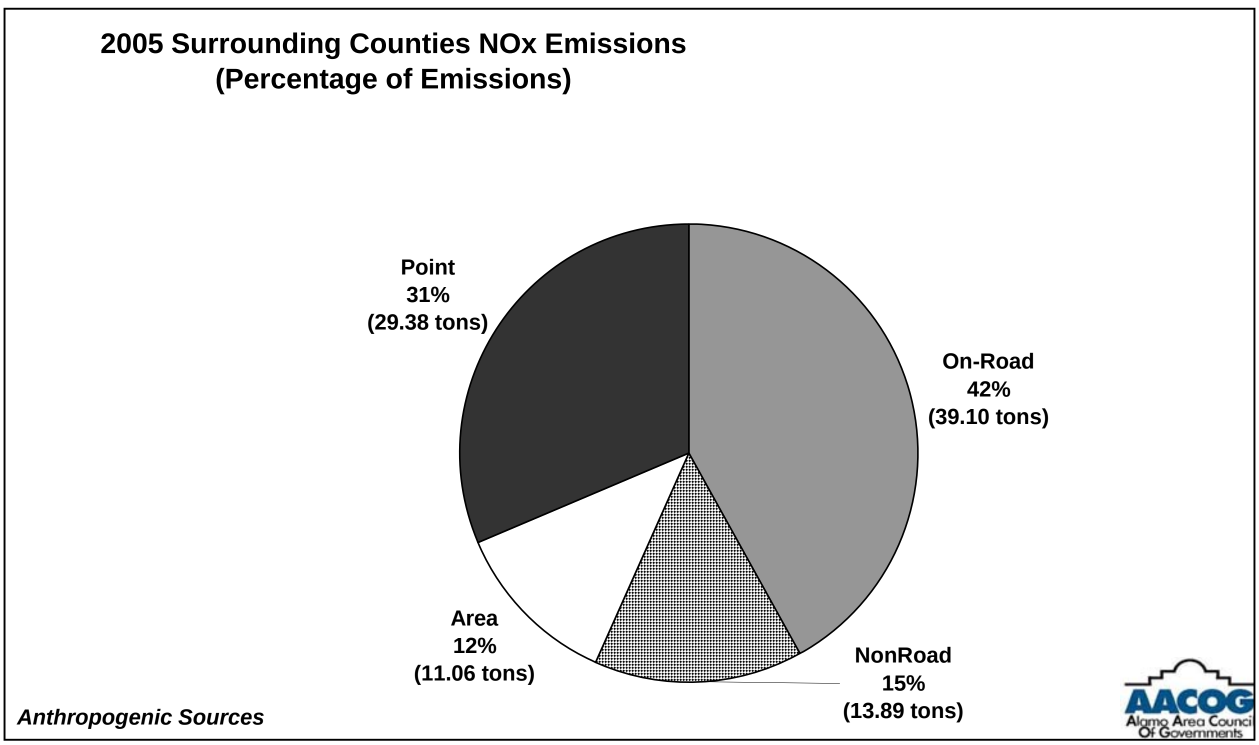


Figure 1-6. 2005 Bexar County CO Emissions

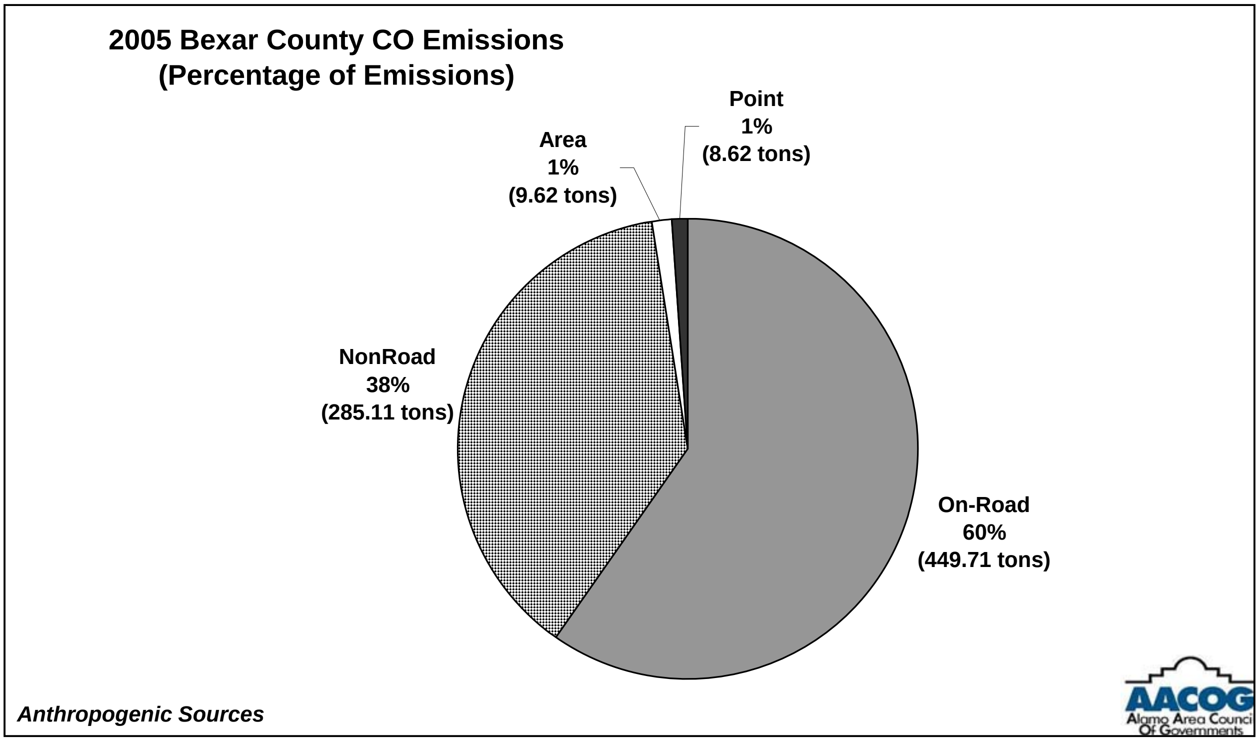


Figure 1-7. 2005 Surrounding Counties CO Emissions

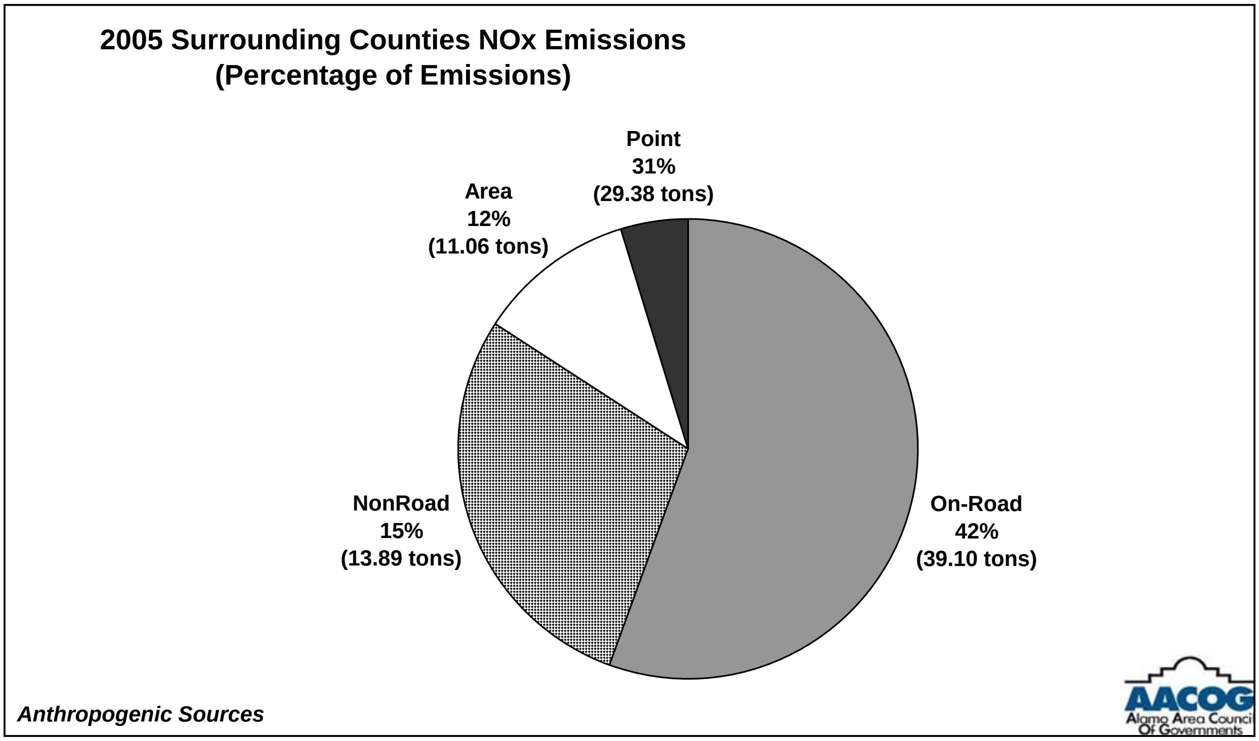


Table 1-1. 2005 VOC Emissions by Source Category for each County (Tons per Day for Average Ozone Weekday)

Category	Atascosa	Bandera	Bexar	Comal	Frio	Gillespie	Guadalupe	Karnes	Kendall	Kerr	Medina	Wilson	Total
On-Road	1.49	0.46	40.80	3.39	0.95	0.79	3.27	0.55	1.02	1.45	1.37	1.00	56.56
Non-Road	0.38	1.75	16.61	3.33	0.34	0.62	1.41	0.13	1.40	2.87	0.79	0.29	29.92
Point	0.36	0.04	4.74	0.35	0.15	0.00	0.86	0.23	0.01	0.00	0.00	0.00	6.74
Airport/Military	0.01	0.00	2.52	0.03	0.01	0.02	0.05	0.00	0.00	0.09	0.04	0.00	2.77
Area	3.87	0.92	47.93	4.00	2.90	1.45	6.96	1.29	2.13	1.98	4.35	3.01	80.79
Biogenic	72.57	80.97	63.60	42.04	85.38	49.32	38.83	51.52	49.42	61.11	95.32	48.36	738.43
Total	78.67	84.14	176.20	53.14	89.73	52.20	51.38	53.72	53.99	67.49	101.88	52.66	915.20

Table 1-2. 2005 NOx Emissions by Source Category for each County (Tons per Day for Average Ozone Weekday)

Category	Atascosa	Bandera	Bexar	Comal	Frio	Gillespie	Guadalupe	Karnes	Kendall	Kerr	Medina	Wilson	Total
On-Road	3.92	0.81	90.29	9.11	2.98	1.75	8.28	1.43	2.80	3.08	3.12	1.83	129.39
Non-Road	1.07	0.21	23.45	3.93	0.35	0.50	3.25	0.23	0.50	0.69	2.65	0.40	37.22
Point	10.28	3.70	55.84	11.20	0.63	0.00	3.05	0.48	0.03	0.00	0.00	0.00	85.22
Airport/Military	0.00	0.00	4.58	0.00	0.00	0.01	0.02	0.00	0.00	0.05	0.02	0.00	4.69
Area	1.51	0.16	11.19	0.77	0.91	0.40	2.63	0.75	0.64	0.35	1.99	0.96	22.24
Biogenic	5.40	2.71	3.75	1.59	5.60	3.44	2.98	3.72	2.23	3.76	5.13	3.89	44.20
Total	22.18	7.59	189.08	26.61	10.48	6.09	20.21	6.61	6.20	7.92	12.92	7.08	322.96

Table 1-3. 2005 CO Emissions by Source Category for each County (Tons per Day for Average Ozone Weekday)

Category	Atascosa	Bandera	Bexar	Comal	Frio	Gillespie	Guadalupe	Karnes	Kendall	Kerr	Medina	Wilson	Total
On-Road	20.01	5.62	449.71	44.63	13.66	10.43	41.89	6.88	14.42	17.99	17.61	11.81	654.67
Non-Road	6.33	7.38	261.26	26.11	3.20	6.46	22.87	2.63	10.22	18.30	8.23	5.14	378.11
Point	8.63	0.32	8.62	5.58	0.42	0.00	2.73	0.26	0.01	0.00	0.00	0.00	26.57
Airport/Military	0.09	0.00	24.51	0.29	0.08	0.20	0.42	0.02	0.00	0.97	0.46	0.00	27.05
Area	4.24	3.00	8.96	2.36	4.90	5.19	3.28	2.03	3.24	4.69	5.79	1.92	49.61
Biogenic	19.54	13.70	15.43	9.75	21.06	13.61	10.65	12.56	11.50	15.56	21.41	12.86	177.63
Total	58.83	30.02	768.49	88.72	43.31	35.90	81.83	24.38	39.39	57.51	53.50	31.73	1,313.63

CHAPTER 2 – NON-ROAD EMISSIONS

Agricultural Equipment

Agricultural equipment emissions were inventoried to quantifying NOx, VOC, and CO. Emissions were calculated using the EPA NONROAD 2004 model[1] and crop data gathered from the United States Department of Agriculture (USDA) and the county extension offices.

Methodology

The 2005 AACOG Emissions Inventory includes 26 different types of equipment used for agricultural purposes in the 12-county region. Separate methodologies were employed to determine tractor and combine emissions as compared to emissions from balers, agricultural mowers, tillers, etc. This section describes both methodologies in detail.

Tractors and Combines

In order to quantify tractor and combine emissions, crop specific data for each county was analyzed. This crop specific data included:

- Type of crop – Corn, cotton, hay, peanuts, small grain, sorghum, and vegetables
- Acres of each crop per county grown in 2005 or closest year to 2005
- Agricultural processes – Plow, plant, fertilize, cultivate, and harvest
- Months during which each agricultural processes was performed for each crop
- Activity rate annual total for agricultural processes (hours per acre)
- Seasonal allocation of activity rates – portion of annual activity rate performed during the ozone season months (hours per acre)

Crop acreage by county for Hay was gathered from Volume I of the 2002 United States Department of Agriculture: Census of Agriculture.[2] Crop acreage for all other crop types came from the Quick Stats: Agricultural Statistics Data Base for the year 2004, the closest year of data to the EI year of 2005.

Agricultural activities consist of plowing the fields and planting, fertilizing, cultivating, and harvesting the crops. During the times of agricultural processes, the use of in-field farm machinery emits air pollutants. The South-central Texas climate for 2005 determines the month in which an agricultural process occurred for each crop. These months were determined through the consensus of agricultural experts based on their observations of farm activity over the last 20 years. Table 2-1 describes the historical agricultural activity for each crop in this region.

Activity Rates

To calculate emissions from agricultural tractors and combines, the time-length it takes the average farmer to plow, plant, fertilize, cultivate and harvest each acre, according to the type of crop, is necessary. Table 2-2 describes the hours required to complete one acre of agricultural activity for each crop in the AACOG region. Agricultural tasks using tractors are cultivating, planting, plowing and fertilizing; combines are used for harvesting. These rates also reflect the number and width of rows in each acre.

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[1] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

[2] United States Department of Agriculture, July 2004. National Agricultural Statistics Service, 2002. Agriculture Census: Volume I Geographic Area Series. Available online: http://www.nass.usda.gov/census/

Table 2-1. Typical Agricultural Activity by Month for the AACOG Region

Crop	Months of Agricultural Activity				
	Plow	Plant	Fertilize	Cultivate	Harvest
Corn	Dec.	Feb./Mar.	Feb. – **Apr.**	**Apr.**	**Jul.**
Hay	Jan.	Mar.	**Apr.**	N/A	**Jun. – Aug.**
Peanuts	**Apr.**	**Jun./Jul.**	N/A	**Jul. – Aug.**	**Sep. –** Nov.
Small Grains	**Sep.**	**Oct. –** Dec.	Jan.	N/A	**May**
Sorghum	Jan.	**Apr.**	Mar.	**May**	**Jul.**
Cotton	Feb.	**Apr. – Jun.**	**May**	**Jun. – Aug.**	**Aug.**
Vegetables	Activity is year around				

N/A = Not Applicable; **Bolded** months – occur during the ozone season

Table 2-2. Average Rate to Accomplish Each Agricultural Activity, AACOG Region

Crop	Agricultural Activity in Acres/Hour				
	Plow	Plant	Fertilize	Cultivate	Harvest
Corn	4	4	25	4	3 hrs/acre
Hay	6	8	25	N/A	Cut – 6
					Rake – 12
					Bale – 2
Peanuts	5	5	N/A	8	Dig – 1
					Shake – 1
Small Grains	6	8	25	N/A	3
Sorghum	4	4	25	4	3
Cotton	4	4	25	4	3
Vegetables	*Most work done by hand or small equipment*				

N/A - Not Applicable

Seasonal Allocation

Seasonal allocation factors were developed for ozone season emissions. For example, fertilization of corn only occurs during the months of February through April. Since the ozone season extends from April through October, approximately one-third of the activity is performed during ozone season. Therefore, one-third of the hours required for fertilization activity (Table 2-3) were included in the weekday ozone season emissions estimations. Seasonal allocation factors were applied to the annual activity rates to determine ozone season emissions. This was accomplished by identifying the agricultural activities that occurred during the ozone season.

Performance & Emission Factors

The NONROAD model was utilized to develop emission factors for tractor and combine emissions. NONROAD runs were performed for the entire state of Texas with a gasoline RVP of 8.7 and with an RVP of 7.8. The modeled hydrocarbons (HC), nitrogen oxides (NOx), and carbon monoxide (CO) emissions output was used along with the equipment population, load factor, activity rate, and average horsepower of gasoline and diesel tractors, as well as diesel combines. HC was converted to VOC using a conversion factor of 0.993 for gasoline engines and 1.053 for diesel engines following EPA guidance.[3] Gasoline powered combines were not calculated due to their very small population numbers in the region.

Table 2-3. Activity Rate for Agricultural Processes, AACOG Region – 2005 Ozone Season

Crop	Agricultural Activity (Acres/Hour)				
	Plow	Plant	Fertilize	Cultivate	Harvest
Corn	0	0	8.33	4	3
Hay	0	0	25	0	Cut – 6 Rake – 12 Bale – 2
Peanuts	5	5	0	8	Dig – 0.66 Shake – 0.66
Small Grains	6	2.66	0	0	3
Sorghum	0	4	0	4	3
Cotton	0	4	4	4	3
Vegetables	Most work done by hand or small equipment				

Table 2-4. Agricultural Equipment Performance Factors for Texas

Agriculture Equipment	Average HP	Population	Load Factor	Activity Rate
4-Str Tractor	56.95	172	0.62	550
Diesel Tractor	132.04	92,095	0.59	475
Diesel Combine	190.04	18,580	0.59	150

Table 2-5. Agricultural Equipment Emission Factors

Agriculture Equipment	Calculated EF (g/hp-hr)					
	RVP 7.8			RVP 8.7		
	HC	NOx	CO	HC	NOx	CO
4-Str Tractor	8.70	7.59	262.90	8.82	7.62	262.90
Diesel Tractor	0.85	6.68	4.42	0.84	7.34	4.42
Diesel Combine	0.84	12.61	3.35	0.60	9.57	3.35

The annual hours of equipment usage was estimated for each crop by determining the product sum of the crop acres and the hours required to perform each agricultural task.

Sample Calculations

Equation (1)

NONROAD model based emission factor (EF) calculation for agricultural equipment type E:

$$EF_E = (PA_E \times 2000 \text{ lbs/ton} \times 453.6 \text{ g/lbs}) / [(POP_E \times HRS_E) \times (HP_E \times LF_E)]$$

[3] Assessment and Standards Division Office of Transportation and Air Quality U.S. Environmental Protection Agency, May 2003. Conversion Factors for Hydrocarbon Emission Components. EPA420-P-03-002, p. 5 of 6. Available online: http://www.epa.gov/otaq/models/nonrdmdl/p03002.pdf

Where,

EF_E	=	Emission factor for agricultural equipment type E (g/hp-hr)
PA_E	=	Total pollutant amount for Texas from agricultural equipment type E for HC, NOx, or CO (tons/yr) based on RVP 7.8 or RVP 8.7 value for county (from NONROAD model)
POP_E	=	NONROAD model total population of agricultural equipment type E in Texas (Table 2-4)
HRS_E	=	NONROAD model activity rate in hours/year for agricultural equipment type E in Texas (Table 2-4)
HP_E	=	Average horse power for agricultural equipment type E (Table 2-4)
LF_E	=	Load factor for agricultural equipment type E (Table 2-4)

Calculated diesel tractor NOx emission factor from NONROAD model of RVP 7.8:

EF_E = (26,365.59 tons NOx/yr x 2000 lbs/ton x 453.6 g/lbs) / [(98,861.67 475 hrs) x (132.04 hp x 0.59)]
= 6.5 g NOx/hp-hr for diesel tractor

Equation (2)
Annual activity rates for plowing, planting, fertilizing, cultivating, or harvesting of crop type C:

$$RATE_C = ACRE_C / AR_C$$

Where,

$RATE_C$	=	Annual county activity rate in hours for plowing, planting, cultivating, fertilization, or harvesting crop type C
$ACRE_C$	=	Acres of crop type C per county (from Census of Agriculture)
AR_C	=	Annual agricultural activity rate in acres/hour for plowing, planting, cultivating, fertilization, or harvesting crop type C (from table 2-3)

Annual activity rate for the agricultural activity of plowing the 1,700 acres of sorghum farmland in Comal County:

$RATE_C$ = 1,700 acres / 4 acres/hr
= 425 hrs plowing sorghum

Equation (3)
Annual activity rate for all tractor activities working crop C:

$$AAR_C = PLOW_C + PLAN_C + CULT_C + FERT_C$$

Where,

AAR_C	=	Annual tractor activity rate total for crop C (hours)
$PLOW_C$	=	Annual plowing activity rate for crop C (hours) (from equation 2)
$PLAN_C$	=	Annual planting activity rate for crop C (hours) (from equation 2)
$CULT_C$	=	Annual cultivating activity rate for crop C (hours) (from equation 2)
$FERT_C$	=	Annual fertilization activity rate for crop C (hours) (from equation 2)

Annual activity rate for a diesel tractor working 1,700 acres of sorghum farmland in Comal County:

AAR_C = 425 hrs + 425 hrs + 425 hrs + 68 hrs
= 1,343 hrs for a diesel tractor working on sorghum

Equation (4)
Annual emissions from equipment type E for crop type C:

AE_E = (AAR_C x EF_E x LF_E x AHP_E x FU_E) x 0.002205 lbs/g / 2,000 lbs/ton

Where,

AE_E = Annual emissions from equipment type E for crop type C (tons/yr)
AAR_C = Annual equipment activity rate for crop C (hours) (from equation 4)
EF_E = Emission factor by equipment type E, pollutant and RVP specific, Table 2-5 (g/hp-hr) (from equation 1)
LF_E = Load factor for equipment type E (Table 2-4)
HP_E = Average horse power for equipment type E (Table 2-4)
FU_E = Fuel use ratio for equipment type E (diesel or gasoline)

Annual NOx emissions from a diesel tractor working sorghum fields in Comal County:

AE_E = (1,343 hrs x 6.5 g/hp-hr x 0.59 x 132 hp x 0.9981) x 0.002205 lbs/g / 2,000 lbs/ton
= 0.748114 tons NOx/yr from diesel tractor working sorghum fields

Equation (5)
Ozone season activity rates for plowing, planting, fertilizing, cultivating, and harvesting crop C:

$ORATE_C$ = $ACRE_C$ / OAR_C

Where,

$ORATE_C$ = Ozone season county activity rate in hours for plowing, planting, cultivating, fertilization, or harvesting crop type C
$ACRE_C$ = Acres of crop C per county (from Census of Agriculture)
OAR_C = Ozone season agricultural activity rate in acres/hour for plowing, planting, cultivating, fertilization, or harvesting for crop C (from table 2-3) (acres/hour)

Ozone season activity rate for the agricultural activity of plowing the 1,700 acres of sorghum farmland in Comal County:

$ORATE_C$ = 1,700 acres / 4 acres/hr
= 425 hrs plowing sorghum

Equation (6)
Ozone season activity rate for all tractor activities working crop C:

OAR_E = $OPLOW_C$ + $OPLAN_C$ + $OCULT_C$ + $OFERT_C$

Where,

OAR_E = Ozone season activity rate for equipment E (hrs)
$OPLOW_C$ = Ozone season plowing activity rate for crop C (hours) (from equation 5)
$OPLAN_C$ = Ozone season planting activity rate for crop C (hours) (from equation 5)
$OCULT_C$ = Ozone season cultivating activity rate for crop C (hours) (from equation 5)
$OFERT_C$ = Ozone season fertilization activity rate for crop C (hours) (from equation 5)

Ozone season activity rate for a diesel tractor working 1,700 acres of sorghum farmland in Comal County:

OAR_E = 0 + 425 + 425 + 0
= 850 hours

Equation (7)
Daily ozone season emissions for agriculture equipment type E by crop:

OE_E = (OAR_C x EF_E x LF_E x HP_E x FU_E) x CF / DAYS x 0.002205 lbs/g / 2,000 lbs/ton

Where,

OE_E = Total ozone season emissions from equipment type E (tons/yr)
OAR_C = Ozone season activity rate for crop C (hrs) (from equation 6)
EF_E = Emission factor for agriculture equipment type E (Table 2-5) (g/hp-hr)
LF_E = Load factor for agriculture equipment type E (Table 2-4)
HP_E = Average horse power for agriculture equipment type E (Table 2-4)
FU_E = Fuel use ratio for agriculture equipment type E (diesel or gasoline)
DAYS = Number of activity days per ozone season (170)

Daily ozone season emissions from a diesel tractor working sorghum fields in Comal County:

OE_A = (850 hrs x 6.5 x 0.59 x 132.04 x 0.9981) / 170 x 0.002205 lbs/g / 2,000 lbs/ton
= 0.00279 tons NOx/day for diesel tractor working sorghum fields

Other Off-Road Agricultural Equipment

The NONROAD 2004 model[4] was utilized to develop emissions for all other agricultural equipment besides tractors and combines. Emissions for the following equipment types were calculated using this method:

- Agricultural Mowers
- Balers
- Hydro Power Units
- Irrigation Sets
- Sprayers
- Swathers
- Tillers
- Other Agricultural Equipment

[4] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

Separate NONROAD runs were performed for each county to determine annual and weekday emissions. Performing these runs involved entering county specific specifications in order to accurately calculate emissions. One specification was the use of the appropriate Reid Vapor Pressure (RVP) used during the assessment of daily emissions during the summer months. Table 2-6 details the RVPs used for each county when estimating the ozone season daily emissions.

Table 2-6. RVP Used by AACOG Counties During the Summer Months

County	RVP 8.7	RVP 7.8
Atascosa		X
Bandera	X	
Bexar		X
Comal		X
Frio	X	
Gillespie	X	
Guadalupe		X
Karnes		X
Kendall	X	
Kerr	X	
Medina		X
Wilson		X

Other inputs entered into the NONROAD model included region specific minimum, maximum, and mean temperatures. Season specific temperatures were used to determine ozone season daily emissions; yearly specific temperatures were used to determine annual emissions.

Spatial Allocation

Emissions were allocated to the 4km grid for Atascosa, Bexar, Comal, Frio, Guadalupe, Medina, and Wilson counties by the location of fields for each type of crop. Crop data for the AACOG region was obtained through the collaboration of the Texas Agricultural Extension Service County Extension Agent, by county, the United States Department of Agriculture Farm Service Agency (USDA/FSA) director, and AACOG staff.[5] Crop information gathered at the respective county extension offices involved the preparation of county maps created by AACOG staff with GIS software containing county roads, cities, rivers, creeks and lakes. These features were necessary to orient the location of 4-km grid cells to their location on aerial photographs. The map was then overlaid with the Comprehensive Air Quality Model with Extensions (CAMx) four-kilometer grid system with each grid cell marked with a unique numerical identifier.

By arranging the USDA/FSA aerial photographs (1:40,000 scale) in a grid, closely matching the UAM grid system, land usage in a photograph could be interpreted for each CAMx grid square. The aerial photograph was first matched to its corresponding grid square and the grid square boundaries established. Next, the County Agent and Director of the Farm Service Agency identified all agricultural activity within the aerial photograph using the field notes posted on the photographs and their extensive knowledge of local farm acreage and crops to estimate the percent of land in each grid square cultivated for the following crops:

- Sorghum
- Small Grains
- Hay
- Peanuts

[5] Alamo Area Council of Governments, Oct. 1999. 1996 Emission Inventory for the Alamo Area Council of Governments Region. San Antonio, Texas.

- Corn
- Other Crops (orchards, plant nursery's, etc.)
- Vegetables
- Cotton

The aerial photographs were marked for cultivated fields, their size, and their case number, which assisted the agents in identifying the size of cultivated fields and the type of crops. Other informational sources were used when necessary including:

- *Soil Interpretive Map* – overlaid with the AACOG county map, was used in determining the location of known farming operations within each grid square and the exact crops cultivated within one percent of the four-kilometer grid.
- *Square Template* – cut with the inside made the exact size of the four-kilometer grid square by size to the scale of the aerial photographs. The template limited the contents of the grid square, allowing simplified interpretation.

Cultivated fields of small grains, sorghum, corn, peanuts, vegetables, and cotton crops were identified and sized first, followed by hay meadows and then any special use land such as urban or water; the remaining acreage identified as unimproved rangeland or "range". Table 2-7 is an example of a grid data cell. In this case, cultivated corn crops were estimated to cover 10% of the 4-km grid square; sorghum covered 5%. This accounted for 15% of the acreage. No special usage was identified, thus the remaining 85% was marked as range.

Table 2-7. Typical Agricultural Grid Data Cell

Cell Number	29-48
Range	85%
Corn	10%
Hay	
Peanuts	
Sorghum	5%
Vegetables	
Cotton	
Small Grains	
Urban	
Water	
Total	100%

Commercial Boating

The only constant commercial boating in the 12-county AACOG region is Rio San Antonio Cruises (formerly Yanaguana Cruise)[6] and the San Antonio Park Rangers on the Riverwalk in downtown San Antonio. Rio San Antonio Cruises offers boat tours of the Riverwalk, chartered tours, and dinner and cocktail cruises. A boat taxi with 39 stops is also offered to customers. During special events, the barges are used for parade purposes along the river.

Rio San Antonio Cruises has 40 barges that operate on CNG. The city of San Antonio has 16 CNG maintenance barges and San Antonio Park Rangers has four CNG motorboats for the

[6] Rio San Antonio, Rio San Antonio Cruises, Available online: http://www.riosanantonio.com/

river walk.[7] Since there are only a few Rio San Antonio Cruises barges and San Antonio boats, and they operate on clean burning fuel (CNG), the emissions are insignificant and will not be included in the emission inventory.

Commercial Equipment

The 2005 commercial equipment emissions inventory includes emission estimates from the use of generator sets, pumps, air compressors, gas compressors, welders, and pressure washers in the 12-county AACOG region. For each commercial equipment category, emissions were calculated for a variety of engine types: 2-stoke gasoline, 4-stroke gasoline, LPG, CNG, and diesel.

Methodology

Commercial equipment emissions were estimated using local survey data in conjunction with the EPA NONROAD model. The local data were obtained by mailing questionnaires of equipment use to businesses, government agencies, and schools throughout the AACOG region. The survey, a copy of which is included at the end of this section, requested that the respondent provide information regarding the types and quantities of equipment in use, equipment horsepower (HP) ratings, activity levels, and other data. The results of the surveys were then used to modify appropriate NONROAD files such as the equipment activity file, equipment population file, and seasonal adjustment file (Table 2-8) in preparation for conducting the commercial equipment runs.

Table 2-8. NONROAD Files and Factors Modified for Obtained Survey Data

NONROAD File	Factor Modified
ACTIVITY.DAT	Avg. Total Hrs/Yr Use Per Unit
Allocation Files	No Modification
Deterioration Factor Files	No Modification
Emissions Factor Files	No Modification
Growth Files	No Modification
TX.POP	Percentage of units by HP bin
SEASON.DAT	Weekday & Weekend Allocations
Technology Files	No Modification

To adequately represent the population of the 1,892 businesses in the area, 140 responses, identified as commercial equipment operators, for a 95% confidence level and 8% confidence interval for sampling accuracy.[8] This determination was made by using the equation:

Equation (1)

$$RN = [CLV^2 \times 0.25 \times POP] / [CLV^2 \times 0.25 + (POP - 1) CIN^2]$$

Where,

RN = Number of survey responses needed to accurately represent

[7] Park Ranger Workload, Facilities and Equipment, City of San Antonio, p. 13. Available online: http://www.ci.sat.tx.us/performance/pdf/Park%20Ranger%20Report.pdf#search='San%20Antonio%20Park%20Rangers%20river'

[8] Texas Workforce Commission, 2002. Employment Data for 3rd quarter 2001. Austin, Texas.

population of businesses in the AACOG region
CLV = 95% confidence level (1.96)
POP = Business population size for AACOG region (1,892 businesses)
CIN = ± 8% confidence interval (0.08)

The number of responses needed for accurate representation:

RN = [1.96^2 x 0.25 x 1,892 businesses] / [1.96^2 x 0.25 + (1,892 businesses – 1) 0.08^2]

RN = 140 responses

AACOG received 56 responses to the 2002 commercial equipment questionnaire. In order to use an adequate number of survey responses, AACOG staff combined the 2002 questionnaire data with information from a similar survey conducted in the region in 1995 to get the required 140 responses. It was assumed the types of commercial equipment used by business and industry would not have changed greatly between 1995 and 2002. The 1995 survey data from companies who also responded to the 2002 survey were removed from the calculations to avoid double counting.

Activity Rates

Annual activity levels were determined for each equipment category by summing the 1995 and 2002 annual activity responses for an equipment type. The local activity levels were used to update NONROAD "activity.dat" file.

Weekday / Weekend Allocation

To develop weekday and weekend allocation factors for NONROAD "season.dat" file from the survey data, the percentage of weekday hours or weekend hours to total hours were calculated for each SCC and the resulting fraction was divided by either 5 (weekdays) or 2 (weekend days) using the formulas:

Sample Calculation

Equation (2)

Weekday allocation factor for commercial equipment for equipment type A:

$$WDAF_A = [(AU_{WDA} \times 5) / (AU_{WDA} \times 5) + (AU_{WNA} \times 2)] / 5$$

Where,

$WDAF_A$ = Weekday allocation factor for equipment type A
AU_{WDA} = Average weekday usage for equipment type A (hrs/weekday)
AU_{WNA} = Average weekend usage for equipment type A (hrs/weekend day)
5 = Number of weekdays (days)
2 = Number of weekend days (days)

The average hours of use for 4-stroke gasoline welders as calculated from the combined 1995 and 2002 AACOG surveys were 1.419580 hours each weekday and 0.268116 hours each weekend day. Thus, the weekday temporal allocation factor for the 4-stroke welders was calculated as:

$WDAF_A$ = [(1.419580 hrs/wkday x 5 days) / (1.419580 hrs/wkday x 5 days) + (0.268116 hrs/wkend day x 2 days)] / 5 days
= 0.185917 weekday allocation factor

Table 2-9 below compares NONROAD default day-of-the-week adjustment factors with those calculated from the survey data.

Table 2-9. Comparison of Default and Modified Temporal Allocation Data

SCC	Equipment	Engine Type	Default NONROAD Day of Week Adjustment (Mon-Fri)	Day of Week Adjustment Factor (Mon-Fri)	Default NONROAD Day of Week Adjustment (Sat-Sun)	Day of Week Adjustment Factor (Sat-Sun)
2260006005	Generator Set	Gas, 2-cycle	0.1666667	*No Change*	0.0833334	*No Change*
2265006005	Generator Set	Gas, 4-cycle	0.1666667	0.1998067	0.0833334	0.0004833
2267006005	Generator Set	LPG	0.1666667	0.2000000	0.0833334	0.0000000
2268006005	Generator Set	CNG	0.1666667	*No Change*	0.0833334	*No Change*
2270006005	Generator Set	Diesel	0.1666667	0.1995527	0.0833334	0.0011183
2260006010	Pumps	Gas, 2-cycle	0.1666667	*No Change*	0.0833334	*No Change*
2265006010	Pumps	Gas, 4-cycle	0.1666667	0.1970535	0.0833334	0.0073662
2267006010	Pumps	LPG	0.1666667	*No Change*	0.0833334	*No Change*
2268006010	Pumps	CNG	0.1666667	*No Change*	0.0833334	*No Change*
2270006010	Pumps	Diesel	0.1666667	0.2000000	0.0833334	0.0000000
2260006015	Air Compressors	Gas, 2-cycle	0.1666667	*No Change*	0.0833334	*No Change*
2265006015	Air Compressors	Gas, 4-cycle	0.1666667	0.1969462	0.0833334	0.0076346
2267006015	Air Compressors	LPG	0.1666667	*No Change*	0.0833334	*No Change*
2268006015	Air Compressors	CNG	0.1666667	0.2000000	0.0833334	0.0000000
2270006015	Air Compressors	Diesel	0.1666667	0.1993875	0.0833334	0.0015313
2268006020	Gas Compressors	CNG	0.1666667	*No Change*	0.0833334	*No Change*
2270006020	Gas Compressors	Diesel	0.1666667	*No Change*	0.0833334	*No Change*
2265006025	Welders	Gas, 4-cycle	0.1666667	0.1859517	0.0833334	0.0351207
2267006025	Welders	LPG	0.1666667	0.1940299	0.0833334	0.0149254
2270006025	Welders	Diesel	0.1666667	0.2000000	0.0833334	0.0000000
2265006030	Pressure Washers	Gas, 4-cycle	0.1666667	0.1841368	0.0833334	0.0396580
2267006030	Pressure Washers	LPG	0.1666667	*No Change*	0.0833334	*No Change*
2270006030	Pressure Washers	Diesel	0.1666667	0.2000000	0.0833334	0.0000000

Average Horsepower and Equipment Population

Average horsepower ratings for each equipment type were determined from the survey data based on the HP ranges used in the 2004 version of the NONROAD model. The average HP ratings per range were calculated utilizing the same formula used as to determine average equipment activity levels. The NONROAD “TX_pop” file was modified by changing the model’s default average HP for each bin in an equipment category to the average HP within that range as calculated from the combined 1995 and 2002 survey data.

In the absence of an appropriate methodology to grow the 1995 equipment population to the year 2002, the *total* equipment population for each SCC (the sum of equipment in each HP range for an equipment category in the NONROAD default file) was not updated in the equipment population file. Instead, the total population for each equipment type in the default file was allocated to a horsepower bin based on the percentage of equipment in the range as determined from the 1995 and 2002 survey results. If there were no pieces of equipment listed in the 1995 or 2002 surveys for a certain HP range, the population for the bin was changed to

0.0. Several types of light commercial equipment, such as CNG generator sets, were not reported in either the 1995 or 2002 survey results. For instances such as these, the default HP, activity levels, and daily allocation factors were left unmodified from the default data. T

Seasonal Adjustment

Neither the 1995 nor 2002 surveys requested information regarding the use of equipment during the ozone season versus other times of the year. As a consequence, no adjustments were made to the NONROAD seasonal allocation factors. Therefore, the summer season weekday emission estimations in the 2002 commercial equipment inventory are based on the model's default allocations for the southwest region during June, July, and August.

Sample Survey Questionnaire

A sample of the questionnaire sent to businesses, government agencies, and schools throughout the 12-county AACOG region to facilitate development of the 2002 equipment emissions inventory is provided on the following pages.

Alamo Area Council of Governments
Equipment Environmental Impact Survey
Internal Combustion Exhaust

The Alamo Area Council of Governments (AACOG) is conducting a study to assess and quantify local air quality within the San Antonio Metropolitan area and contiguous counties by performing an emission inventory. AACOG has defined the study area to include Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. Our goal is to provide better information and services to businesses and individuals, and help minimize additional regulation on the community. The purpose of this survey is to gather data on emissions produced by several types of equipment in the region.

The study area does not presently exceed Environmental Protection Agency (EPA) air quality standards. However, if the standards are exceeded in the future we will be classified as nonattainment, which will result in expensive and stringent regulations for your business and the community. By filling out this confidential survey, you will be providing valuable data that will be used to evaluate cost-effective approaches to pollution control. Thank you for taking the time to provide this information.

Instructions:
1. Please look through the equipment types shown on the following page.
2. List any of the equipment types regularly operated at your business.
3. Fill in the appropriate figures for each equipment type you listed. (Estimates are acceptable.)

If you have other internal combustion equipment that is not shown, please include it as well.

NOTE: IF YOUR BUSINESS HAS MORE EQUIPMENT THAN WILL FIT IN THE SPACE PROVIDED, PLEASE MAKE ADDITIONAL COPIES OF THE SURVEY.

Completed surveys can be faxed to (210) 225-5937, or mailed to:
Alamo Area Council of Governments
8700 Tesoro, Suite 700
San Antonio, Texas 78217
Attn: Chris Langston

If you have any questions or comments, please call us at (210) 362-5270.

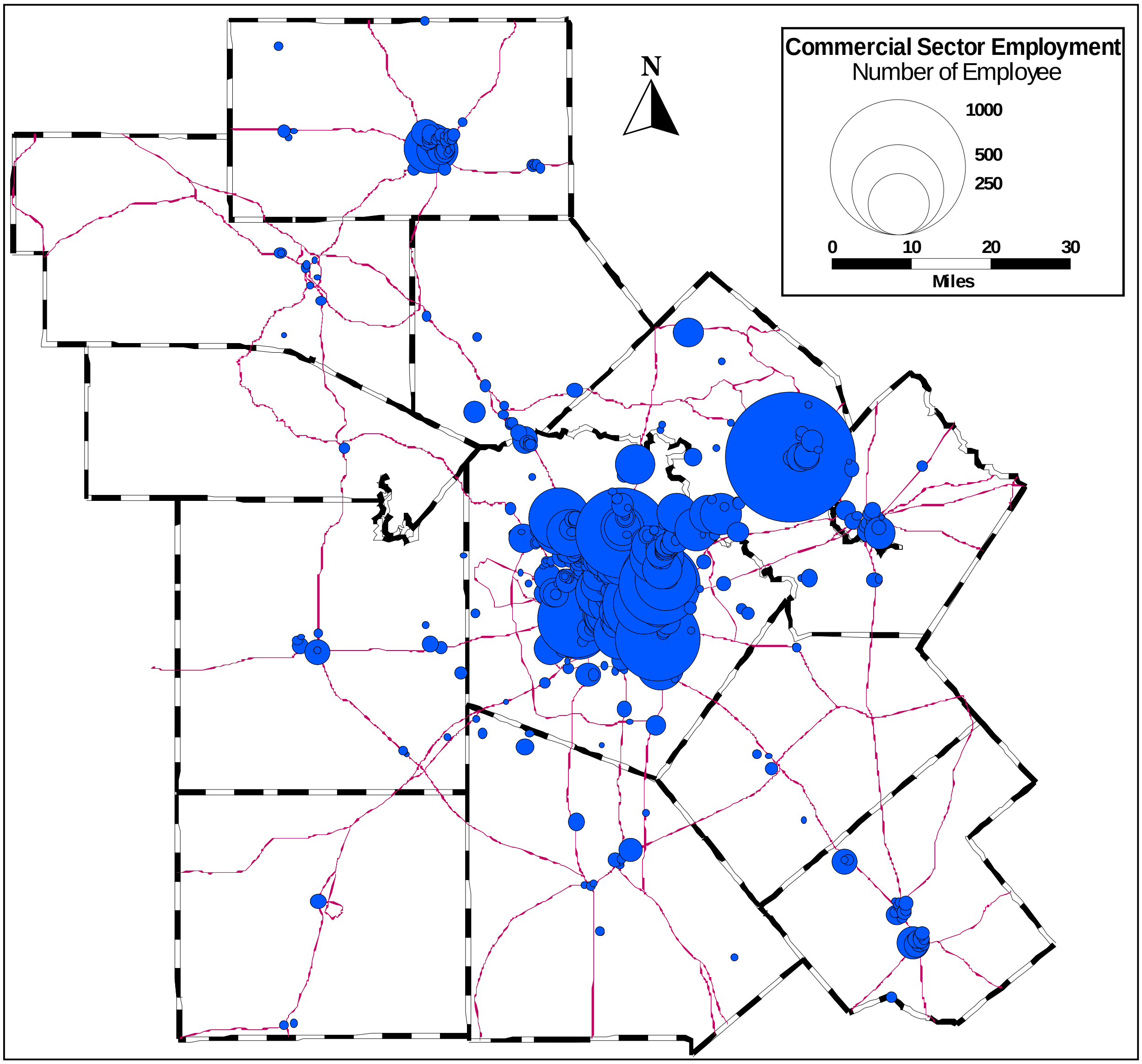
SURVEY STARTS ON THE OTHER SIDE OF THIS PAGE

	Internal Combustion Equipment Type	Engine Type Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
			Industrial & Commercial Equipment			
1	Generators					
2	Pumps					
3	Compressors					
4	Welders					
5	Pressure Washers					
6	Aerial Lifts					
7	Forklifts					
8	Sweepers/Scrubbers					
9	AC/Refrigeration					
10	Terminal Tractors					
11	Single Board Light Plants					
12	Other General Industrial or Material Handling Eqmt. Type:____________					

	Internal Combustion Equipment Type	Engine Type Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
Construction Equipment						
1	Bore/Drill Rigs					
2	Excavators					
3	Concrete & Mortar Mixers					
4	Cranes					
5	Graders					
6	Crushing/Processing Eqmt.					
7	Rough Terrain Forklifts					
8	Rubber Tire Loaders					
9	Other Loaders					
10	Dozers					
11	Tractors/Backhoes					
12	Scrapers					
13	Rollers					
14	Trenchers					
15	Pavers					
16	Other Construction Equipment Type: ___________					

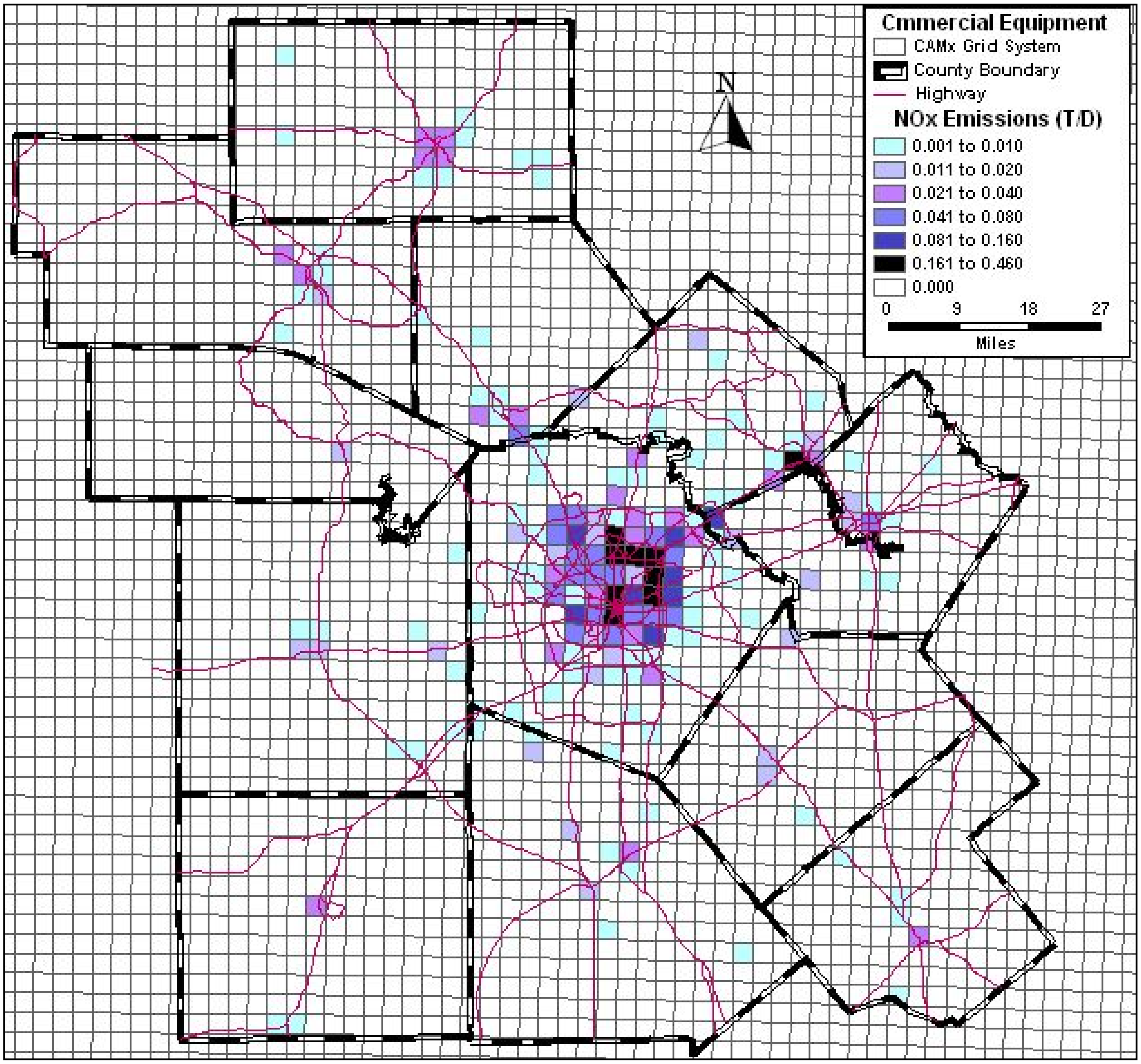
Spatial Distribution
Emissions are allocated on the 4km grid by the location of commercial equipment employment (Figures 2-1 and 2-2).

Figure 2-1. 2005 Spatial Distribution of Employment Centers for Commercial Sector



Plot Date: March 22, 2007
Map Compilation: March 19, 2007
Source: TIGER files, 2004 Texas Work Force Employment Data, Local Survey Data

Figure 2-2. 2005 Spatial Distribution of NOx Emissions from Commercial Equipment



Plot Date: April 24, 2007
Map Compilation: March 19, 2007
Source: TIGER files, 2004 Texas Work Force Employment Data, Local Survey Data

Commercial Lawn and Garden Equipment

Commercial Lawn and Garden equipment can be broken down into 8 categories:

- Golf Courses
- Public Schools
- Universities/Colleges
- Commercial Lawn and Garden Companies (both for residential properties and commercial properties)
- Non-Military Government Facilities, Parks, and Hospitals
- Other Commercial Companies

- Cemeteries
- Airports and Military Bases (Small Airports, Commercial Airports, Army Bases, and Air Force Bases)

Lawn and garden equipment used at airports or Military Bases is covered within Chapter 3, Airport and Military Emissions. Cemetery lawn and garden equipment were not included because the emissions are expected to be very small, as cemeteries do not cover a large improved land area in the San Antonio region. Also, AACOG did not receive enough survey responses from cemeteries to be statistically significant. This section will cover lawn and garden equipment emissions from golf courses, public schools, universities/colleges, commercial companies, and non-military government facilities, parks, and hospitals.

This inventory takes into account the following types and categories of equipment:

- 2260004016 2-stroke commercial rotary tillers
- 2265004016 4-stroke commercial rotary tillers
- 2260004021 2-stroke commercial chain saw
- 2260004026 2-stroke commercial trimmer/Edger/Brush Cutter
- 2265004026 4-Stroke commercial trimmer/Edger/Brush Cutter
- 2260004030 2-stroke commercial leaf blower/vacuums
- 2265004030 4-stroke commercial leaf blower/vacuums
- 2260004071 2-stroke commercial turf equipment
- 2265004071 4-stroke commercial turf equipment
- 2270004071 Diesel commercial turf equipment
- 2265004011 4-stroke commercial lawnmower
- 2265004041 4-stroke commercial rear engine riding mower
- 2265004046 4-stroke commercial front mower
- 2265004051 4-Stroke commercial Shredder
- 2265004056 4-Stroke commercial Lawn and Garden Tractors
- 2270004056 Diesel commercial Lawn and Garden Tractors
- 2265004066 4-Stroke commercial Chipper/Stump Grinder
- 2267004066 LPG commercial Chipper/Stump Grinder
- 2270004066 Diesel commercial Chipper/Stump Grinder
- 2265004076 4-stroke commercial other lawn and garden equipment
- 2270004076 Diesel commercial other lawn and garden equipment

Methodology – Golf Courses

The methodology used in producing golf courses' lawn and garden equipment emission estimates for the AACOG region relies on local data produced from surveys and on national data used in the EPA NONROAD Emission Inventory Model in the absence of reliable local data. The methodology involves the following steps:

1. Conducting a survey of local golf course lawn and garden equipment activity to determine local equipment use rates and equipment characteristics.

2. Determining equipment population and activity for golf courses without local data. This was accomplished by applying an average acre to equipment ratio of those golf course sites with available equipment population data to those golf courses without data.

3. Conduct a second survey with estimations of local golf course equipment activity at each golf course. The golf courses were asked to make corrections and send back the survey.

4. Estimating VOC, NOx, and CO annual emissions by inputting local data into the NONROAD model for equipment populations and converting the tons/year estimate into an estimate for a typical weekday (tons/day) for the summer ozone season.

Step 1: Conduct a Survey of Equipment Activity for Local Golf Courses
The preferred method for calculating golf course equipment emissions involves conducting a survey of equipment use within the AACOG region (a copy of which is attached to the end of this section). There are 54 large private and public golf courses in the AACOG region. Names and addresses of these companies, and the responses from these companies remained confidential through the use of proprietary codes. Due to a lack of responses, data for only two golf courses was collected.

The survey provided the following information for the two golf courses:

- Activity Rates (HRS) – total annual hours of use by type of equipment
- Temporal Profiles – equipment use on weekdays and equipment use on weekend days for all types of equipment
- Engine Characteristics:
  - Engine Type – gasoline 2-stroke, gasoline 4-stroke, diesel, LPG, CNG
  - Engine Horsepower – rated power of the engine

Step 2: Determine County Equipment Population for Golf Courses that Have Missing Local Data.
Aerial photography was used to determine the improved acres for each golf course that did not respond to the survey. The equipment population had to be estimated based on number of improved acres at these golf course. An acre to equipment ratio was calculated for golf courses by dividing the total pieces of equipment counted for each category by the total number of acres. This ratio was used to calculate estimated equipment populations for the remaining golf courses. The number of acres of a golf course was multiplied by the equipment ratio and the result was rounded to the nearest whole number.

Sample Calculation
Equation (1)
Equipment to acre ratio for golf courses:

$$R = EQ_A / AC$$

Where,

R = Ratio of equipment type A per acre
EQ_A = Total pieces of equipment type A
AC = Total number of acres for golf courses in that responded to the survey

Estimated number of tractors per acre of golf course in the AACOG region:

POP_A = 9 / 1,316
= 0.00684

Equation (2)
Estimated equipment population by equipment type:

$$POP_A = AC_A \times R_A$$

Where,

POP_A = Population of equipment type A
AC_A = Number of acres for the golf course A
R_A = Ratio of equipment type A per acre

Estimated number of tractors for a 260 acre golf course in the AACOG region:

POP_A = 260 x 0.00684
= 1.78
= 2 tractors

Step 3: Conduct a Second Survey of Equipment Activity for Golf Courses

After analyzing aerial photographs / district appraisal data of golf courses and calculating estimations for equipment, a second survey was sent out to the local golf courses with the estimations of their equipment population, HP, and activity hours. This survey used the same format as the initial survey. Companies were asked to correct the estimations and send the surveys back to AACOG. There was a 15 percent response rate to the second survey.

Step 4: Estimate Annual Emissions of Ozone Precursors

Once county level equipment population was calculated, emissions of volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) were calculated using NONROAD Model 2004. In using the NONROAD model, some adjustments were made for local conditions.

Table 2-10. Golf Course Equipment Population Estimations Based on AACOG Survey

Golf Course Lawn and Garden Equipment	SCC	Engine Type	Estimated Equipment Population	Hours/Year per piece of equipment	NONROAD model Default Hours	Adjustment factor	New Equipment populations
Chain Saws	2260004021	Gasoline 2-cycle	48	57	303	0.19	9
Trimmers/ Edgers/ Brush Cutters	2260004026	Gasoline 2-cycle	90	489	137	3.57	321
Leaf Blowers/ Vacuums	2260004031	Gasoline 2-cycle	97	735	282	2.60	253
Lawn Mowers	2265004011	Gasoline 4-cycle	34	530	406	1.31	44
Rotary Tillers	2265004016	Gasoline 4-cycle	14	131	472	0.28	4
Rear Engine Riding Mowers	2265004041	Gasoline 4-cycle	90	1,420	569	2.49	225
Front Mowers	2265004046	Gasoline 4-cycle	123	1,255	86	14.59	1,795
Commercial Turf Equipment/ Sod Cutters	2265004071	Gasoline 4-cycle	192	1,280	682	1.88	360
Commercial Mowers	2270004046	Diesel	137	1,252	480	2.61	357
Lawn and Garden Tractors	2270004056	Diesel	62	793	433	1.83	113
Chippers/ Stump/ Grinders/ Mulchers	2270004066	Diesel	14	131	465	0.28	4
Total			901				3,485

Population File
The equipment population, activity hours and horsepower for each golf course were added up and compiled into a master spreadsheet by county. The equipment population estimated from the survey was multiplied by the ratio of the activity hours from the survey over the default NONROAD model hours. The default NONROAD hours in the model were low for most equipment. In particular, front-engine mower hours were very low in the NONROAD model (86 hours per year). Golf courses need regular lawn maintenance and require extensive use of equipment.

Two of the three categories that had higher default hours in the NONROAD model are chain saws and chippers/stump grinders. Very often golf courses do not need to use this equipment once the course is built. A number of survey respondents indicated they only use this equipment after a flood. Once the adjustment factor was calculated, this master spreadsheet was converted into the population file for the NONROAD model. Table 2-10 lists the breakdown for each type of equipment.

Also, the allocation file was updated with the horsepower (HP) estimates from the survey. Table 2-11 lists the default NONROAD 2004 HP and the calculated average HP from the survey responses. In almost all cases, the horsepower levels were very similar between the default values and the survey responses. However, golf courses tended to use larger front-engine mowers, commercial turf equipment and lawn and garden tractors. For the NONROAD run, equipment populations were allocated to horsepower bins based on survey responses.

Table 2-11. Golf Course Equipment HP Estimations Based on AACOG Survey

Golf Course Lawn and Garden Equipment	Engine Type	SCC	NONROAD model Default HP	Estimated Equipment HP
Chain Saws	Gasoline 2-cycle	2260004021	3.5	3.5
Trimmers/ Edgers/ Brush Cutters	Gasoline 2-cycle	2260004026	1.5	1.5
Leaf Blowers/ Vacuums	Gasoline 2-cycle	2260004031	2.0	2.0
Lawn Mowers	Gasoline 4-cycle	2265004011	4.1	3.7
Rotary Tillers	Gasoline 4-cycle	2265004016	4.7	4.7
Rear Engine Riding Mowers	Gasoline 4-cycle	2265004041	10.7	10.7
Front Mowers	Gasoline 4-cycle	2265004046	13.5	27.6
Commercial Turf Eq./ Sod Cutters	Gasoline 4-cycle	2265004071	12.6	18.1
Commercial Mowers	Diesel	2270004046	29.1	26.0
Lawn and Garden Tractors	Diesel	2270004056	21.0	47.9
Chippers/ Stump/ Grinders/ Mulchers	Diesel	2270004066	143.9	142.4

Allocation File
An allocation file was made to properly allocate emissions for each county. The file was made by taking the default landscape allocation file for Texas (TX_LSCAP.AOL), then replacing values (employees in landscape and horticulture service) with zero for all counties except those in the study area. The values for the AACOG region were allocated based on the number of acres for golf courses in each county (Table 2-12). The values of the counties were added up and the total was used to replace the value for the entire State of Texas. This allowed the NONROAD model to calculate emissions for the AACOG region as a whole and distribute the emissions to each county appropriately. Figure 2-3 shows the location of Golf Courses in the AACOG region.

Table 2-12. Allocation of Golf Course Equipment in the AACOG Region, 2005

FIPS	County	Total Acres (Indicator value)	Percentage
48013	Atascosa	142	1.6%
48019	Bandera	595	6.7%
48029	Bexar	4075	46.0%
48091	Comal	511	5.8%
48163	Frio	0	0.0%
48171	Gillespie	210	2.4%
48187	Guadalupe	687	7.8%
48255	Karnes	160	1.8%
48259	Kendall	300	3.4%
48265	Kerr	1673	18.9%
48325	Medina	335	3.8%
48493	Wilson	165	1.9%
48000	AACOG	8852	100.0%

Activity File
Hours per year were based on the data in table 2-13 for each type of equipment calculated based on the returned surveys.

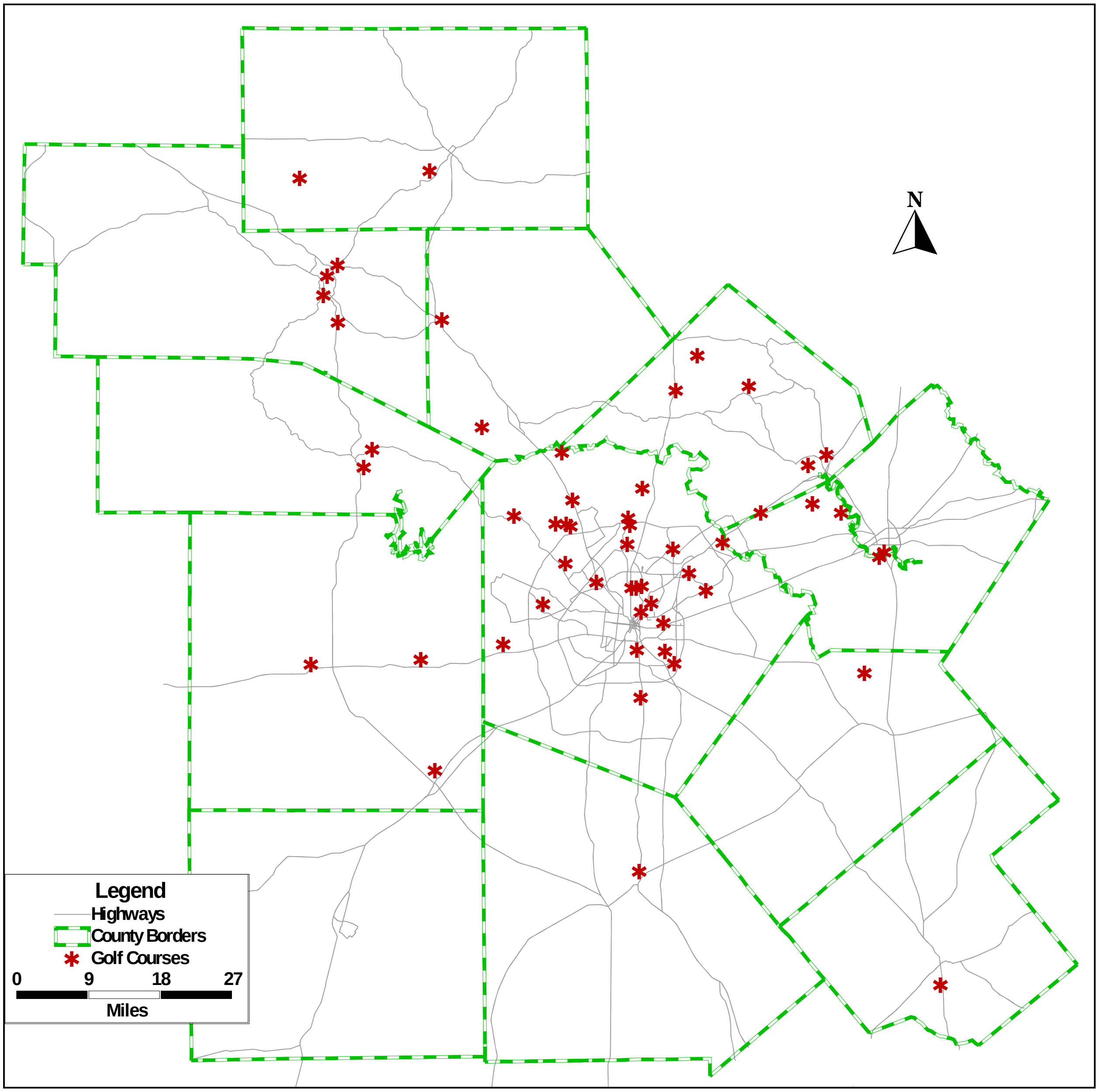
Table 2-13. Golf Equipment Survey Results for Average Weekday Hours of Usage – AACOG Region, 2005

Commercial Lawn & Garden Equipment	Engine Type	Avg. # Hrs. Ea. Unit is Operated Weekday	Avg. # Hrs. Ea. Unit is Operated Weekend
Chain Saws	Gasoline 2-cycle	0.2	0.1
Trimmers/ Edgers/ Brush Cutters	Gasoline 2-cycle	1.7	0.3
Leaf Blowers/ Vacuums	Gasoline 2-cycle	2.8	0.1
Lawn Mowers	Gasoline 4-cycle	1.4	1.3
Rotary Tillers	Gasoline 4-cycle	0.5	0.0
Rear Engine Riding Mowers	Gasoline 4-cycle	4.0	3.5
Front Mowers	Gasoline 4-cycle	4.0	1.7
Commercial Turf Equipment/ Sod Cutters	Gasoline 4-cycle	4.1	1.8
Rear Engine Riding Mowers	Diesel	4.4	0.8
Lawn and Garden Tractors	Diesel	2.9	0.3
Chippers/ Stump/ Grinders/ Mulchers	Diesel	0.5	0.0

Season File
A weekday versus weekend adjustment factor of 0.174323 per weekday and 0.064193 per weekend day was used in the calculations. The results were based on the total hours for each time period from the AACOG survey.

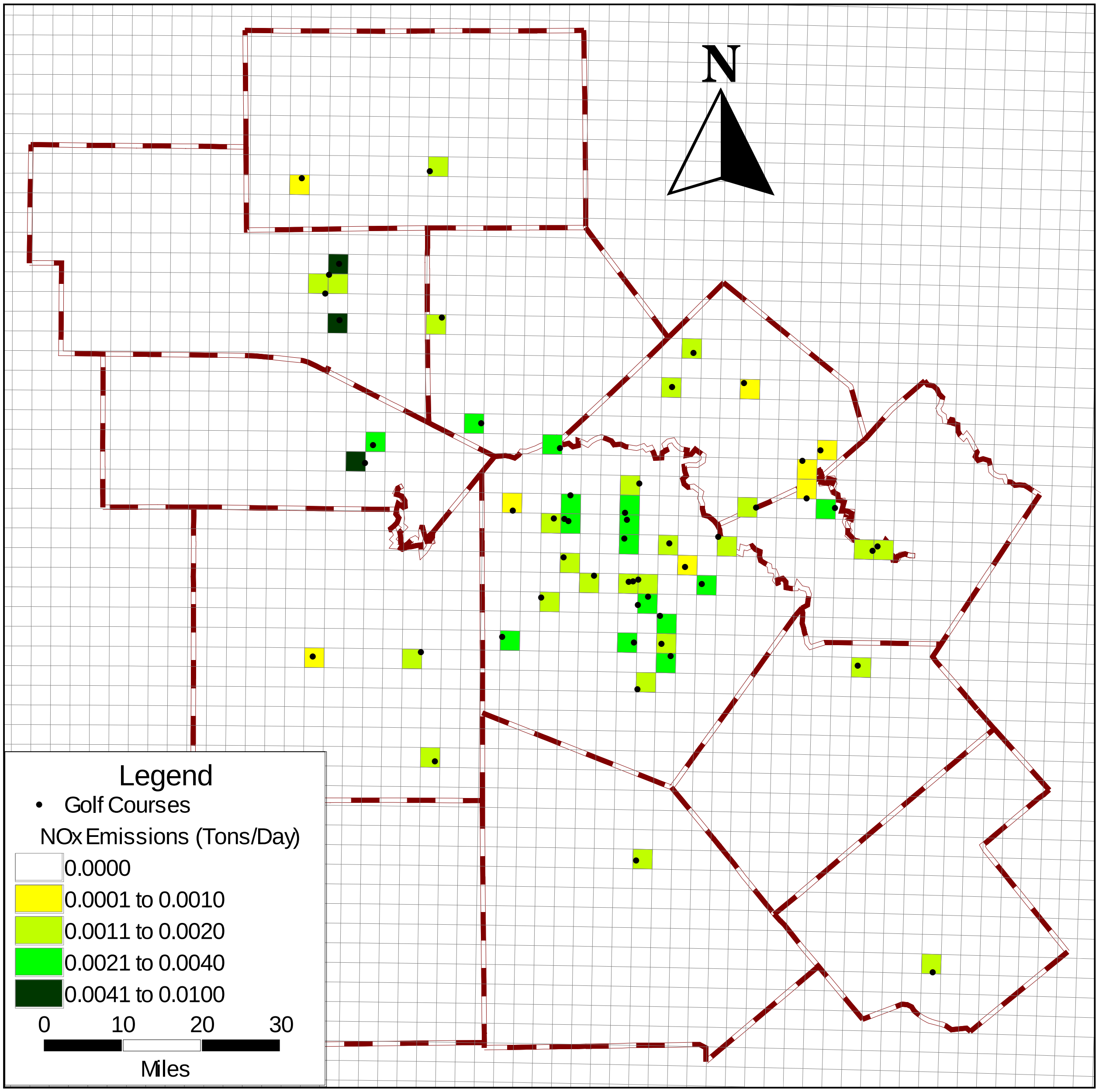
Spatial Distribution
Emissions are allocated on the 4km grid by the location of the golf courses (Figure 2-4).

Figure 2-3. Location of Golf Courses in the AACOG Region, 2005



Plot Date: Jul 15, 2005
Compilation Date: Jul 14, 2005
Source: Aerial Photography, District Appraisal Data, and Telephone Survey

Figure 2-4. Golf Courts Diesel Lawn and Garden Equipment NOx Emission, 2005



Plot Date: November 9, 2005
Map Compilation: October 12, 2005
Source: Aerial Photography, District Appraisal Data, and Telephone Survey

DRAFT

Alamo Area Council Of Governments

October 3, 2004

[COMPANY NAME]
[STREET ADDRESS]
[CITY] [STATE] [ZIP]

ATTENTION: OPERATIONS MANAGER

Re: San Antonio Regional Emissions Inventory

The Alamo Area Council of Governments (AACOG) requests your assistance in the development of the air quality emission inventory for Bexar County and the surrounding counties. AACOG is conducting this inventory in order to assess and quantify local air quality within the metropolitan area of San Antonio and contiguous counties. This inventory is especially significant because the San Antonio region has been declared in non-attainment deferred of federal air quality standards, the National Ambient Air Quality Standards.

AACOG will calculate the equipment source component of this inventory from information submitted by local organizations involved in landscaping, lawn and garden and such activities in and around the San Antonio region using the enclosed survey. With this survey, we are requesting information on any lawn and garden, construction, or industrial equipment used during the 2004 calendar year within Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. The purpose of this survey is to provide better information and services to the region, as well as help minimize additional regulation on the community.

Your input is vital to this process and will serve to achieve a true and correct emissions inventory. Please provide your responses on the attached survey and return it to us in the self-addressed envelope by the date indicated. The information you provide will be considered strictly confidential and unavailable to public information requests. Please submit your response by October 20, 2004.

Thank you for your time and participation. If you have any questions or comments please feel free to contact Steven Smeltzer at (210) 362-5266.

Regionally yours,

Al J. Notzon III
Executive Director
Enclosures (2)

	Internal Combustion Equipment Type	Engine Type Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas Electric	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
COMMERCIAL LAWN AND GARDEN EQUIPMENT						
1	Lawn Mowers					
2	Rear Engine Riding Mowers					
3	Front Mowers					
4	Rotary Tillers					
5	Chain Saws					
6	Chippers/Stump Grinders/Mulchers					
7	Trimmers/Edgers/ Brush Cutters					
8	Commercial Turf Equipment/ Sod Cutters					
9	Leaf Blowers/ Vacuums					
10	Lawn and Garden Tractors					
11	Shredders					
12	Other Lawn and Garden Equipment: (Please Describe): ________________					

Methodology – Public Schools and University/Colleges

The methodology used in calculating emission volumes from lawn and garden equipment at public schools and university/colleges in the AACOG region relied on local data, produced from surveys, and when necessitated, on national data used in EPA's NONROAD Emission Inventory Model. The methodology involved the following steps:

1. Conducting a survey of local public schools and university/college lawn and garden equipment activity to determine local equipment use rates and equipment characteristics.

2. Determining equipment population and activity for public schools and university/colleges without local data. For public schools, this was accomplished by applying an average number of schools in each school district to equipment ratio of those school districts with available equipment population data to those school districts without data. For universities/colleges, this was accomplished by applying an average acre to equipment ratio of those university/college sites with available equipment population data to those university/college sites without data.

3. Conducting a second survey with estimations of local public schools and university/colleges equipment activity. The public schools and universities/ colleges were asked to make corrections and send back the survey.

4. Estimating VOC, NOx, and CO annual emissions by inputting local data into the NONROAD model for equipment populations and converting the tons/year estimate into an estimate for a typical weekday (tons/day) for the summer ozone season.

Step 1: Conduct a Survey of Local Schools Equipment Activity

The preferred method for calculating public school and university/college equipment emissions involves conducting a survey of equipment use within the AACOG region. There are 14 universities and colleges in the San Antonio region. Likewise, there are 46 school districts in the AACOG region representing 624 public schools.[9] Only school districts were included in the public school categories. Small private schools were assumed to contract out there lawn and garden equipment with commercial companies and emissions from this equipment is insignificant.

Names and addresses of these schools and their responses remained confidential throughout the survey process through the use of proprietary codes. The survey had excellent response rates for both categories.

The survey provided the following information for public schools and Universities/ colleges:

- Activity Rates (HRS) – total annual hours of use by type of equipment
- Temporal Profiles – equipment use on weekdays and equipment use on weekend days for all types of equipment
- Engine Characteristics:
    - Engine Type – gasoline 2-stroke, gasoline 4-stroke, diesel, LPG, CNG
    - Engine Horsepower – rated power of the engine

[9] National Center for Education Statistics (last accessed June 17, 2005). Search for Public School Districts. Available online: http://nces.ed.gov/ccd/districtsearch/

Step 2: Determine County Equipment Population for Schools without Local Data.
Aerial photography was used to determine the number of improved acres for each university/college. The equipment population estimations were based on the number of improved acres at each university/college that did not provide a survey response.

An acre to equipment ratio was created for universities/colleges by dividing the total pieces of equipment counted for each category by the total number of acres. This ratio was used to calculate estimated equipment population for the remaining university/college sites. The number of acres for a university/college was multiplied by the equipment ratio to get the estimated number of equipment pieces.

Sample Calculation
Equation (1)
Equipment to acre ratio for college/university sites:

$$R_A = EQ_A / AC$$

Where,

R_A = Ratio of equipment type A per acre
EQ_A = Total pieces of equipment type A
AC = Total number of acres for college/universities that responded to the survey

Estimated number of chainsaws per acre of university in the AACOG region:

$$POP_A = 12 / 832.19$$
$$= 0.0144$$

Equation (2)
Estimated equipment population by SCC category:

$$POP_A = AC_A \times R_A$$

Where,

POP_A = Population of equipment type A
AC_A = Number of acres for college/university A
R_A = Ratio of equipment type A per acre

Estimated number of chainsaws for university A:

$$POP_A = (114) \times (0.0144)$$
$$= 1.64$$
$$= 2 \text{ chainsaws}$$

A similar method was use to calculate equipment at public schools, but it was based on the number of schools in each school district. School districts were used instead of individual schools because school districts often have one central maintenance department for the whole district.

Equation (3)
Equipment to school ratio for public school districts:

$$R_A = EQ_A / SD$$

Where,

R_A = Ratio of equipment type A to school
EQ_A = Total pieces of equipment type A
SD = Total number of public schools that responded to the survey

Estimated number of trimmers per school in the AACOG region:

POP_A = 228 / 266
= 0.8571

Equation (4)
Estimated equipment population by SCC category:

$$POP_A = SD_A \times R_A$$

Where,

POP_A = Population of equipment type A for school district A
SD_A = Number of school in school district A
R_A = Ratio of equipment type A to school

Estimated number of trimmers for school district A:

POP_A = (12) x (0.8571)
= 10.29
= 10 trimmers

Step 3: Conduct a Second Survey of Schools Equipment Activity

After analyzing the equipment for each school district or university/college and calculating estimates of equipment, a second survey was sent out to local schools with the estimates of their equipment populations, HP, and activity hours. This survey used the same format as the initial survey. The schools were asked to correct the estimations and to send the surveys back to AACOG. There was a 43 percent response rate to the second survey for public schools. Sixty-two percent of universities/colleges responded to the survey. The increased response rate improved equipment estimations

In order to draw conclusions about this population, the goal of the survey was to receive as many responses as possible. Since a response from the total population was not realistic, determining how many responses would be necessary to accurately make conclusions about the population was an important question. Due to factors such as budget and time constraints, a 95 percent level of confidence was chosen. The level of confidence is the risk of error the researcher is willing to accept. The confidence interval, or the level of sampling accuracy, was set at ± 5%. The following equation was used to determine the number of responses needed for a 95% level of confidence, and a ± 5% confidence interval.[10]

Sample Calculation

Equation (5)
Number of survey responses required representing an accurate school population:

$$RN = [CLV^2 \times 0.25 \times POP] / [CLV^2 \times 0.25 + (POP - 1) CIN^2]$$

Where,

RN = Number of survey responses needed to accurately represent

[10] Rea, L.M. and Parker, R.A., 1992. Designing and Conducting Survey Research. Jossey-Bass Publishers: San Francisco.

population of schools in the AACOG region
CLV = 95% confidence level (1.96)
POP = School population for AACOG region, 637 schools (13 Universities/Colleges and 624 Public Schools)
CIN = ± 5% confidence interval (0.05)

The number of responses needed for accurate representation:

RN = $[1.96^2 \times 0.25 \times 637 \text{ schools}] / [1.96^2 \times 0.25 + (637 \text{ schools} - 1)\ 0.05^2]$

RN = 239.9 responses

Thus, 240 survey responses were needed in order to meet the 95% level of confidence, and the ±5% confidence interval. There were 274 schools responding to the survey. This number satisfies the desired number of responses.

Step 4: Estimate Annual Emissions of Ozone Precursors

Once county level equipment populations were determined, emissions of volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) were calculated using NONROAD Model 2004. Two separate runs of the NONROAD model were completed: one run for public schools and one run for universities/colleges. In using the NONROAD model, some adjustments were made for local conditions.

Population File

The equipment population and horsepower for each public school and university/college were added up and compiled into a master spreadsheet by county. The equipment population estimated from the survey was multiplied by the ratio of activity hours from the survey to the default NONROAD model hours.

The default NONROAD hours in the model were low for most equipment. In particular, gasoline 4-cycle front-engine mower hours were very low in the NONROAD model at only 86 hours per year. Shredders also had low activity values in the NONROAD model at 61 hours for gasoline 4-cycle and 120 hours for diesel-powered equipment per year. Once the adjustment factor was calculated, this master spreadsheet was converted into the population file for the NONROAD model. The following table 2-14 lists the breakdown for each type of equipment.

Table 2-14. Public Schools Equipment Population Based on AACOG Survey

Public Schools Lawn and Garden Equipment	SCC	Engine Type	Estimated Equipment Population	Hours/Year per piece of equipment	NONROAD model Default Hours	Adjustment factor	New Equipment populations
Chain Saws	2260004021	Gasoline 2-cycle	63	241	303	0.79	50
Trimmers/ Edgers/ Brush Cutters	2260004026	Gasoline 2-cycle	535	1,040	137	7.59	4,060
Leaf Blowers/ Vacuums	2260004031	Gasoline 2-cycle	218	490	282	1.74	379
Lawn Mowers	2265004011	Gasoline 4-cycle	246	783	406	1.93	475
Rotary Tillers	2260004016	Gasoline 4-cycle	13	167	472	0.35	5
Rear Engine Riding Mowers	2265004041	Gasoline 4-cycle	33	1,454	569	2.56	84
Front Mowers	2265004046	Gasoline 4-cycle	14	1,385	86	16.11	232
Shredders	2265004051	Gasoline 4-cycle	7	1,175	61	19.25	136
Lawn and Garden Tractors	2265004056	Gasoline 4-cycle	178	1,099	721	1.52	272
Commercial Turf Equipment/ Sod Cutters	2265004071	Gasoline 4-cycle	5	1,305	682	1.91	9
Commercial Mowers	2270004046	Diesel	21	1,247	480	2.60	55
Lawn and Garden Tractors	2270004056	Diesel	61	1,022	433	2.36	144
Chippers/ Stump/ Grinders/ Mulchers	2270004066	Diesel	5	653	465	1.40	7
Commercial Turf Equipment/ Sod Cutters	2270004071	Diesel	4	1,168	1,068	1.09	5
Shredders	2270004051	Diesel	5	1,697	120	14.14	66
Total			1,405				5,979

Table 2-15. Universities/Colleges Equipment Populations Based on AACOG Survey

University/College Lawn and Garden Equipment	2260004021	Gasoline 2-cycle	Estimated Equipment Population	Hours/Year per piece of equipment	NONROAD model Default Hours	Adjustment factor	New Equipment population
Chain Saws	2260004021	Gasoline 2-cycle	18	449	303	1.48	26
Trimmers/ Edgers/ Brush Cutters	2260004026	Gasoline 2-cycle	44	995	137	7.26	320
Leaf Blowers/ Vacuums	2260004031	Gasoline 2-cycle	32	716	282	2.54	82
Lawn Mowers	2265004011	Gasoline 4-cycle	22	376	406	0.93	20
Rotary Tillers	2265004016	Gasoline 4-cycle	4	351	472	0.74	3
Rear Engine Riding Mowers	2265004041	Gasoline 4-cycle	26	963	569	1.69	45
Front Mowers	2265004046	Gasoline 4-cycle	7	715	86	8.32	61
Lawn and Garden Tractors	2265004056	Gasoline 4-cycle	3	701	721	0.97	3
Other Lawn and Garden Equipment	2265004076	Gasoline 4-cycle	1	418	120	3.48	5
Shredders >6HP	2265007010	Gasoline 4-cycle	1	209	50	4.18	6
Commercial Mowers	2270004046	Diesel	12	1,305	480	2.72	32
Lawn and Garden Tractors	2270004056	Diesel	7	381	544	0.70	5
Commercial Turf Equipment/ Sod Cutters	2270004071	Diesel	1	522	1,068	0.49	1
Shredders	2270007010	Diesel	1	1,044	61	17.11	25
Total			179				634

Also, the allocation file was updated with the horsepower (HP) estimates from the survey. Table 2-16 and Table 2-17 list the default NONROAD 2004 HP and the calculated average HP from the survey responses. In almost all cases, the horsepower levels were very similar between the default values and the survey responses. However, public schools tended to use larger rear-engine rider mowers and shredders, but smaller gasoline lawn and garden tractors and chainsaws. Universities/colleges tended to use smaller chainsaws and larger lawn and garden tractors. For the NONROAD model run, equipment populations were allocated to horsepower bins based on survey responses.

Table 2-16. Public School Equipment HP Estimations Based on AACOG Survey

Public Schools Lawn and Garden Equipment	Engine Type	SCC	NONROAD model Default HP	Estimated Equipment HP
Chain Saws	Gasoline 2-cycle	2260004021	3.5	2.2
Trimmers/ Edgers/ Brush Cutters	Gasoline 2-cycle	2260004026	1.5	1.4
Leaf Blowers/ Vacuums	Gasoline 2-cycle	2260004031	2.0	2.1
Lawn Mowers	Gasoline 4-cycle	2265004011	4.1	5.3
Rotary Tillers	Gasoline 4-cycle	2265004016	4.7	4.6
Rear Engine Riding Mowers	Gasoline 4-cycle	2265004041	10.7	19.6
Front Mowers	Gasoline 4-cycle	2265004046	13.5	19.0
Shredders	Gasoline 4-cycle	2265004051	4.2	38.0
Lawn and Garden Tractors	Gasoline 4-cycle	2265004056	14.4	6.7
Commercial Turf Equipment/ Sod Cutters	Gasoline 4-cycle	2265004071	12.6	25.0
Commercial Mowers	Diesel	2270004046	29.1	22.2
Lawn and Garden Tractors	Diesel	2270004056	21.0	21.6
Chippers/ Stump/ Grinders/ Mulchers	Diesel	2270004066	143.9	40.0
Commercial Turf Equipment/ Sod Cutters	Diesel	2270004071	143.9	23.4
Shredders	Diesel	2270007010	N/A	60.0

Allocation File

An allocation file was created to properly allocate emissions for each county. The file was made by taking the default landscape allocation file for Texas (TX_LSCAP.AOL), and replacing values (employees in landscape and horticulture service) with zero for all counties except those in the study area. The values for the public schools in the AACOG region were allocated based on the number of schools in each county (Table 2-18). The values of the counties were added up and the total was used in place of the entire Texas state value. This allows the NONROAD model to calculate emissions for the AACOG region as a whole and distribute the emissions to each county appropriately. For the university/colleges, the values were allocated based on the total number of acres in each county. The results are listed in Table 2-19.

Table 2-17. University/College Equipment HP Estimations Based on AACOG Survey

College Lawn and Garden Equipment	Engine Type	SCC	NONROAD Default HP	Estimated Equipment HP
Chain Saws	Gasoline 2-cycle	2260004021	3.5	1.8
Trimmers/ Edgers/ Brush Cutters	Gasoline 2-cycle	2260004026	1.5	1.3
Leaf Blowers/ Vacuums	Gasoline 2-cycle	2260004031	2.0	2.3
Lawn Mowers	Gasoline 4-cycle	2265004011	4.1	5.1
Rotary Tillers	Gasoline 4-cycle	2265004016	4.7	6.0
Rear Engine Riding Mowers	Gasoline 4-cycle	2265004041	10.7	16.8
Front Mowers	Gasoline 4-cycle	2265004046	13.5	13.5
Lawn and Garden Tractors	Gasoline 4-cycle	2265004056	14.4	68.0
Other Lawn and Garden Equipment	Gasoline 4-cycle	2265004076	5.4	8.0
Shredders >6HP	Gasoline 4-cycle	2265007010	8.6	8.0
Commercial Mowers	Diesel	2270004046	29.1	27.3
Lawn and Garden Tractors	Diesel	2270004056	21.0	29.6
Commercial Turf Equipment (com)	Diesel	2270004076	48.8	28.0
Shredders	Diesel	2270007010	N/A	200.0

Activity File
Hours per year were based on the data in Table 2-20 and Table 2-21 for each type of equipment calculated based on the returned surveys.

Season File
The weekday vs. weekday adjustment factor of 0.1997586 for weekdays and 0.0012071 for weekends was calculated from the returned AACOG surveys for public schools. The adjustment factor for universities was 0.1923550 for weekdays and 0.0191125 for weekends. For almost all types of equipment at schools, activity only occurs on weekdays. The results were based on the total hours for each time period from the AACOG survey.

Table 2-18. Allocation of Public Schools by County, 2005*[11]

FIPS	County	Total # of Schools (Indicator value)	Percentage
48013	Atascosa	28	4.5%
48019	Bandera	7	1.1%
48029	Bexar	412	66.0%
48091	Comal	33	5.3%
48163	Frio	10	1.6%
48171	Gillespie	9	1.4%
48187	Guadalupe	35	5.6%
48255	Karnes	14	2.2%
48259	Kendall	13	2.1%
48265	Kerr	18	2.9%
48325	Medina	20	3.2%
48493	Wilson	25	4.0%
48000	AACOG	624	100.0%

*Military Base Schools are not included (these schools are in the Miltary/Airport section)

Table 2-19. Allocation of Universities/Colleges by County, 2005[12]

FIPS	County	Total # of Acres (Indicator value)	Percentage
48013	Atascosa	5	0.5%
48019	Bandera	0	0.0%
48029	Bexar	906	82.7%
48091	Comal	0	0.0%
48163	Frio	0	0.0%
48171	Gillespie	0	0.0%
48187	Guadalupe	184	16.8%
48255	Karnes	0	0.0%
48259	Kendall	0	0.0%
48265	Kerr	0	0.0%
48325	Medina	0	0.0%
48493	Wilson	0	0.0%
48000	AACOG	1,095	100.0%

Spatial Distribution

Emissions are allocated on the 4km grid by the location of the public schools and universities (Figure 2-5).

[11] U.S. Department of Education. National Center for Education Statistics, 2002. Available online: http://nces.ed.gov/ (20 July 2004)

[12] *Ibid.*

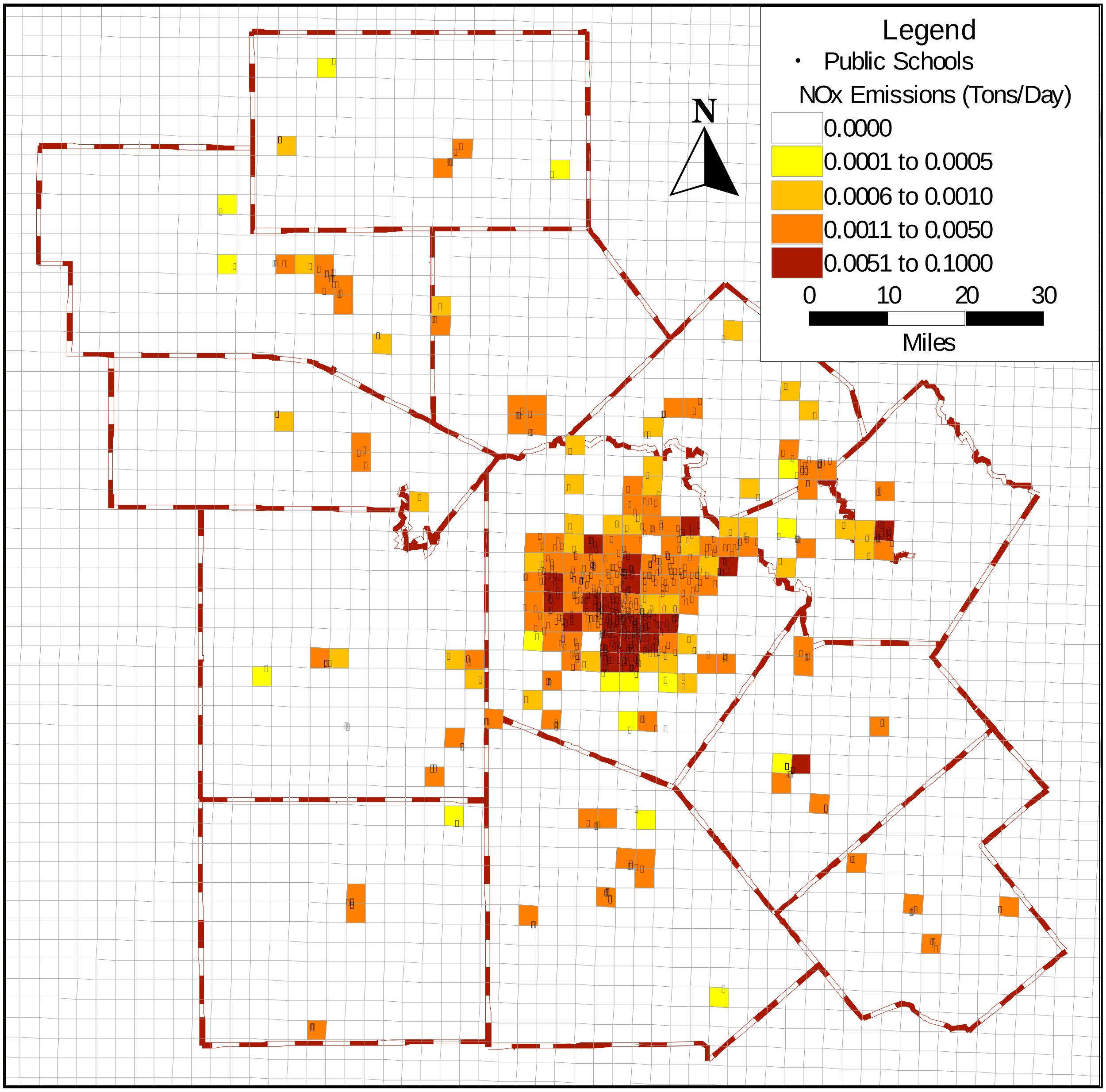
Table 2-20. Public School Equipment Survey Results for Average Weekday Hours Usage – AACOG Region, 2005

Lawn & Garden Equipment	Engine Type	Avg. # Hrs. Ea. Unit is Operated	Avg. # Hrs. Ea. Unit is Operated Weekend
Chain Saws	Gasoline 2-cycle	0.9	0.0
Trimmers/ Edgers/ Brush Cutters	Gasoline 2-cycle	4.0	0.0
Leaf Blowers/ Vacuums	Gasoline 2-cycle	1.9	0.0
Lawn Mowers	Gasoline 4-cycle	3.0	0.0
Rotary Tillers	Gasoline 4-cycle	0.7	0.0
Rear Engine Riding Mowers	Gasoline 4-cycle	5.6	0.0
Front Mowers	Gasoline 4-cycle	5.4	0.1
Shredders	Gasoline 4-cycle	4.5	0.0
Lawn and Garden Tractors	Gasoline 4-cycle	4.2	0.0
Commercial Turf Equipment/ Sod Cutters	Gasoline 4-cycle	5.0	0.0
Commercial Turf Equipment/ Sod Cutters	Diesel	4.5	0.0
Commercial Mowers	Diesel	4.8	0.0
Lawn and Garden Tractors	Diesel	3.9	0.0
Chippers/ Stump/ Grinders/ Mulchers	Diesel	2.5	0.0
Shredders	Diesel	6.5	0.0

Table 2-21. University/College Equipment Survey Results for Average Weekday Hours Usage – AACOG Region, 2005

Lawn & Garden Equipment	Engine Type	Avg. # Hrs. Ea. Unit is Operated Weekday	Avg. # Hrs. Ea. Unit is Operated Weekend
Chain Saws	Gasoline 2-cycle	1.7	0.0
Trimmers/ Edgers/ Brush Cutters	Gasoline 2-cycle	3.8	0.0
Leaf Blowers/ Vacuums	Gasoline 2-cycle	2.6	0.3
Lawn Mowers	Gasoline 4-cycle	1.4	0.0
Rotary Tillers	Gasoline 4-cycle	1.3	0.1
Rear Engine Riding Mowers	Gasoline 4-cycle	3.5	0.3
Front Mowers	Gasoline 4-cycle	2.7	0.0
Lawn and Garden Tractors	Gasoline 4-cycle	2.7	0.0
Other Lawn and Garden Equipment	Gasoline 4-cycle	1.6	0.0
Shredders >6HP	Gasoline 4-cycle	0.8	0.0
Commercial Mowers	Diesel	5.0	0.0
Lawn and Garden Tractors	Diesel	4.3	0.0
Commercial Turf Equipment/ Sod Cutters	Diesel	2.0	0.0
Shredders	Diesel	4.0	0.0

Figure 2-5. Public Schools Diesel Lawn and Garden Equipment NOx Emissions, 2005



Plot Date: November 9, 2005
Map Compilation: October 6, 2005
Source: National Center for Education Statistics, 2002. Available online: http://nces.ed.gov/ (20 July 2004)

Methodology – *Commercial Lawn and Garden Companies*

The methodology used in producing commercial companies' lawn and garden equipment emission estimates for the AACOG region relied on local data produced from surveys, results from an ERG survey[13], and on national data used in the EPA's NONROAD Emission Inventory Model, in the absence of reliable local data. The methodology involved the following steps:

1. Conducting a survey of commercial lawn and garden equipment activity to determine local equipment use rates and equipment characteristics.

2. Determining equipment population and activity of local commercial companies that did not respond to the survey. This was based on applying survey equipment population responses to all lawn and garden equipment companies (SIC 0782 / NAICS 56173).

3. Estimating VOC, NOx, and CO annual emissions by inputting local data into the NONROAD model for equipment populations and converting the tons/year estimate into an estimate for a typical weekday (tons/day), for the summer ozone season.

Step 1: Conduct a Survey of Commercial Companies' Equipment Activity

The preferred method for calculating commercial companies' equipment emissions involves conducting a survey of equipment use within the AACOG region. The total number of companies was collected from the 2002 Census County Business Patterns[14] because this was the latest data available. The breakdown of commercial companies and employment by county is provided in Table 2-22.

Both AACOG and ERG conducted a survey of commercial lawn and garden companies in the AACOG region. The survey results were checked to make sure there were no overlaps between the surveys. Names and addresses of these companies and their responses remained confidential throughout the survey process through the use of proprietary codes. The survey provided the following information for the commercial companies' lawn and garden equipment:

- Activity Rates (HRS) – total annual hours of use by type of equipment
- Temporal Profiles – equipment use on weekdays and equipment use on weekend days for all types of equipment
- Equipment Counts

Once the AACOG survey was completed, the results were combined with ERG results. A total of 54 companies responded to the survey (45 from AACOG Survey and 9 from ERG survey) in the AACOG region. Listed in the following Table (2-23) is the combined population results for both the AACOG and ERG survey data. There was a 19 percent response rate between the two surveys.

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[13] Rick Baker and Sam Wells, Nov. 24, 2003. Development of Commercial Lawn and Garden Emission Estimations for the state of Texas and Selected Metropolitan Areas. Prepared by Eastern Research Group and Starcrest Consulting Group for Texas Commission on Environmental Quality.

[14] US Census Bureau (last access June 15, 2005), 2002 MSA Business Patterns (NAICS). Available on-line: http://censtats.census.gov/cgi-bin/msanaic/msasect.pl
http://censtats.census.gov/cgi-bin/msanaic/msadetl.pl

Table 2-22. Commercial Lawn and Garden Companies in the AACOG Region (SIC 0782, NAICS 56173)[15]

FIPS	County	Number of Commercial Companies	Number of Employees
48013	Atascosa	4	7
48019	Bandera	2	8
48029	Bexar	199	3,402
48091	Comal	29	74
48163	Frio	0	0
48171	Gillespie	6	17
48187	Guadalupe	14	74
48255	Karnes	0	0
48259	Kendall	13	83
48265	Kerr	16	62
48325	Medina	5	10
48493	Wilson	2	8
Total	AACOG	290	3,744

Table 2-23. Commercial Lawn and Garden Equipment Survey Totals by Equipment Type

Equipment Type	Survey Equipment Counts
Lawn Mowers	117
Tillers	15
Chainsaws	221
Trimmers	93
Blowers	184
Rear Mower	60
Front Mower	50
Shredder	16
Tractor	14
Chippers	35
Turf	8
Other Lawn and Garden Equip.	4
Total	817

<u>Step 2: Determine County Equipment Population for Commercial Companies without Local Data</u>
Equipment population was estimated based on the same methodology used in the ERG report. The population of equipment calculated from the survey respondents was multiplied by the total number of companies in the AACOG region and divided by the total number of survey respondents.

The total equipment population was then adjusted by a factor based on the average hours of use per year from the AACOG survey data. Some equipment sources – chainsaws, front mowers, and shredders – had much higher activity rates than the NONROAD default hours. The adjustment factor in Table 2-24 was applied to each equipment category from the

[15] *<u>Ibid.</u>*

AACOG/ERG survey. Also, a 10% SWAG Factor was applied to the Lawn and Garden equipment category based on the methodology used in the ERG study.

Table 2-24. Commercial Lawn and Garden Equipment Hours per Year and Adjustment Factors

Equipment Type	AACOG Survey Hours/Year	NONROAD Default Hours/Year	Adjustment Factor
Lawn Mowers	2,023	406	4.98
Tillers	661	472	1.40
Chainsaws	1,409	303	4.65
Trimmers	1,612	137	11.76
Blowers	1,268	282	4.50
Rear Mower	1,368	569	2.40
Front Mower	1,457	86	16.94
Shredder	1,398	50	27.96
Tractor	1,066	721	1.48
Chippers	1,162	465	2.50
Turf	1,230	682	1.80
Other Lawn and Garden Eqip.	1,566	61	25.67

Sample Calculation
Equation (1)
Estimated population of commercial equipment A in the AACOG region:

$$POP_A = EQ_A \times CO \times AF_A / SR$$

Where,

POP_A = Estimated population of commercial equipment type A in the AACOG region
EQ_A = Total number of equipment type A from Table 2-23
CO = Total number of commercial lawn and garden companies from Table 2-22
AF_A = Hours adjustment factor for equipment type A from Table 2-24
SR = Total number of survey respondents (54)

Estimated population of commercial chainsaws in AACOG region:

POP_A = (221 X 290 X 4.65) / (54)
= 5,517 commercial chainsaws

Step 3: Estimated Annual Emissions of Ozone Precursors

Once county level equipment populations were determined, emissions of volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) were calculated using NONROAD Model 2004. In using the NONROAD model, some adjustments were made for local conditions.

Population File

The equipment population for each type of equipment was summed based on the AACOG and ERG survey responses. This master spreadsheet was then converted into the population file for the NONROAD model (Table 2-25).

Table 2-25. Comparison of Commercial Lawn and Garden Equipment Survey Population Estimations v. NONROAD Default Populations by Equipment Type

Equipment Type	EPA Non-Road Model Default Population	AACOG Estimated Population	Percent of NONROAD Model Population	2002 ERG Results for Texas
Lawn Mowers	11,020	3,131	28%	71%
Tillers	4,054	113	3%	24%
Chainsaws	5,258	5,517	105%	137%
Trimmers	13,402	5,876	44%	58%
Blowers	7,636	4,443	58%	79%
Rear Mower	339	774	229%	804%
Front Mower	2,764	4,548	165%	29%
Shredder	2,127	2,403	113%	6%
Tractor	2,719	111	4%	6%
Chippers	682	470	69%	206%
Turf	6,827	78	1%	2%
Other	5,084	3,904	77%	71%
Total	58,051	31,367	54%	60%

Allocation File

An allocation file was created to properly allocate emissions for each county. The file was made by taking the default landscape allocation file for Texas (TX_LSCAP.AOL), then replacing values (employees in landscape and horticulture service) with zero for all counties except those in the study area. The values for the AACOG region were allocated based on the number of companies from Table 2-22 of 2002 Census County Business Patterns employment estimations. The values for each county were added up and the total was used to replace the value for the State of Texas. This allowed the NONROAD model to calculate emissions for the AACOG region as a whole and distribute the emissions to each county appropriately.

Season File

A weekday versus weekend adjustment factor of 0.1978955 per weekday and 0.0052613 per weekend day was used in the calculations. The results were based on the total hours for each time period from the AACOG survey. Most commercial lawn and garden companies in the AACOG region do not operate on weekends so the default NONROAD factor is inappropriate.

Methodology – *Non-Military Government Facilities, Parks, and Hospitals*

The methodology used in producing non-military government facilities, parks, and hospitals lawn and garden equipment emission estimates for the AACOG region relied on local data produced from surveys and on national data used in EPA's NONROAD 2004 Emission Inventory Model, in the absence of reliable local data. The methodology involved the following steps:

1. Conducting a survey of non-military government facilities lawn and garden equipment activity to determine local equipment use rates and equipment characteristics.

2. Estimating VOC, NOx, and CO annual emissions by using survey responses and NONROAD model defaults and converting the tons/year estimate into an estimate for a typical weekday (tons/day) for the summer ozone season.

This category includes hospitals, municipality offices, parks, national wildlife areas (NWA), utilities, transportation departments, commercial parks (i.e. Sea World, etc.), power plants, etc.

Step 1: Conduct a Survey of Equipment Activity for Non-Military Government Facilities, Parks, and Hospitals

The preferred method for calculating non-military government facilities, parks, and hospitals equipment emissions involves conducting a survey of equipment use within the AACOG region. These facilities included local municipalities, power generation companies, hospitals, commercial parks, and state parks. Names and addresses of these facilities, and the responses from these facilities remained confidential throughout the survey process through the use of proprietary codes. The survey provided the following information for non-military government facilities, parks, and hospitals lawn and garden equipment:

- Activity Rates (HRS) – total annual hours of use by type of equipment
- Temporal Profiles – equipment use on weekdays and equipment use on weekend days for all types of equipment
- Equipment Counts

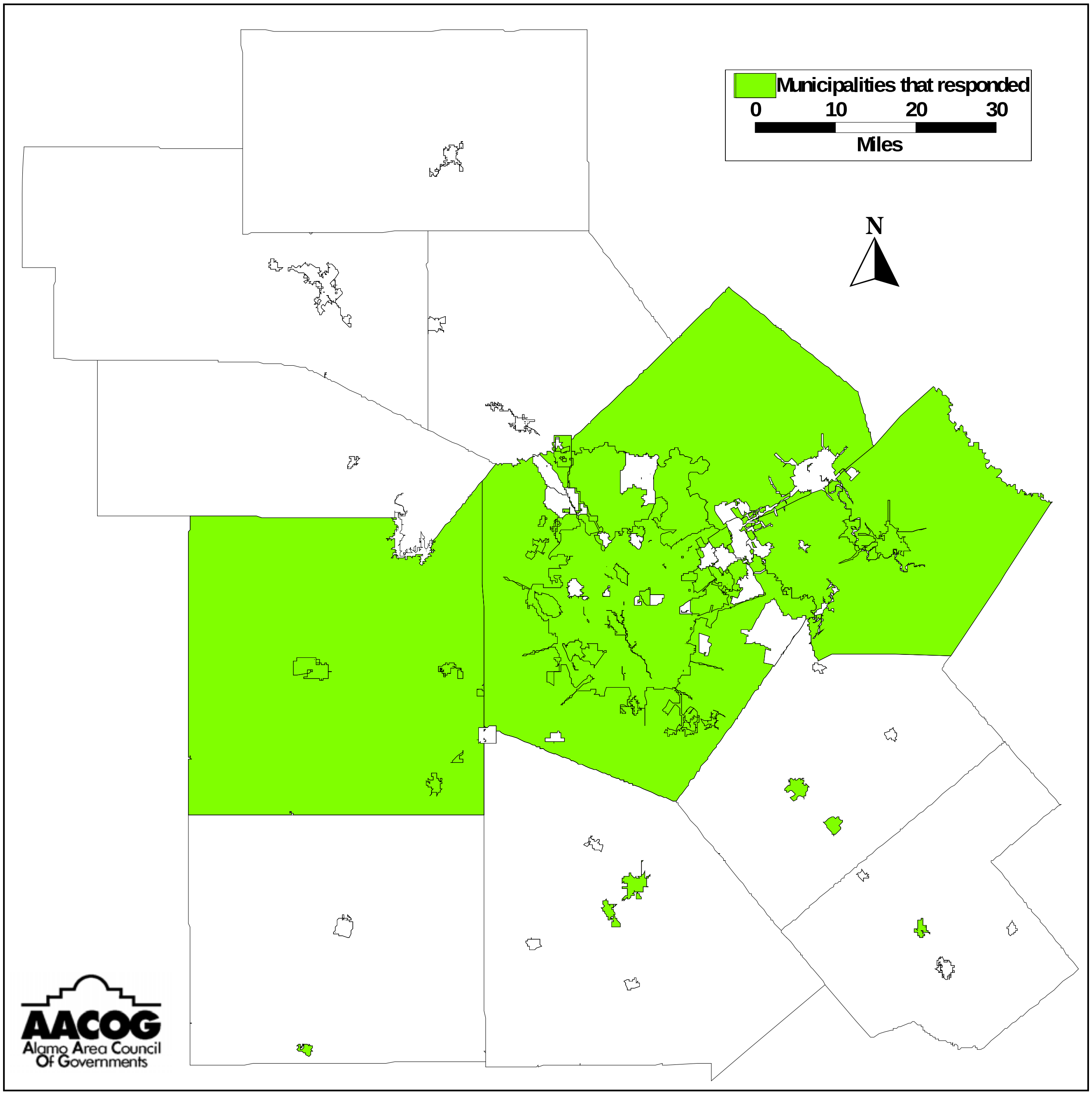
For the municipal governments, 42 percent (26) responded to the survey. These governments represent 81% of the population in the AACOG region. The municipalities that responded to the survey are plotted on Figure 2-5.

For other governmental entities, the results from the 2004 survey were combined with the 1995 survey because of a lack of responses to the 2004 survey. For other governmental organizations, there was a 67 percent response rate to the survey. Unfortunately, if a facility did not respond to the survey, their equipment counts were not included in the total because there was no methodology to estimate their equipment populations.

Step 2: Estimate Annual Emissions of Ozone Precursors

For each type of equipment for non-military governmental facilities, parks, and hospitals, VOC, NOx, and CO emissions were calculated for each category using the following formula:

Figure 2-6. Areas Covered by Municipalities that Responded to the Survey, 2004



Plot Date: September 8, 2004
Compilation Date: September 7, 2004
Source: Survey Data

Sample Calculations
Equation (1)
Annual Emissions for each type of equipment:

$$AEE_A = POP_A \times HP_A \times LF_A \times ACT_A \times EF_A$$

Where,

AEE_A = Annual exhaust emissions (tons/yr) for equipment type A
POP_A = Engine population for equipment type A
HP_A = Average power (hp) for equipment type A
LF_A = Load factor for equipment type A
ACT_A = Activity (hrs/yr) for equipment type A
EF_A = Emission factor (g/hp-hr) for equipment type A

In addition, the model calculates evaporative emissions based on source: diurnal, displacement, or spillage.

The values for load factor (LF), and emission factor (EF) were obtained from EPA's NONROAD Emission Inventory Model.[16] LF values were easily obtainable from the data files of this model. However, the EF values were not as easily obtainable, and thus had to be obtained through the method described below.

In an effort to find the most recent and specific equipment type emission factors, EPA's most recent version (2004) of the NONROAD Emission Inventory Model was used. The values for these factors had to be calculated by first determining all of the default values used in the model, performing a run, and then using the results of the run to work in reverse through the formula to determine what EFs were used by the model for an average ozone season day. For example, the EFs were developed through the following process:

1. A 2005 NONROAD Model run for commercial lawn and garden equipment was performed for the state of Texas using ozone season temperatures and yearly average temperatures.

2. The output from this run was used to obtain the following for all types of commercial lawn and garden equipment:
   - VOC, CO, and NOx emissions in tons/year for each type of equipment (the results of the run).
   - Equipment population used in the NONROAD Model for each type of equipment.

3. The NONROAD Model input file activity.dat, was used to obtain the following values:
   - The activity rate used in the NONROAD Model for each type of commercial lawn and garden equipment in hours/year (HRS).
   - The LF used in the NONROAD Model for each type of equipment.

4. The average horsepower used in the NONROAD Model for each type of equipment was determined from the input file Tx.pop.

5. With all the known factors in place, the EFs for VOC, CO, and NOx were calculated through the use of the following formula:

[16] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

Equation (2)
Emission factors for ozone precursors by equipment type:

EF = NRE_A / (EQ_A x HRS_A x HP_A x LF_A)

Where,

EF_A = Emission factor for equipment type A (g/bhp-hr)
NRE_A = VOC, CO, and NOx emissions in tons/year for equipment type A (the results of the NONROAD model)
EQ_A = Equipment population for equipment type A (NONROAD model)
HRS_A = Annual hours of use for equipment type A (NONROAD model)
HP_A = Average rated horsepower for equipment type A (NONROAD model)
LF_A = Typical load factor for equipment type A (NONROAD model)

The resulting EFs were used in the remaining steps to calculate emissions from each type of equipment. There are an estimated 5 chainsaws at facility A. These Chainsaws are operated 4 hrs/weekdays and 1,040 hrs/yr total. (HRS), and have a HP of 3. From the NONROAD Model, the typical LF for these chainsaws is 0.7, and the EF for NOx is 1.3708 grams/hp-hr during the ozone season.

AE = 5 chainsaws x 1,040 hrs/yr x 3 hp x 0.7 x 1.3708 g/hp-hr / 453.6 g/lb. / 2,000 lbs
= 0.0165 tons NOx/yr

A final step in the calculation is to determine weekday versus weekend emissions. The equipment activity rates for weekdays for each piece of equipment at each facility were estimated.

Equation (3)

OWDE = POP_A x HRS_A x HP_A x LF_A x EF_A / 453.6 / 2,000

Where,

OWDE = Daily emissions for ozone season weekday (tons/yr)
POP_A = Equipment population of type A
HRS_A = weekday hours of use for equipment type A per week
HP_A = Average rated horsepower for equipment type A
LF_A = Typical load factor for equipment type A
EF_A = Emission factor for equipment type A (g/bhp-hr)
453.6 = Conversion factor (453.6 g / 1 lb.)
2,000 = Conversion factor (1 ton / 2,000 lbs)

The weekday ozone season emissions for 5 chainsaws at facility A:

OWDE = 5 x 4 hrs/weekday x 3 hp x 0.7 x 1.3708 g/hp-hr / 453.6 g/lb. / 2,000 lbs
= 0.000063 tons NOx /weekday

This same procedure is then used for CO and VOCs to produce estimates of these pollutants by facility. The emission estimates are added up for each facility in a county to get a county emission total.

Season File
A weekday versus weekend adjustment factor was calculated separately for each piece of equipment based on the survey responses. Overall the average weekday versus weekend adjustment factor was 0.184357 per weekday and 0.039107 per weekend day. However a factor for each individual piece of equipment was calculated based on the filled out survey data for each agency or park.

Methodology – Other Commercial Companies
The methodology used in producing other commercial companies' lawn and garden equipment emission estimates for the AACOG region relied on local data produced from surveys and on national data used in EPA's NONROAD 2004 Emission Inventory Model, in the absence of reliable local data. These facilities are commercial companies that are not lawn and garden businesses, but use their own equipment to maintain their landscaping. The methodology involved the following steps:

1. Conducting a survey of commercial companies' lawn and garden equipment activity to determine local equipment activity and equipment characteristics.

2. Estimating VOC, NOx, and CO annual emissions by using survey responses and NONROAD model defaults and converting the tons/year estimate into an estimate for a typical weekday (tons/day) for the summer ozone season.

<u>Step 1: Conduct a Survey of Equipment Activity for Other Commercial Companies</u>

The preferred method for calculating other commercial companies' equipment emissions involves conducting a survey of equipment use within the AACOG region. Names and addresses of these facilities, and the responses from these facilities remained confidential throughout the survey process through the use of proprietary codes. The survey provided the following information for other commercial companies' lawn and garden equipment:

- Activity Rates (HRS) – total annual hours of use by type of equipment
- Temporal Profiles – equipment use on weekdays and equipment use on weekend days for all types of equipment
- Equipment Counts

Unfortunately, if a facility did not respond to the survey, their equipment counts were not included in the total because there was no methodology to estimate their equipment populations.

<u>Step 2: Estimate Annual Emissions of Ozone Precursors</u>
For each type of equipment for other commercial companies' VOC, NOx, and CO emissions were calculated for each category using the following formula:

Sample Calculations
Equation (1)
Annual Emissions for each type of equipment:

$$AEE_A = POP_A \times HP_A \times LF_A \times ACT_A \times EF_A$$

Where,

AEE_A = Annual exhaust emissions (tons/yr) for equipment type A
POP_A = Engine population for equipment type A
HP_A = Average power (hp) for equipment type A

LF_A	= Load factor for equipment type A
ACT_A	= Activity (hrs/yr) for equipment type A
EF_A	= Emission factor (g/hp-hr) for equipment type A

In addition, the model calculates evaporative emissions based on source: diurnal, displacement, or spillage.

The values for load factor (LF), and emission factor (EF) were obtained from EPA's NONROAD Emission Inventory Model.[17] LF values were easily obtainable from the data files of this model. However, the EF values were not as easily obtainable, and thus had to be obtained through the method described below.

In an effort to find the most recent and specific equipment type emission factors, EPA's most recent version (2004) of the NONROAD Emission Inventory Model was used. The values for these factors had to be calculated by first determining all of the default values used in the model, performing a run, and then using the results of the run to work in reverse through the formula to determine what EFs were used by the model for an average ozone season day. For example, the EFs were developed through the following process:

1. A 2005 NONROAD Model run for commercial lawn and garden equipment was performed for the state of Texas using ozone season temperatures and yearly average temperatures.

2. The output from this run was used to obtain the following for all types of commercial lawn and garden equipment:
   - VOC, CO, and NOx emissions in tons/year for each type of equipment (the results of the run).
   - Equipment population used in the NONROAD Model for each type of equipment.

3. The NONROAD Model input file activity.dat, was used to obtain the following values:
   - The activity rate used in the NONROAD Model for each type of commercial lawn and garden equipment in hours/year (HRS).
   - The LF used in the NONROAD Model for each type of equipment.

4. The average horsepower used in the NONROAD Model for each type of equipment was determined from the input file Tx.pop.

5. With all the known factors in place, the EFs for VOC, CO, and NOx were calculated through the use of the following formula:

Equation (2)
Emission factors for ozone precursors by equipment type:

$$EF = MAE_A \times 2{,}000 \times 453.6 / EQ_A \times HRS_A \times HP_A \times LF_A$$

Where,

EF_A	= Emission factor for equipment type A (g/bhp-hr)
MAE_A	= VOC, CO, and NOx emissions in tons/year for equipment type A (the results of the model)
2,000	= Conversion factor (1 ton / 2,000 lbs)

[17] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

453.6 = Conversion factor (453.6 g / 1 lb.)
EQ_A = Equipment population for equipment type A
HRS_A = Annual hours of use for equipment type A
HP_A = Average rated horsepower for equipment type A
LF_A = Typical load factor for equipment type A

The resulting EFs were used in the remaining steps to calculate emissions from each type of equipment. There are 5 chainsaws at facility A. These Chainsaws are operated 4 hrs/ weekdays and 1,040 hrs/yr total. (HRS), and have a HP of 3. From the NONROAD Model, the typical LF for these chainsaws is 0.7, and the EF for NOx is 1.3708 grams/hp-hr during the ozone season.

AE = 5 chainsaws x 1,040 hrs/yr x 3 hp x 0.7 x 1.3708 g/hp-hr / 453.6 g/lb. / 2,000 lbs
= 0.0165 tons NOx/yr

Season File

A weekday versus weekend adjustment factor was calculated separately for each piece of equipment based on the survey responses. Overall the average weekday versus weekend adjustment factor was 0.159149 per weekday and 0.102127 per weekend day. However a factor for each individual piece of equipment was calculated based on the filled out survey data for each company.

Once the lawn and garden equipment was added up for all categories, a comparison was done between the NONROAD 2004 defaults and the results from the survey. Table 2-26 shows the breakdown by category and the results from the ERG survey. The AACOG results match closely with ERG findings for most categories. Overall, the NONROAD model over predicted the number of lawn and garden equipment in the AACOG survey. AACOG surveys indicated 79 percent of the equipment population in the defaults (ERG results indicate that the number was 60 percent, but they did not survey all the categories).

There were more rear-engine mowers and chippers in the AACOG survey then indicated by the NONROAD model. At the same time, the NONROAD model over predicted the number of tillers and turf equipment. These results do not include the lawn and garden equipment at military bases that would increase the total percentage of equipment. Military equipment is included in Chapter 3 – Airport and Military Base Emissions.

Table 2-26. Comparison of Survey Equipment Population Estimations v. NONROAD Default Estimates, 2005*

Equipment Type	2005 EPA NONROAD Model Default Population	Commercial Lawn and Garden Companies	Universities / Colleges	Public Schools	Golf Courses	Government Facilities / Parks / Hospitals	Other Companies	Commercial /Private Airports	Percent of NONROAD Model Population	2002 ERG Results for Texas
Lawn Mowers	11,020	3,131	20	475	44	175	34	12	35%	71%
Tillers	4,054	113	3	5	4	7	0	2	3%	24%
Chainsaws	5,258	5,517	26	50	9	551	9	3	117%	137%
Trimmers	13,402	5,876	320	4,060	321	2,294	70	132	98%	58%
Blowers	7,636	4,443	82	379	253	524	15	26	75%	79%
Rear Mower	339	774	77	139	582	154	1	10	513%	804%
Front Mower	2,764	4,548	61	232	1,795	225	3	16	249%	29%
Shredder	2,127	2,403	31	202	0	16	8	7	125%	6%
Tractor	2,719	111	8	416	113	83	3	10	27%	6%
Chippers	682	470	0	7	4	49	0	0	78%	206%
Turf	6,827	78	1	14	360	29	0	22	7%	2%
Other	5,084	3,904	5	0	0	60	43	0	79%	71%
Total	58,051	31,367	634	5,979	3,485	4,167	187	239	79%	60%

*Does not include military Lawn and Garden Equipment

Construction Equipment

This category includes emissions generated from most construction equipment sectors. Emissions from landfill and quarry equipment are in other sections of the emission inventory. The following is a list of construction equipment.

- Pavers
- Plate Compactors
- Rollers
- Scrapers
- Paving Equipment
- Surfacing Equipment
- Signal Boards/Light Plants
- Trenchers
- Bore/Drill Rigs
- Excavators
- Concrete/Industrial Saws
- Cement & Mortar Mixers
- Off-highway Trucks
- Crushing/Proc. Equipment
- Rough Terrain Forklifts
- Rubber Tire Loaders
- Rubber Tire Tractor/Dozers
- Tractors/Loaders/Backhoes
- Crawler Tractor/Dozers
- Skid Steer Loaders
- Off-Highway Tractors
- Dumpers/Tenders
- Cranes
- Other Construction Equipment

Methodology
The methodology used in producing construction equipment emission estimates for the AACOG region is based on a methodology developed for the Dallas area, local data, and default data from the EPA's NONROAD 2005 Emission Inventory Model. The methodology steps are:

1. Developing surrogate factors to estimate diesel equipment population, usage rates, and equipment characteristics.
2. Updating NONROAD 2005 model input files using local data.
3. Estimating VOC, NOx, and CO annual emissions from construction equipment using the NONROAD 2005 model.

Step 1: Development of Surrogate Factors
To calculate construction equipment population in San Antonio, surrogate factors were used to adjust Dallas equipment populations calculated in an Eastern Research Group (ERG) study.[18] This methodology was also used in pervious studies conducted by ERG for the CAPCOG and Dallas/Fort Worth regions. To determine surrogate factors for the AACOG region, the Dallas data was divided into industry sectors that facilitated comparisons of industry trends and other data closely related to equipment populations. The surrogate factors are listed in Table 2-27 and the methodologies to calculate the values are detailed below. The data sources for the surrogate factors are TxDOT,[19] Texas Water Development Board[20], County Business Patterns,[21] and Census Building permits.[22]

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[18] Eastern Research Group, Inc. August 31, 2005. Ozone Science and Air Modeling Research Project H43T163: Diesel Construction Equipment Activity and Emissions Estimates for the Dallas/Ft. Worth Region. Austin, TX 78731.
[19] Texas Department of Transportation, Aug. 15, 2005. Letting Schedule for San Antonio and Dallas District (FY 2005), Finance Division, Austin, Texas. Available online: http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/let/2005/letsat.htm and http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/let/2005/letdal.htm
[20] Texas Water Development Board, April 2006. 2006 Regional Water Plan: County Population Projections for 2000 - 2060. Austin, TX. Available online:

Sample Calculations
Equation (1)
Allocation of construction equipment to the AACOG region by sector:

$$EA_S = AMA_S / AMD_S$$

Where,

EA_S = Equipment allocation to the AACOG region for sector S
AMA_S = Allocation value for the AACOG region for sector S
AMD_S = Allocation value for the Dallas region for sector S

Allocation of heavy highway construction equipment to the AACOG region was calculated using highway letting amounts, provided by TxDOT, for the Dallas ($598,297,002) and AACOG ($385,952,165) regions:

$$EA_S = (\$385{,}952{,}165 / \$598{,}297{,}002) = 0.65$$

Equation (2)
Population of each type of construction equipment, in the AACOG region, for sector A:

$$POP_A = DEQ \times EA_A$$

Where,

POP_A = Population of the construction equipment type A in the AACOG region for each sector
DEQ_A = Population of the construction equipment type A in the Dallas region for each sector
EA_A = Equipment allocation to the AACOG region for equipment type A for each sector from Table 2-27

Number of heavy highway rollers (100-175 hp) in the AACOG region for heavy highway construction:

$$POP_A = 67.5 \times 0.65 = 43.5 \text{ rollers (100-175 hp)}$$

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http://www.twdb.state.tx.us/data/popwaterdemand/2003Projections/Population%20Projections/STATE_REGION/County_Pop.htm
[21] U.S. Census Bureau, July 14, 2006, County Business Patterns, 2004. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.
[22] U.S. Census Bureau, 2006. Building Permits. http://www.census.gov/const/www/permitsindex.html

Table 2-27. Diesel Construction Equipment – Surrogate Factors by Sector, 2005

Sector	Allocation Method	Data Source	Year	Surrogate Factor
Heavy Highway	TxDOT Lettings	TxDOT	2005	0.65
Utility	MSA Population	TWDB	2005	0.35
Municipal	MSA Population	TWDB	2005	0.35
Commercial Construction	Construction Employees Population	County Business Patterns	2004	0.23
Residential	Family Dwelling Building Permits	Census Building permits	2005	0.30
City/County Roads	MSA Population	TWDB	2005	0.35
TxDOT	MSA Population	TWDB	2005	0.35
Scrap Recycling	Scrap and waste Materials	County Business Patterns	2004	0.19
Landscaping	Landscaping, Lawn and Garden Services	County Business Patterns	2004	0.39
Brick and Stone	Related construction materials	County Business Patterns	2004	0.12
Trenches	Construction Employees Population	County Business Patterns	2004	0.23
Concrete	Block, brick, other, and ready-mix	County Business Patterns	2004	0.46
Skid Steer Loaders	Construction Employees Population	County Business Patterns	2004	0.23
Special Trade	Concrete, Erection, & finishing (exclud. Demol. & excav.)	County Business Patterns	2004	0.22
Cranes	Construction Employees Population	County Business Patterns	2004	0.23
RT Forklifts	Construction Employees Population	County Business Patterns	2004	0.23
Mun. and County-Op. Eq.	MSA Population	TWDB	2005	0.35
Manufacturing	Manufacturing Employees	County Business Patterns	2004	0.15
Bore/Drill Rigs	Construction Employees Population	County Business Patterns	2004	0.23
Other	Construction Employees Population	County Business Patterns	2004	0.23
Agriculture	Agriculture, forestry, fishing	County Business Patterns	2004	0.17
Pipeline	Construction Employees Population	County Business Patterns	2004	0.23
Toyota	Toyota Plant's Location	Toyota	2005	none
Quarries	Not Used - In other sections of the 2005 Emission Inventory			
Landfills	Not Used - In other sections of the 2005 Emission Inventory			

Table 2-28. Diesel Construction Equipment – Population Allocation by County, 2005

Sector	48013	48019	48029	48091	48163	48171	48187	48255	48259	48265	48325	48493	Total
Heavy Highway	5.6	1.2	286.7	8.8	10.2	3.5	33.8	0.8	1.7	27.2	2.3	4.1	386.0
Utility	8.4	4.4	302.5	18.6	3.4	4.5	20.4	3.2	5.9	9.3	8.6	7.6	397.0
Municipal	8.4	4.4	302.5	18.6	3.4	4.5	20.4	3.2	5.9	9.3	8.6	7.6	397.0
Commercial Construction	3.7	2.5	289.3	34.4	1.0	5.9	19.2	0.8	7.2	14.9	4.7	3.7	387.3
Residential	1.6	0.0	257.5	54.6	0.0	0.0	38.3	0.0	13.8	0.0	1.1	0.9	367.7
City/County Roads	8.4	4.4	302.5	18.6	3.4	4.5	20.4	3.2	5.9	9.3	8.6	7.6	397.0
TxDOT	8.4	4.4	302.5	18.6	3.4	4.5	20.4	3.2	5.9	9.3	8.6	7.6	397.0
Scrap Recycling	9.5	0.0	261.5	59.5	0.0	0.0	59.5	0.0	9.5	0.0	0.0	0.0	399.5
Landscaping	0.8	1.0	394.8	11.0	0.0	3.6	12.6	1.0	6.1	9.0	1.9	1.0	442.4
Brick and Stone	9.5	0.0	120.0	9.5	0.0	0.0	0.0	0.0	9.5	14.0	0.0	0.0	162.5
Trenches	3.7	2.5	289.3	34.4	1.0	5.9	19.2	0.8	7.2	14.9	4.7	3.7	387.3
Concrete	1.9	11.9	276.0	23.8	11.9	1.9	35.7	1.9	3.8	11.9	3.8	3.8	388.3
Skid Steer Loaders	3.7	2.5	289.3	34.4	1.0	5.9	19.2	0.8	7.2	14.9	4.7	3.7	387.3
Special Trade	1.8	1.1	186.8	13.5	0.3	3.7	11.6	0.5	3.9	6.6	3.3	2.6	235.7
Cranes	3.7	2.5	289.3	34.4	1.0	5.9	19.2	0.8	7.2	14.9	4.7	3.7	387.3
RT Forklifts	3.7	2.5	289.3	34.4	1.0	5.9	19.2	0.8	7.2	14.9	4.7	3.7	387.3
Mun.l and County-Op. Eq.	8.4	4.4	302.5	18.6	3.4	4.5	20.4	3.2	5.9	9.3	8.6	7.6	397.0
Manufacturing	1.5	0.6	318.3	30.6	0.6	4.4	61.6	1.6	8.3	8.2	4.8	2.8	443.4
Bore/Drill Rigs	3.7	2.5	289.3	34.4	1.0	5.9	19.2	0.8	7.2	14.9	4.7	3.7	387.3
Other	3.7	2.5	289.3	34.4	1.0	5.9	19.2	0.8	7.2	14.9	4.7	3.7	387.3
Agriculture	9.5	9.5	66.0	12.0	14.0	9.5	9.5	9.5	17.0	9.5	28.0	0.0	194.0
Pipeline	3.7	2.5	289.3	34.4	1.0	5.9	19.2	0.8	7.2	14.9	4.7	3.7	387.3
Toyota	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0

The results were compared to local construction equipment survey responses in the AACOG region. Most local survey responses matched closely with the results from the Dallas survey data allocated to the AACOG region. One exception was municipal paving equipment: local municipalities in the AACOG region owned and used more paving equipment compared to the Dallas area. The population of construction equipment was updated with the local survey responses. Once allocation of equipment was determined for the AACOG region, equipment populations were allocated to each county using the same methodology (Table 2-28).

Toyota Manufacturing Plant Construction Emissions

The undertaking of a massive construction effort was necessary to build the Toyota manufacturing plant in South Bexar County. Emissions from the construction of this project were calculated separately due to its large scale and non-repetitive pattern (e.g. The project was a one-time event which occurred during the EI year that is not typical of on average).

Equipment population and activity for the construction of the plant was based on the ERG estimations for warehouses in the Dallas construction equipment emission inventory.[23] The warehouses construction equipment estimations were used because these buildings matched the closest to Toyota's planned building. Using equipment estimations for the Cowboys stadium in Arlington, Texas would be unrealistic, because the stadium will require extensive below ground excavation.[24] Table 2-29 lists the calculate population and hours for the construction equipment used to build the Toyota manufacturing plant. Spreaders were assigned to paving equipment based on TCEQ recommendation.[25]

Table 2-29. Toyota Diesel Construction Equipment, 2004-2005

Equipment Description	SCC	HP	Hours per 1000 ft^3	NONROAD Default Hours	Equipment Population
Roller	2270002015	150	0.6	760	1.1
Scrapper	2270002018	200	1.3	914	2.1
Spreader	2270002024	130	0.4	561	1.0
Driller	2270002033	225	1.7	466	5.4
Grader	2270002048	200	0.5	962	0.7
Dozer	2270002063	200	0.4	899	0.6
Dozer	2270002063	310	0.5	899	0.8
Tractor Dump	2270002066	240	0.3	1,135	0.4
Tack Backhoe	2270002066	275	0.2	1,135	0.2

[23] Eastern Research Group, Inc. August 31, 2005. Ozone Science and Air Modeling Research Project H43T163: Diesel Construction Equipment Activity and Emissions Estimates for the Dallas/Ft. Worth Region. Austin, TX 78731.
[24] *Ibid*., p. 5-29.
[25] TCEQ, December 2000. Documentation for the HGA Area Diesel Construction Emissions Project Houston/Galveston Attainment Demonstration and Post-1999 Rate-of-Progress SIP. Austin, Texas, Available online: http://www.tceq.state.tx.us/assets/public/implementation/air/sip/sipdocs/2000-12-HGB/00011sipapb_ado.pdf

Sample Calculation
Equation (3)
Population of equipment type A used for construction of Toyota Plant:

$$EQP_A = (SWAR \times STOY) / HOUR$$

Where,

EQP_A = Total number of equipment used by type
$SWAR_A$ = Equipment hours per thousand cubic foot of warehouse construction by equipment type from Table 2-29
STOY = Square footage of Toyota (1,500,000 ft^3)
$HOUR_A$ = NONROAD default hours by equipment type from Table 2-29

Total number of scrappers used in the Toyota Plant construction project:

EQP_A = (1.3 hrs / 1,000 ft^3 x 1,500,000 ft^3) / 914 hrs
= 2.1 scrappers

As shown in Figure 2-7, most of the construction of Toyota's building took place before the 2005 ozone season.[26] To account for the seasonal adjustment, the following formula was used:

Equation (4)
Population of equipment type A used, during the 2005 ozone season, for construction of Toyota Plant:

$$OSEQ_A = EQP_A \times SADJ$$

Where,

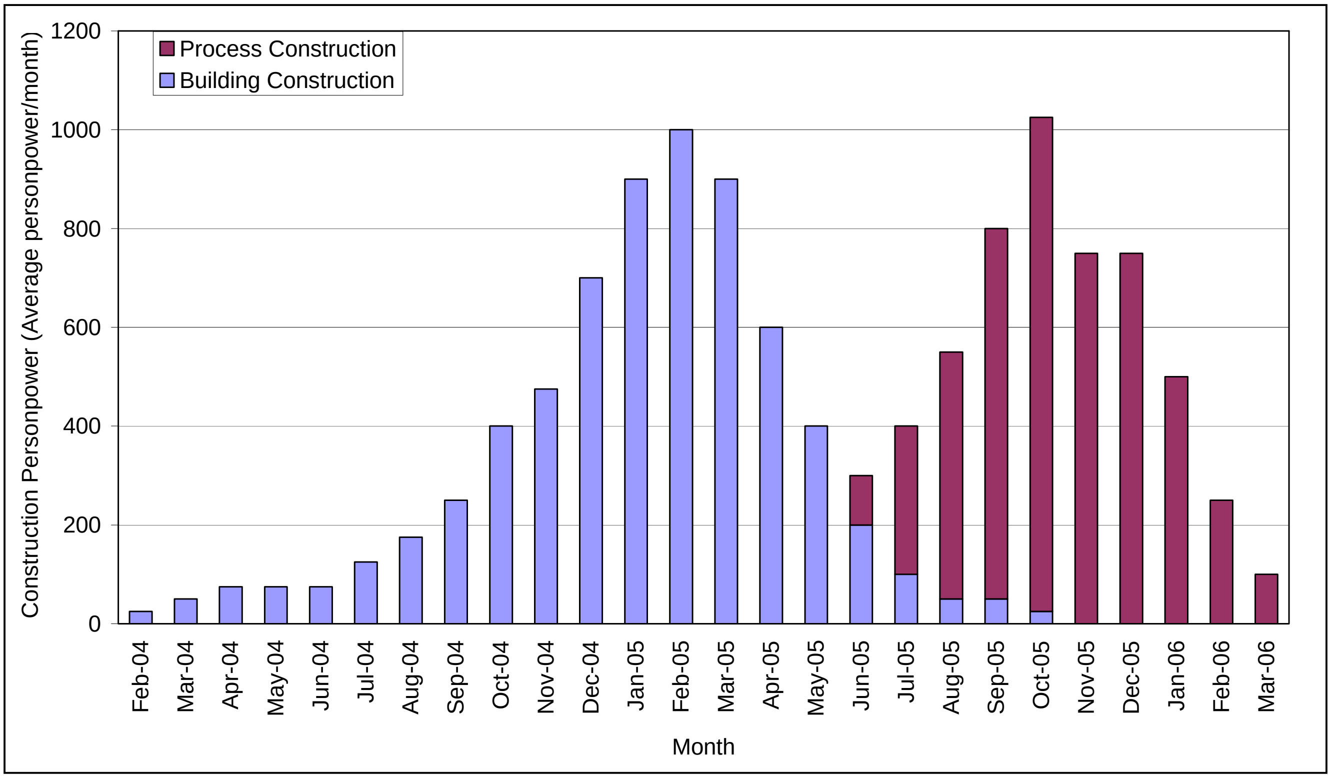
$OSEQ_A$ = Total number of equipment type A used during the 2005 ozone season
EQP_A = Total number of equipment type A from Table 2-16
SADJ = Percentage of person hours of building construction occurring during the 2005 ozone season (21.4%)

Total number of scrappers used, during the 2005 ozone season, to build the Toyota Plant:

$OSEQ_A$ = 2.1 x 0.214
= 0.45 scrappers

[26] Jeff Caldwell, Assistant General Manager Production Engineering, Toyota Vehicle Assembly Plant San Antonio, Texas --TMMTX--, Available online: http://www.sachamber.org/councils/ecodev/toyota/toyota_overview.php

Figure 2 -7. Average Personpower per Month for Construction of the Toyota Manufacturing Plant, Phase 1



Additional Gasoline Fueled Construction Equipment

In order to complete the construction emission inventory, AACOG added gasoline construction equipment to the emission estimations. Equipment population defaults were taken from the NONROAD 2005 model to calculate emissions.[27] The model outputs emission estimates for criteria pollutants at the county level. Adjustments made included changes to the population, allocation, activity, and seasonal files.

Population File

Once the equipment population was calculated for each county, the equipment population files were created for each sector in the NONROAD model.

Allocation File

The construction allocation file for Texas (Tx_const.alo) was updated by replacing values (dollars spent on construction) with zeros for all counties except those in the study area. Afterwards, the values for the AACOG region were calculated using the surrogate factors in Table 2-27 based on population. This allowed the NONROAD model to calculate emissions for the AACOG region as a whole and distribute the emissions to each county appropriately.

Activity File

Because of the extensive study done in the Dallas area, the same activity files was used in the San Antonio study.

[27] U.S. Environmental Protection Agency, Feb. 10, 2006. Final Nonroad 2005 Model. Ann Arbor, MI. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

Season File
Because of the extensive study done in the Dallas area, the same season file was used in the San Antonio study.

The model contains several parameters that can be adjusted to fit desired scenarios. For the purposes of this EI, the following parameters (Table 2-30) were used to produce a separate run for each county in the AACOG region.

Table 2-30. NONROAD Model Options for the 2005 AACOG Equipment Runs

Parameter	Value		Notes
	Summer	Annual	
Fuel RVP	7.8	8.7	Atascosa, Bexar, Comal, Guadalupe, Karnes, &Wilson
	8.7	8.7	Bandera, Gillespie, Frio, Kendall, Kerr, & Medina
Oxygen weight %	0.0	0.0	Model Default
Gas sulfur %	0.0339	0.0339	Model Default
Diesel sulfur %	0.2318	0.2318	Model Default
CNG/LPG sulfur %	0.003	0.003	Model Default
Min temperature	69.4	58.5	National Weather Service Forecast Office[28]
Max temperature	87.8	79.3	
Avg temperature	78.2	68.6	
Stage II controls %	0.0	0.0	Model Default

These parameters were used for each county to produce an emissions report in tons/day for a typical summer weekday, and for each type of equipment. For the purposes of this EI the NONROAD 2005 Model was run for the 2005 summer season. For the annual total, the NONROAD model was run for an annual period with the temperatures of 58.5, 79.3, and 68.6 (F).

Spatial Allocation
Emissions are allocated on the 4km grid by using the methodologies listed in Table 2-31. Heavy Highway construction was allocated based on the dollar value of MPO and TxDOT construction. For the MPO projects, the 410/IH 10 interchange was added based on a cost of $134,000,000 over 6 years and the widening of the IH 410 from McCullough to Nacogdoches was based on $150,000,000 over 3 years. MPO projects (9) with no specific location and the rideshare program were removed from total dollar amount.

[28] National Weather Service Forecast Office (no date). Climate Data and Daily Records for Austin, Del Rio, and San Antonio. Available online: http://www.srh.noaa.gov/ewx/html/climatsum.htm

Table 2-31. Spatial Allocation Surrogates for Construction Equipment

Sector	Spatial Allocation Methodology
Heavy Highway	TxDOT and MPO Construction Dollar Value
Utility	CPS, BexarMet, and SAWS Construction Dollar Value
Commercial Construction	COSA and Bexar County Com. Building and Demolition Permits
Residential	COSA and Bexar County Residential Building Permits
City/County Roads	COSA and Bexar County Road Dollar Value
TxDOT	TxDOT and MPO Construction Dollar Value
Scrap Recycling	Scrap and waste Materials Employment
Landscaping	EPA Default
Brick and Stone	Related construction materials Employment
Concrete	Block, brick, other, and ready-mix Employment
Special Trade	COSA and Bexar County Commercial Building Permits
Municipal/County-Op. Eq.	COSA and Bexar County Road Dollar Value
Manufacturing	Manufacturing Employees (only companies > 4 employees)
Other	Total Construction Dollar Value
Agriculture	Location of Crops (Cotton, Small Grains, Hay, Corn, Sorghum, and Peanuts)
Toyota	Location of Toyota

Utility construction emissions were geo-coded based on the dollar value of San Antonio water system (SAWS), Bexar Metropolitan Water District (BexarMet), and city public service (CPS) 2005 construction projects. SAWS permits we cullied to remove projects with final accept date before March 31, 2005, construction started after Nov. 1, 2005, current permit date after Nov. 1, 2005, expired permit (2 permit), and unknown addresses (9 permits). For CPS construction, projects with close date before March 31, 2005, gas lines with no address, and small projects with no addresses (6 projects) were removed. Also, transmission line projects were removed because these projects are very expensive and did not use as much heavy construction equipment.

Commercial construction allocation was based on the number of Bexar County and City of San Antonio commercial building/demolition permits. The voided permits, stop work permits, partial construction, portable buildings, and “master plan only not to be built” (2) permits were removed from the city of San Antonio commercial building permit database. Partial demolition permits were also removed. For Bexar County, all 2005 commercial sewage permits were used.

Number of city of San Antonio and Bexar County residential building permits were used to geo-code residential construction. Voided permits, stop work permits, partial construction, house move, and “without an address: master plan” (31) permits were removed from the city of San Antonio database. For Bexar County, all 2005 residential sewage permits were used to geo-code residential construction. Figures 2-8 to 2-17 shows the location of construction projects used to allocate emissions for each sector.

Figure 2-8. Heavy Highway Construction Projects, 2005

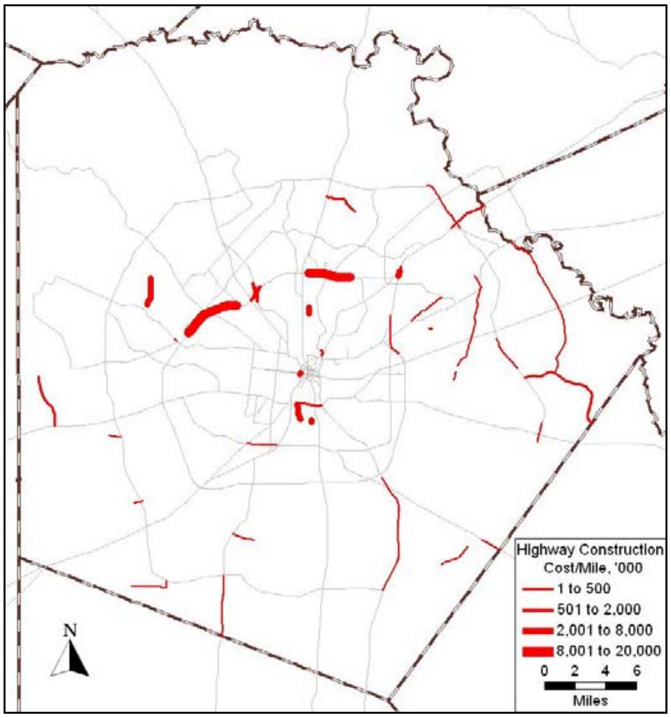
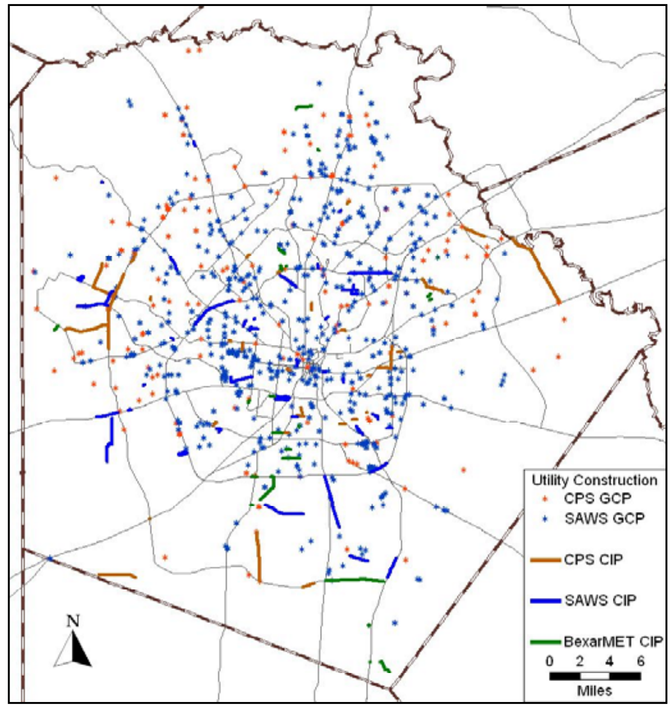


Figure 2-9. Utility Construction Projects, 2005*



*Does not include SAWS' Recycled Water Interbranch Project 2 & 3

Figure 2-10. Commercial Building Permits, 2005

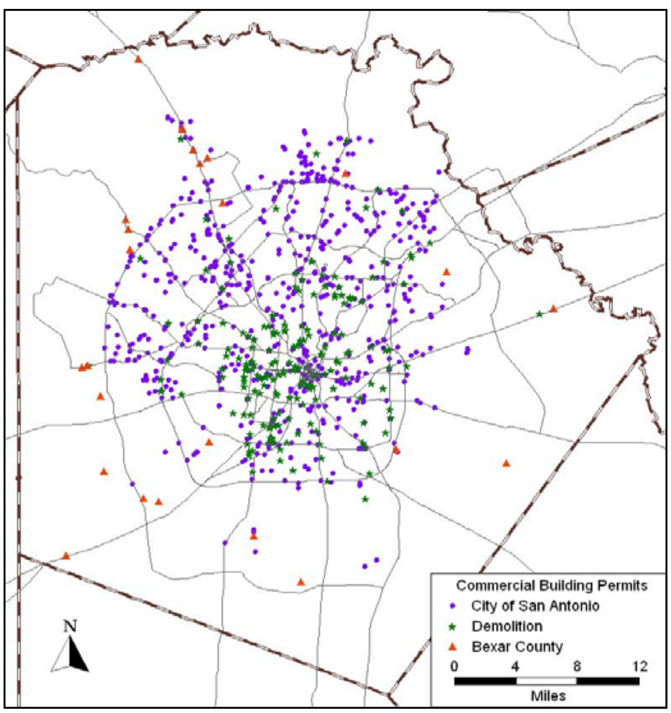


Figure 2-11. Residential and Sewage Permits, 2005

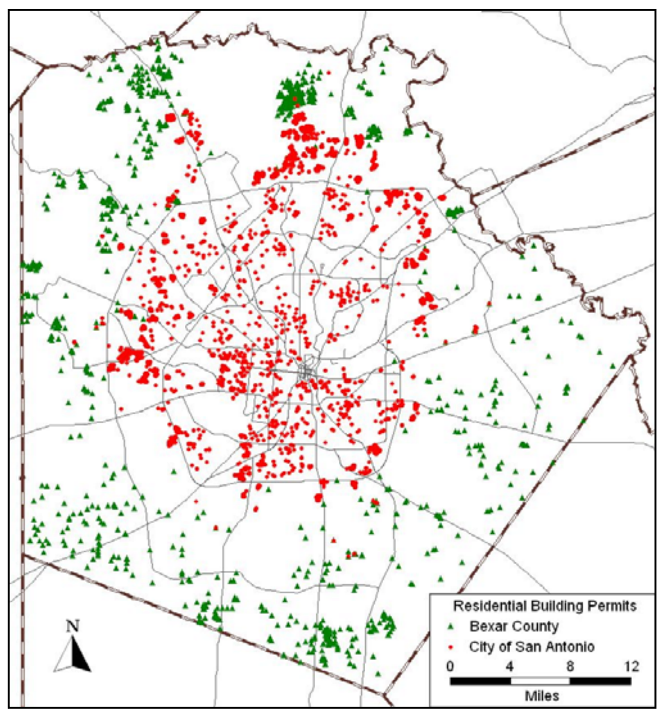


Figure 2-12. City and County Road Construction Projects, 2005

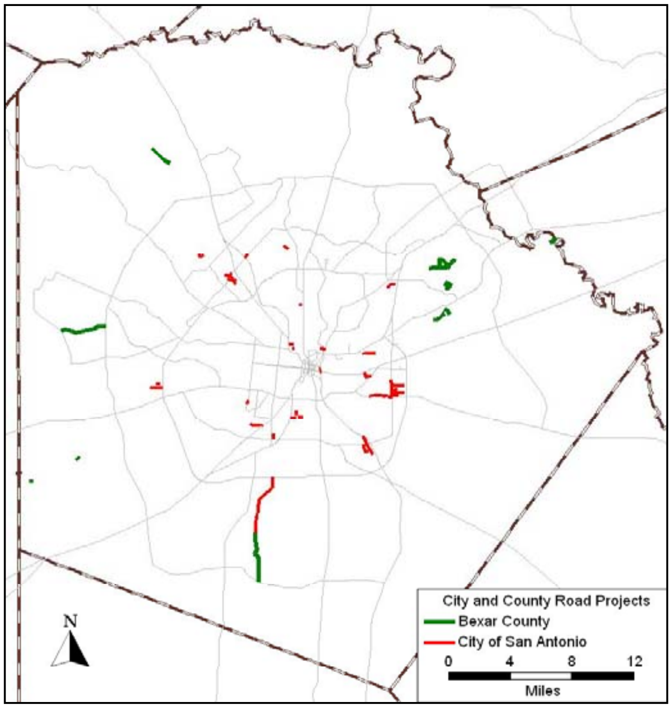


Figure 2-13. Scrap and Waste Materials Employment, 2005

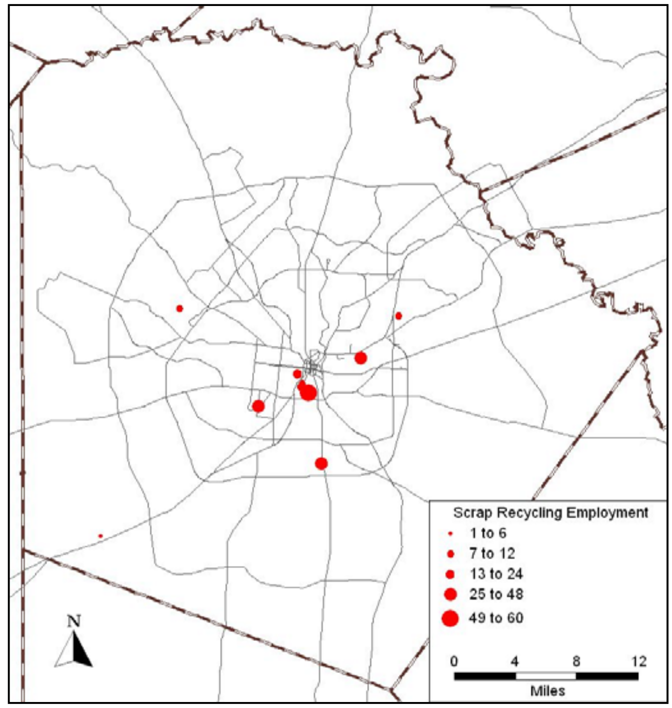


Figure 2-14. Brick and Stone Employment, 2005

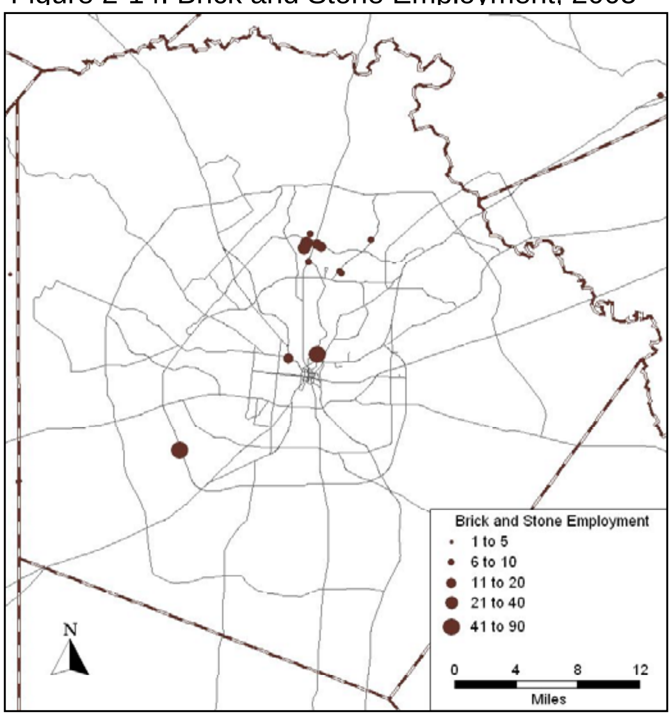


Figure 2-15. Concrete Employment, 2005

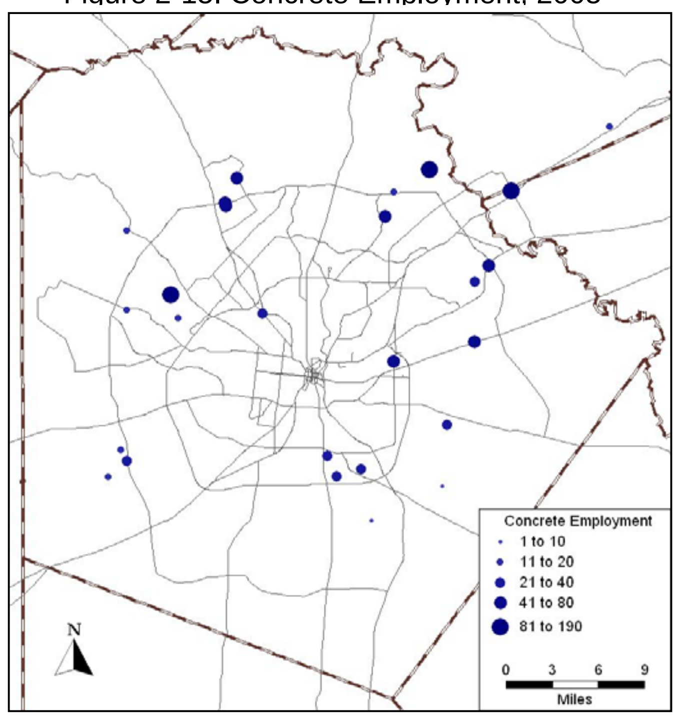


Figure 2-16. Manufacturing Employment, 2005

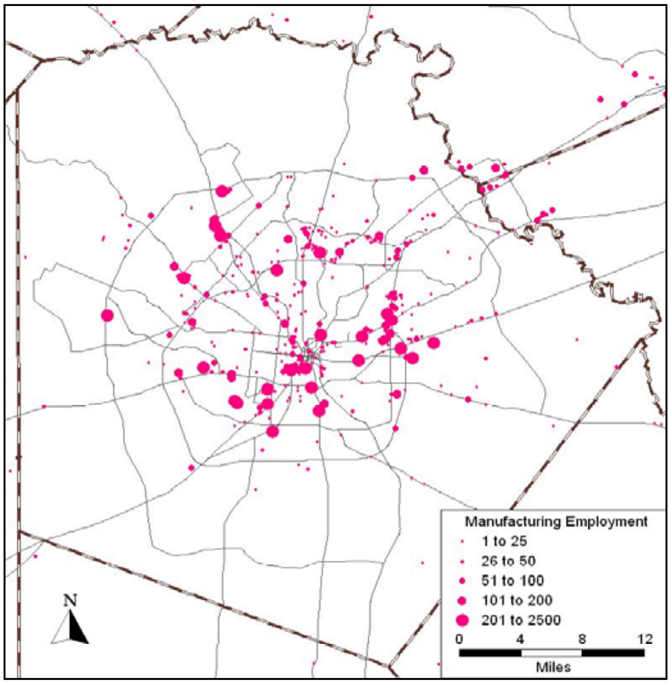
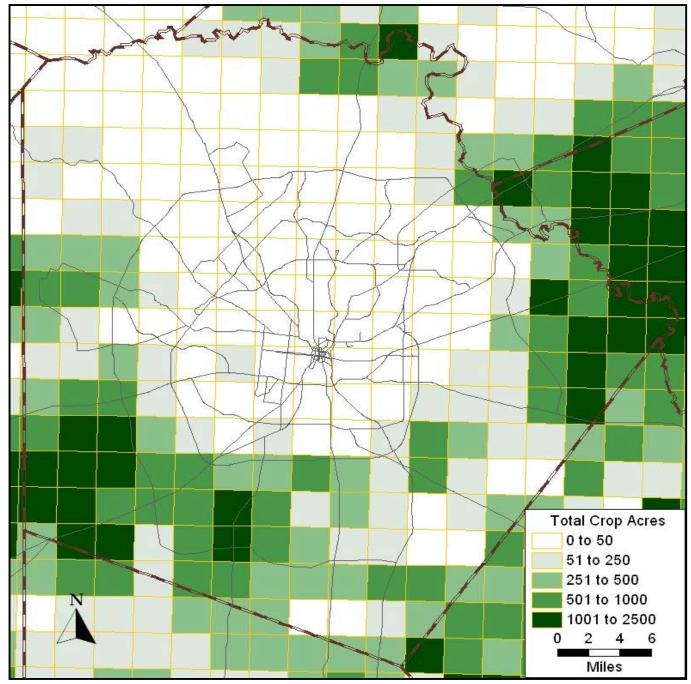


Figure 2-17. Location of Agriculture Crops, 2005



Allocation of emissions by 4km grid cells for each sector is shown in Figure 2-18 to 2-30. While Figure 2-31 shows the default spatial allocation of NonRoad construction equipment emissions, Figure 2-32 shows the updated allocation of the 2005 construction equipment emissions. Figure 2-33 portrays the difference in construction Equipment NOx emissions between default and the 2005 emission inventory while the percent difference in construction emissions is illustrated in Figure 2-34.

Increase emissions are evident on the San Antonio’s west side because of the increase in construction of house, commercial buildings, and services in this part of city. Also, there is an increase in emissions along the northern section of 1604 and at mining/quarry sites. Downtown San Antonio shows a decrease emission because there are fewer new construction projects in this area of the city.

Figure 2-18. Heavy Highway and TxDOT Construction Equipment Emissions (tons NOx/day), 2005

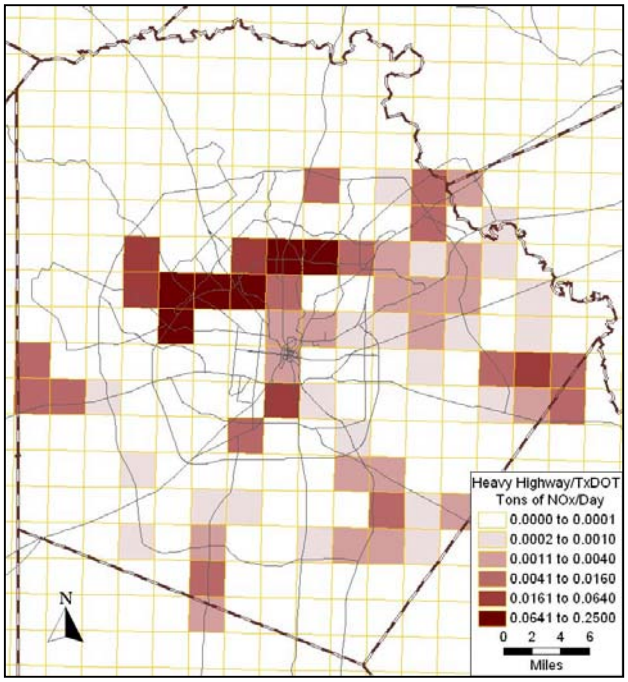


Figure 2-19. Utility Construction Equipment Emissions (tons of NOx/day), 2005.

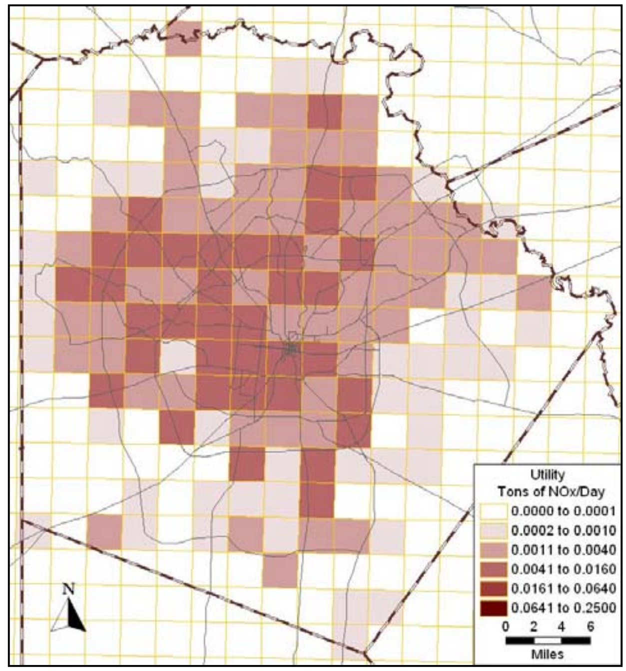


Figure 2-20. Residential Construction Equipment Emissions (tons of NOx/day), 2005

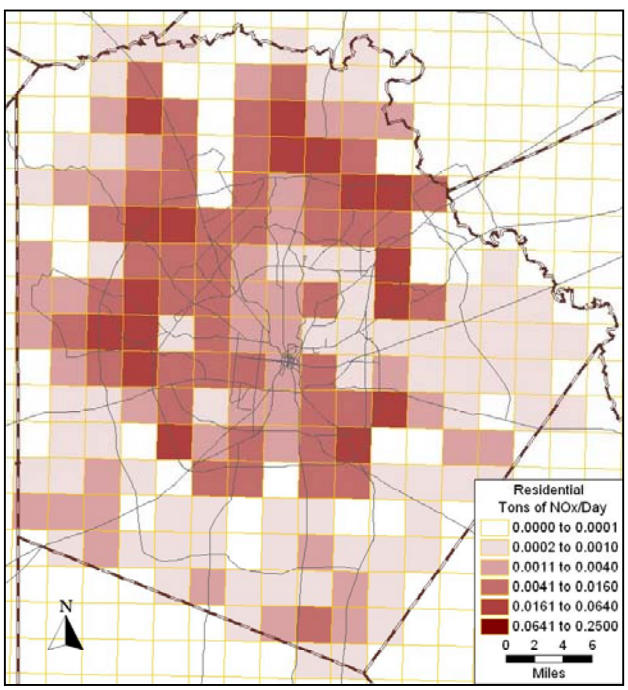


Figure 2-21. Commercial Construction Equipment Emissions (tons of NOx/day), 2005

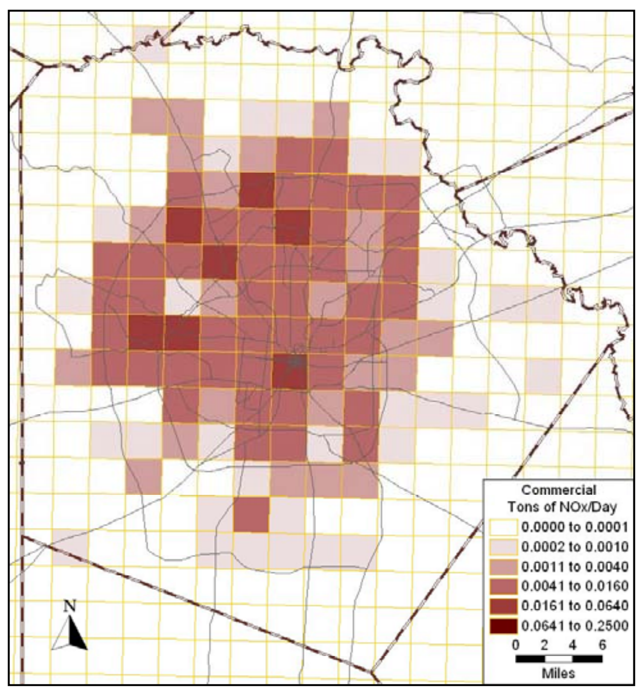


Figure 2-22. City, County, and Municipal Construction Equipment Emissions (tons of NOx/day), 2005

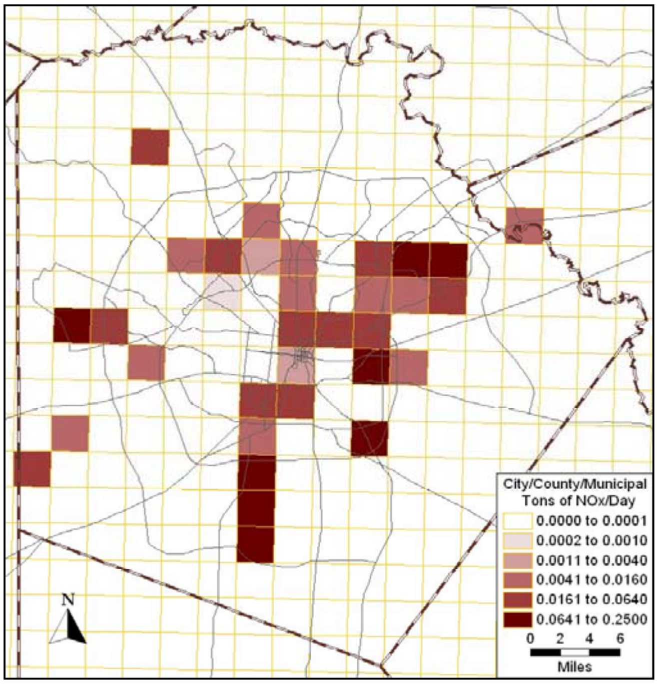


Figure 2-23. Scrap and Waste Construction Equipment Emissions (tons of NOx/day), 2005

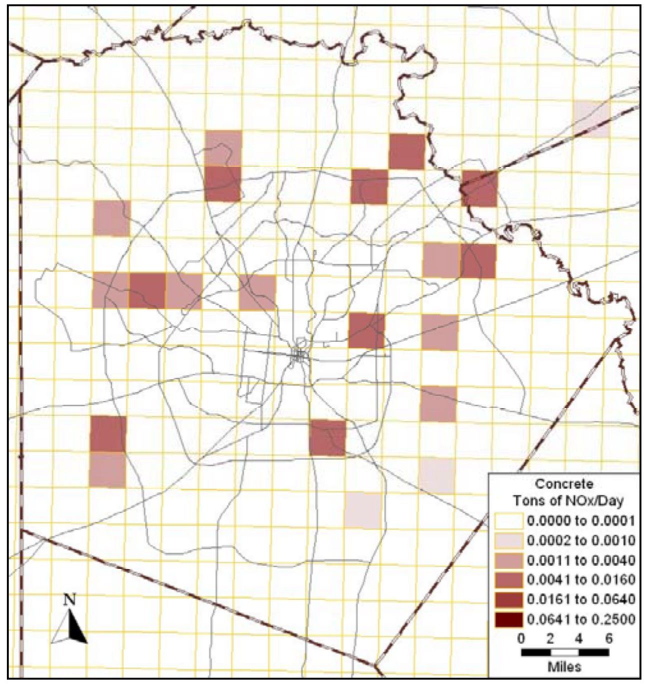


Figure 2-24. Brick and Stone Construction Equipment Emissions, (tons of NOx/day), 2005

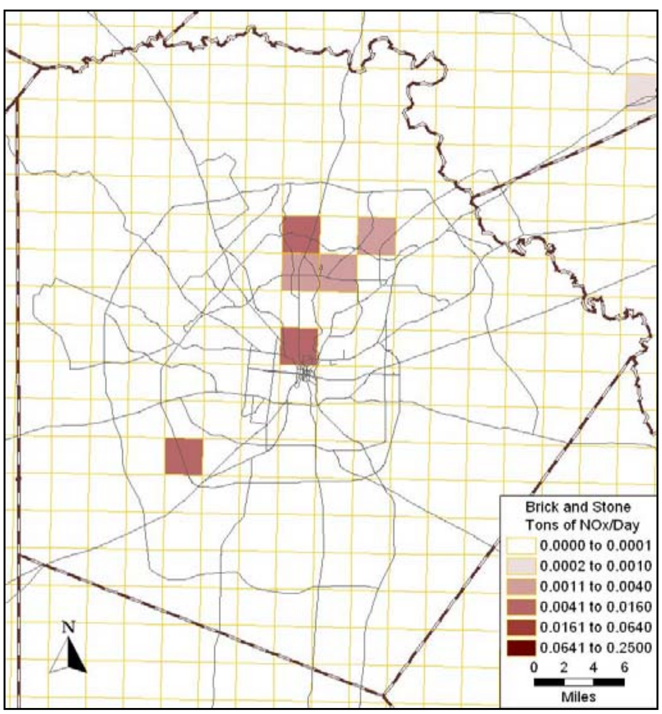


Figure 2-25. Concrete Construction Equipment Emissions, (tons of NOx/day), 2005

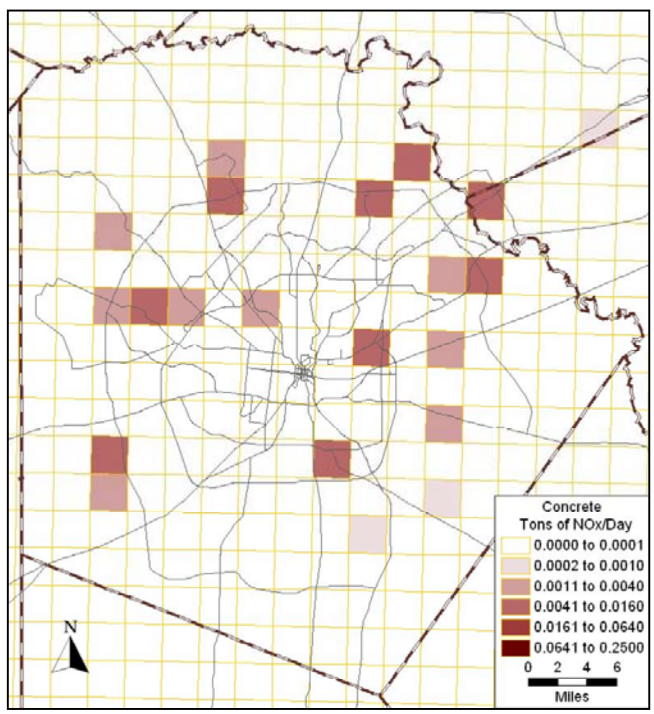


Figure 2-26. Manufacturing Construction Equipment Emissions, (tons of NOx/day), 2005

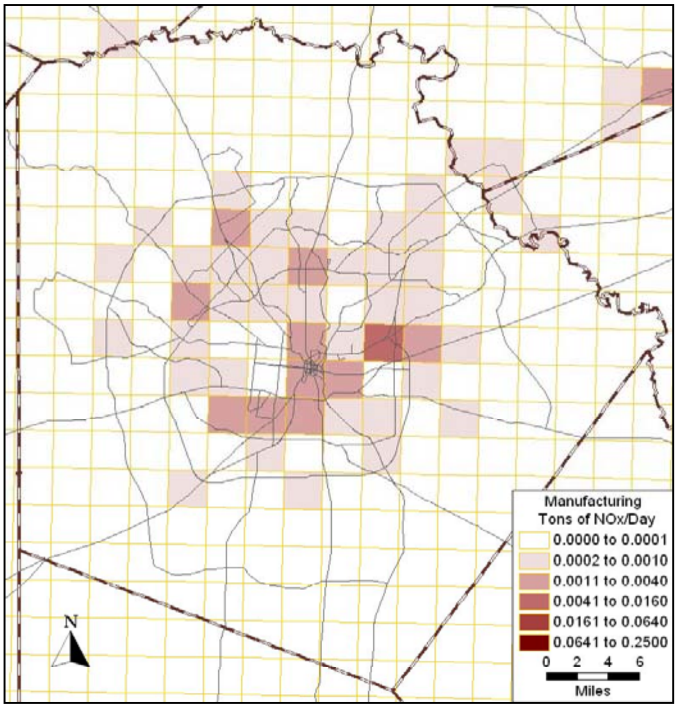


Figure 2-27. Agriculture Construction Equipment Emissions, (tons of NOx/day), 2005

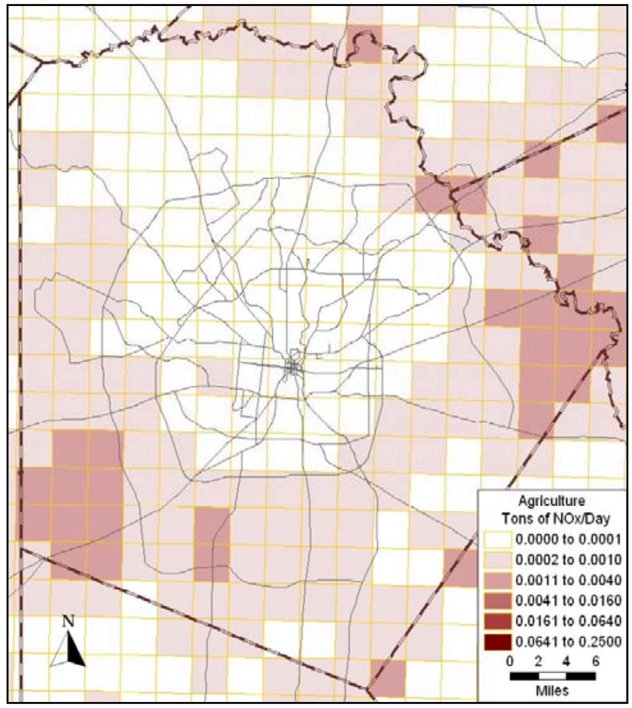


Figure 2-28. Special Trade Construction Equipment Emissions, (tons of NOx/day), 2005

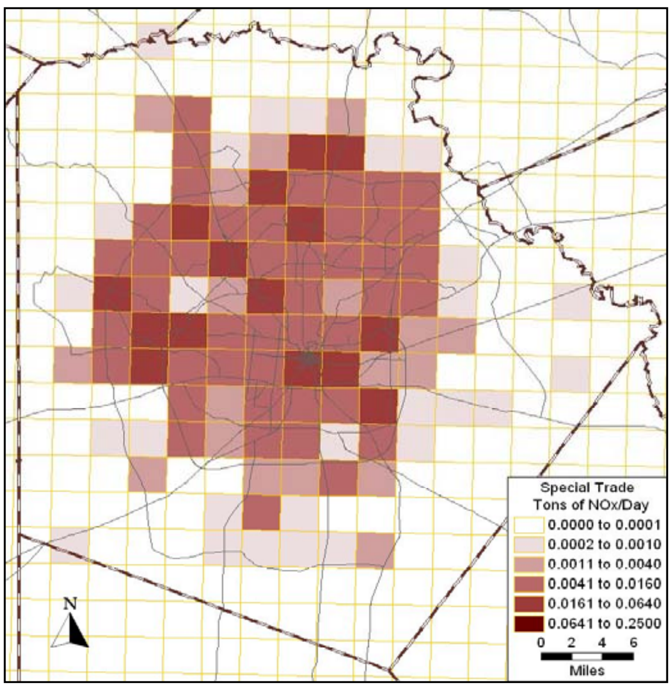


Figure 2-29. Toyota Construction Equipment Emissions, (tons of NOx/day), 2005

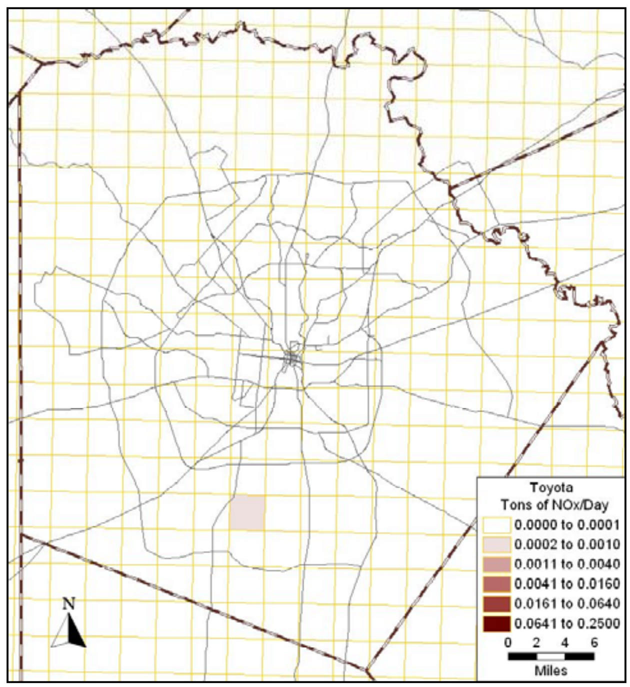


Figure 2-30. Other Construction Equipment Emissions, (tons of NOx/day), 2005

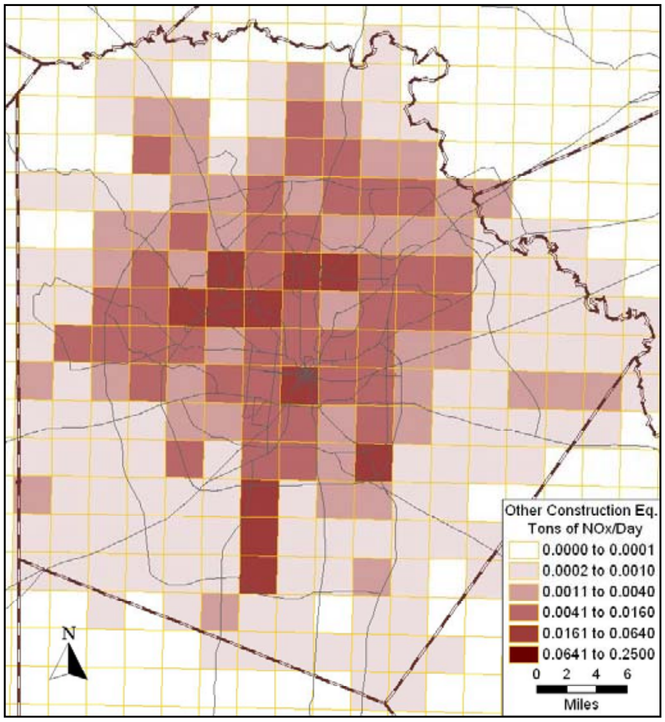


Figure 2-31. Default Non-road Construction Equipment Emissions, (tons of NOx/day), 2005

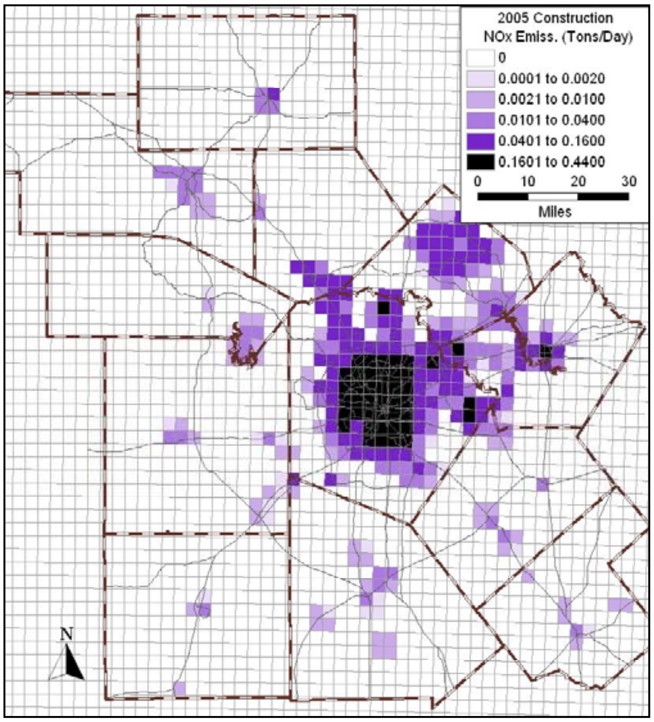


Figure 2-32. 2005 NET EI Construction Equipment Emissions, (tons of NOx/day), 2005

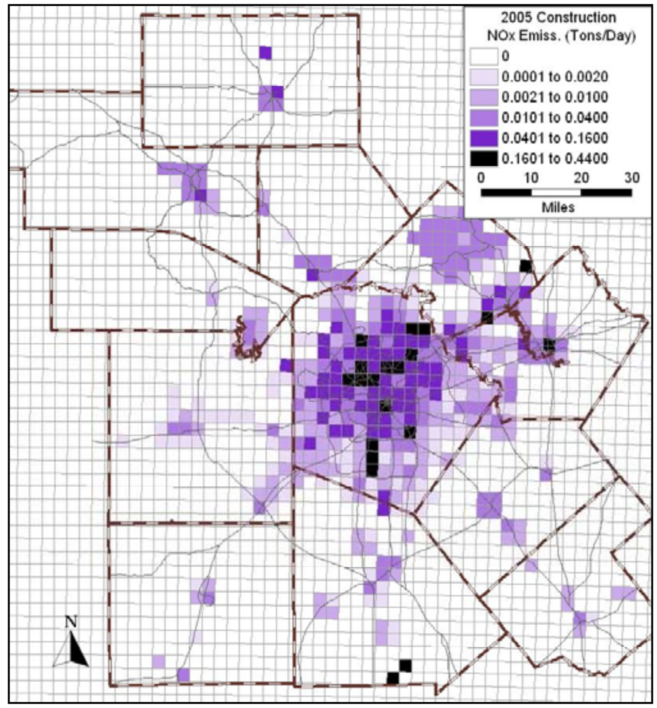


Figure 2-33. Difference between Construction Equipment NOx Emissions 2005 Default and 2005 NET EI

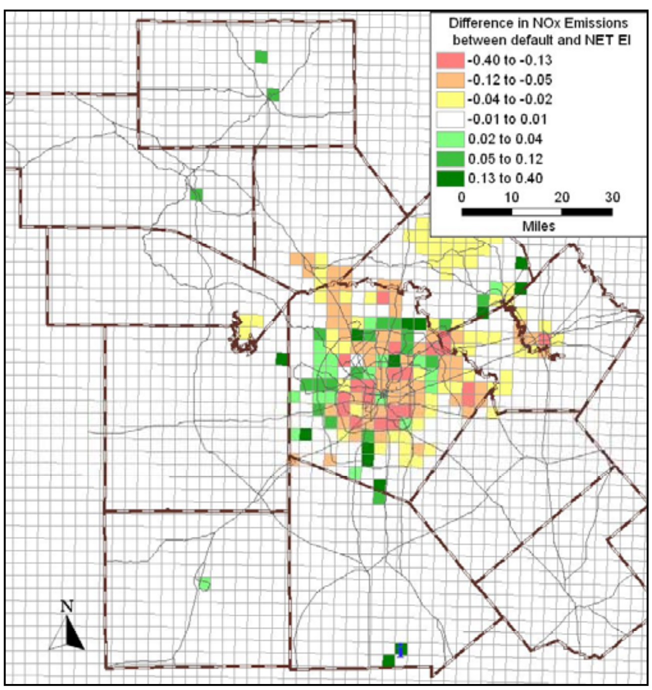
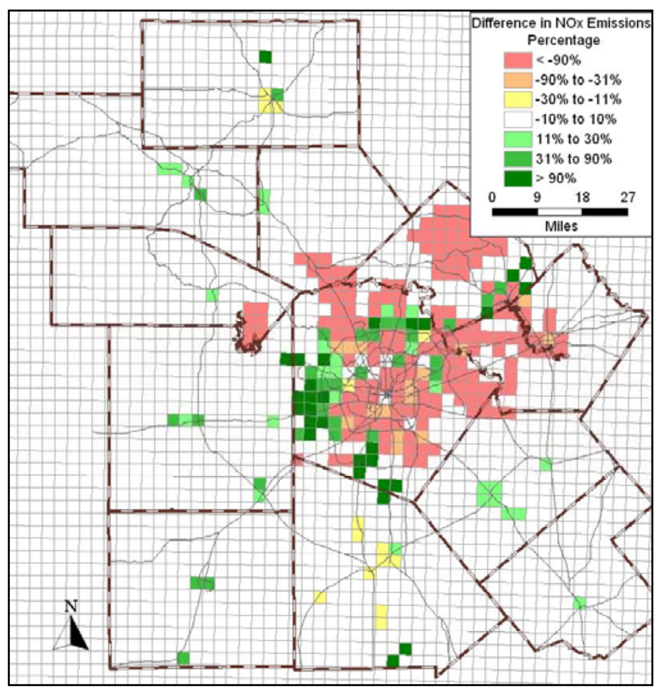


Figure 2-34. Percent Difference in Construction Emissions, 2005
(Only for NOx emissions > 0.005 tons/day)



Industrial Equipment

The 2005 industrial equipment emissions inventory includes emission estimates from the use of aerial lifts, forklifts, sweepers/scrubbers, other general industrial equipment, other material handling equipment, refrigeration units, and terminal tractors in the 12-county AACOG region. For each industrial equipment category, emissions were calculated for a variety of engine types: 2-stoke gasoline, 4-stroke gasoline, LPG, CNG, and diesel.

Methodology
Light industrial equipment emissions were estimated using local survey data in conjunction with EPA's NONROAD model. The local data were obtained by mailing questionnaires of equipment use to businesses, government agencies, and schools throughout the AACOG region. The survey, a copy of which is attached at the end of this section, requested that the respondent provide information regarding the types and quantities of equipment in use, equipment horsepower (HP) ratings, activity levels, and other data. The results of the surveys were used to modify appropriate NONROAD files such as the equipment activity file, equipment population file, and seasonal adjustment file in preparation for conducting the industrial equipment runs (Table 2-8).

Prior to calculating activity levels, average HP, and temporal allocations using local data, it was determined that the response rate to the 2002 equipment survey was too low to qualify as a representative sample of the population of industrial equipment users in the AACOG region. At a 95% confidence level and 8% confidence interval (for sampling accuracy), seventy responses were needed to adequately represent the population of 128 businesses in the area that were identified as industrial equipment operators[29]. This was estimated using the following equation:

Equation (1)

RN = $[CLV^2 \times 0.25 \times POP] / [CLV^2 \times 0.25 + (POP – 1) CIN^2]$

Where,

RN = Number of survey responses needed to accurately represent population of schools in the AACOG region
CLV = 95% confidence level (1.96)
POP = Industrial business population for AACOG region, 128 businesses)
CIN = ± 8% confidence interval (0.08)

The number of responses needed for accurate representation:

RN = $[1.96^2 \times 0.25 \times 128$ businesses$] / [1.96^2 \times 0.25 + (128$ businesses – 1$) 0.05^2]$
RN = 70 responses

AACOG received 50 responses to the 2002 industrial equipment questionnaire. In order to use an adequate number of survey responses, the 2002 data were combined with information from a similar survey conducted by AACOG in 1995. It was assumed the types of industrial equipment used by business and industry would not have changed greatly between 1995 and 2002. The 1995 survey data from companies who also responded to the 2002 survey were removed from the calculations to avoid double counting.

[29]Texas Workforce Commission, 2002. Employment Data for 3rd quarter 2001. Austin, Texas.

Activity Files
The local activity data was used to update the NONROAD activity.dat file. Similarly, the average weekday and weekend hours of use were calculated by summing the weekday or weekend usage for each type of equipment listed in the survey responses and dividing by the number of equipment in that SCC category.

Temporal Allocation Files
To develop weekday and weekend allocation factors for the NONROAD season.dat file from the survey data, the percentage of weekday hours or weekend hours to total hours were calculated for each SCC and the resulting fraction was divided by either 5 (weekdays) or 2 (weekend days) using the formulas:

Sample Calculations
Equation (2)
Weekday allocation factor for commercial equipment for equipment type A:

$$WDAF_A = [(AU_{WDA} \times 5) / (AU_{WDA} \times 5) + (AU_{WNA} \times 2)] / 5$$

Where,

$WDAF_A$ = Weekday allocation factor for equipment type A
AU_{WDA} = Average weekday usage for equipment type A (hrs/weekday)
AU_{WNA} = Average weekend usage for equipment type A (hrs/weekend day)
5 = Number of weekdays (days)
2 = Number of weekend days (days)

The average hours of use for 4-stroke gasoline forklifts as calculated from the combined 1995 and 2002 AACOG surveys were 3.833486 hours each weekday and 1.829290 hours each weekend day. The weekday temporal allocation factor for the 4-stroke forklifts was calculated as:

$$WDAF_A = [(3.833486 \text{ hrs/wkday} \times 5 \text{ days}) / (3.833486 \text{ hrs/wkday} \times 5 \text{ days}) + (1.829290 \text{ hrs/wkend day} \times 2 \text{ days})] / 5 \text{ days}$$
$$= 0.1679438 \text{ weekday allocation factor}$$

Equation (3)
Weekend day allocation factor for commercial equipment in for equipment type A:

$$WNAF_A = [(AU_{WNA} \times 2) / (AU_{WDA} \times 5) + (AU_{WNA} \times 2)] / 2$$

Where,

$WNAF_A$ = Weekend day allocation factor for commercial equipment in SCC category A
AU_{WDA} = Average weekday usage for equipment type A (hrs/weekday)
AU_{WNA} = Average weekend usage for equipment type A (hrs/weekend day)
5 = Number of weekdays (days)
2 = Number of weekend days (days)

The average hours of use for 4-stroke gasoline forklifts as calculated from the combined 1995 and 2002 AACOG surveys were 3.833486 hours each weekday and 1.829290 hours each weekend day. The weekend day temporal allocation factor for the 4-stroke welders was calculated as:

$WNAF_A$ = [(1.829290 hrs/wkend days x 2 days) / (3.833486 hrs/wkday x 5 days) + (1.829290 hrs/wkend day x 2 days)] / 2 days
= 0.0801406 weekend day allocation factor

Table 2-32 compares the NONROAD default day-of-the-week adjustment factors with those calculated from the survey data.

Population File

Average horsepower ratings for each equipment type were determined from the survey data based on the HP ranges used in the 2004 version of the NONROAD model. The average HP ratings per range were calculated employing the same formula used to determine average equipment activity levels. The NONROAD TX_pop file was modified by changing the model's default average HP for each bin in an equipment category to the average HP within that range as calculated from the combined 1995 and 2002 survey data.

In the absence of an appropriate methodology to grow the 1995 equipment population to the year 2002, the *total* equipment population for each SCC (the sum of equipment in all HP ranges for an equipment category in the NONROAD default file) was not updated in the equipment population file. However, the population for the individual HP ranges were modified by allocating the total population for each equipment type in the default file to a horsepower bin based on the percentage of equipment in the range as determined from the 1995 and 2002 survey results. If there were no pieces of equipment listed in the 1995 or 2002 surveys for a HP range, the population for the bin was changed to 0.0.

Several types of light industrial equipment, such as CNG terminal tractors, were not reported in either the 1995 or 2002 survey results. For instances such as these, the default HP, activity levels, and daily allocation factors were left unmodified from the default data.

Table 2-32. Comparison of Default and Modified Temporal Allocation Data

SCC	Equipment	Engine Type	Default NONROAD Day of Week Adjustment (Mon-Fri)	Day of Week Adjustment Factor (Mon-Fri)	Default NONROAD Day of Week Adjustment (Sat-Sun)	Day of Week Adjustment Factor (Sat-Sun)
2265003010	Aerial Lifts	Gas, 4-cycle	0.1666667	0.1999389	0.0833334	0.0001528
2267003010	Aerial Lifts	LPG	0.1666667	No Change	0.0833334	No Change
2270003010	Aerial Lifts	Diesel	0.1666667	0.1897917	0.0833334	0.0255207
2265003020	Forklifts	Gas, 4-cycle	0.1666667	0.1679438	0.0833334	0.0801406
2267003020	Forklifts	LPG	0.1666667	0.1797282	0.0833334	0.0506795
2268003020	Forklifts	CNG	0.1666667	No Change	0.0833334	No Change
2270003020	Forklifts	Diesel	0.1666667	0.1962715	0.0833334	0.0093212
2260003030	Sweepers/Scrubbers	Gas, 2-cycle	0.1666667	No Change	0.0833334	No Change
2265003030	Sweepers/Scrubbers	Gas, 4-cycle	0.1666667	0.1788199	0.0833334	0.0529503
2267003030	Sweepers/Scrubbers	LPG	0.1666667	0.1541158	0.0833334	0.1147106
2268003030	Sweepers/Scrubbers	CNG	0.1666667	No Change	0.0833334	No Change
2270003030	Sweepers/Scrubbers	Diesel	0.1666667	0.2000000	0.0833334	0.0000000
2260003040	Other General Ind Equip	Gas, 2-cycle	0.1666667	No Change	0.0833334	No Change
2265003040	Other General Ind Equip	Gas, 4-cycle	0.1666667	No Change	0.0833334	No Change
2267003040	Other General Ind Equip	LPG	0.1666667	No Change	0.0833334	No Change
2268003040	Other General Ind Equip	CNG	0.1666667	No Change	0.0833334	No Change
2270003040	Other General Ind Equip	Diesel	0.1666667	No Change	0.0833334	No Change
2265003050	Other Matl Handling Eq	Gas, 4-cycle	0.1666667	No Change	0.0833334	No Change
2267003050	Other Matl Handling Eq	LPG	0.1666667	No Change	0.0833334	No Change
2270003050	Other Matl Handling Eq	Diesel	0.1666667	No Change	0.0833334	No Change
2265003060	Refrigeration	Gas, 4-cycle	0.1428571	No Change	0.1428571	No Change
2268003060	Refrigeration	CNG	0.1428571	No Change	0.1428571	No Change
2270003060	Refrigeration	Diesel	0.1428571	No Change	0.1428571	No Change
2265003070	Terminal Tractors	Gas, 4-cycle	0.1666667	No Change	0.0833334	No Change
2267003070	Terminal Tractors	LPG	0.1666667	No Change	0.0833334	No Change
2268003070	Terminal Tractors	CNG	0.1666667	No Change	0.0833334	No Change
2270003070	Terminal Tractors	Diesel	0.1666667	0.1688404	0.0833334	0.0778990

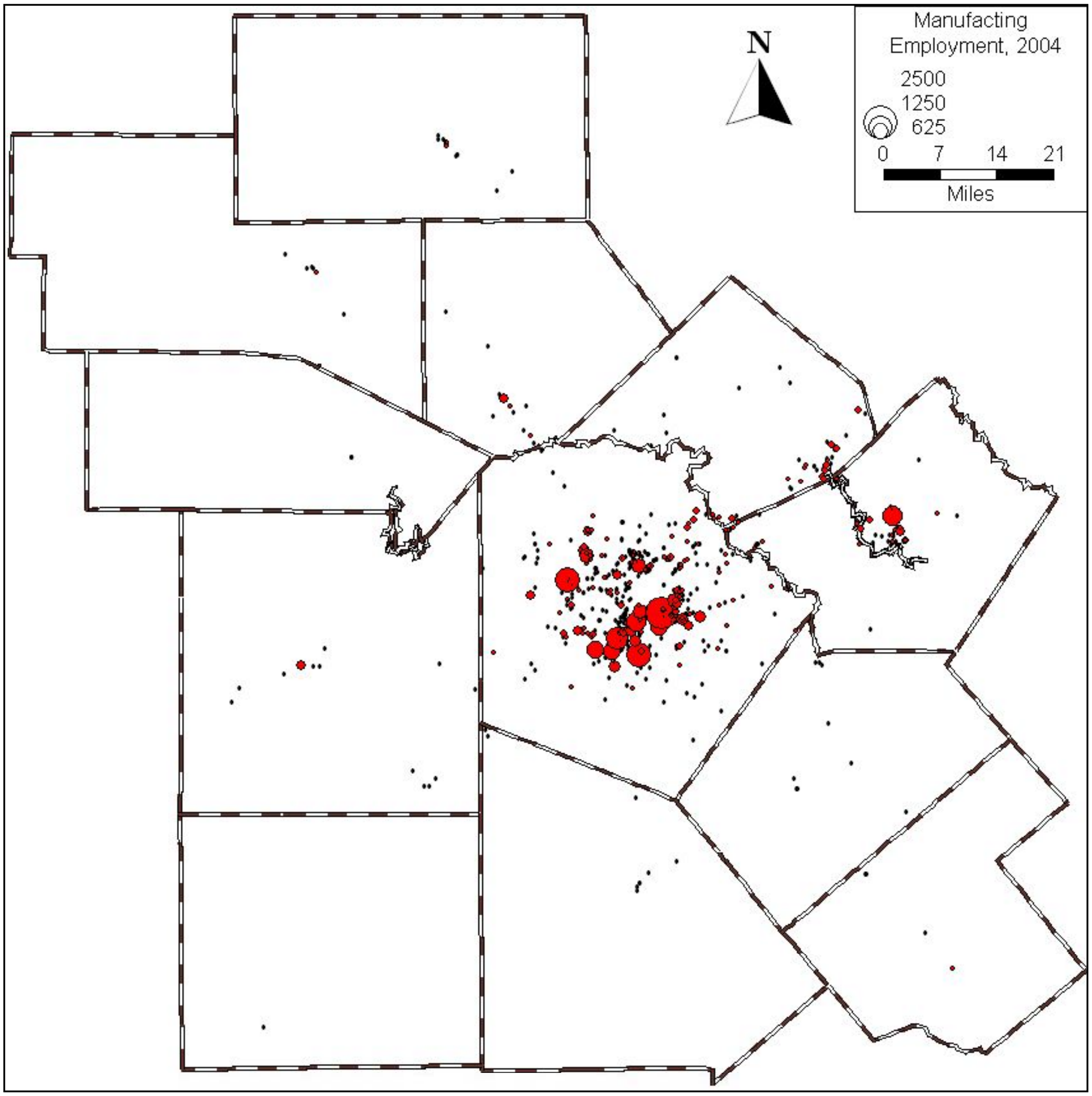
Seasonal Adjustment

Neither the 1995 nor 2002 surveys requested information regarding the use of equipment during the ozone season versus other times of the year. As a consequence, no adjustments were made to the NONROAD seasonal allocation factors. Therefore, the summer season weekday emission estimations in the 2002 industrial equipment inventory are based on the model's default allocations for June, July, and August.

Spatial Distribution

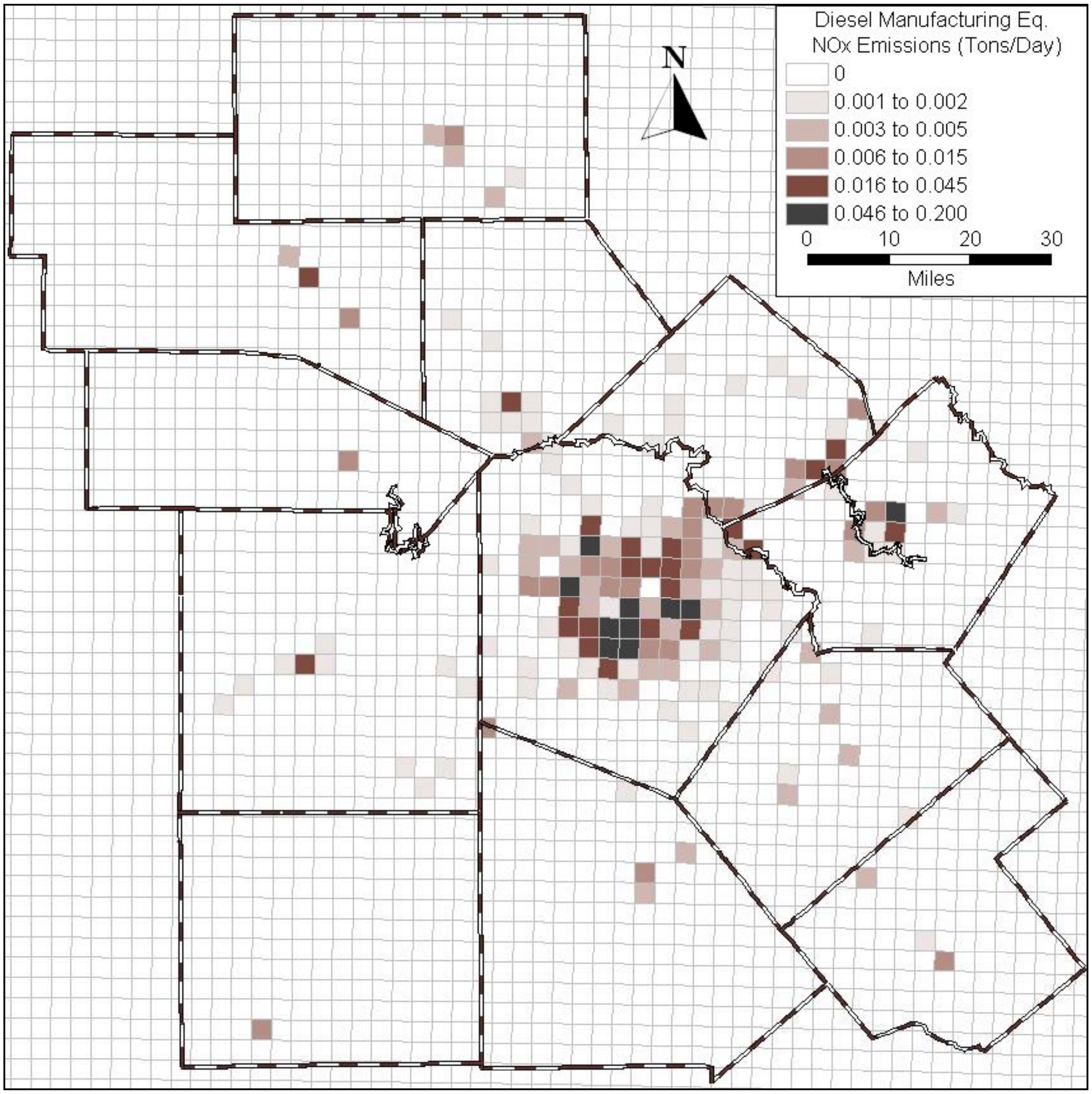
Emissions are allocated on the 4km grid by the location of the Manufacturing Employment (Figure 2-35 and 2-36).

Figure 2-35. Manufacturing Employment, 2004



Plot Date: March 16, 2006
Map Compilation: March 14, 2006
Source: Manufacturing employment and locations were provided by Texas Workforce Commission, 2005, Employment Data for 3rd quarter 2004. Austin, Texas.

Figure 2-36. NOx Emissions from Diesel Manufacturing Equipment, 2005



Plot Date: March 16, 2006
Map Compilation: March 16, 2006
Source: Manufacturing employment and locations were provided by Texas Workforce Commission, 2005, Employment Data for 3rd quarter 2004. Austin, Texas.

Alamo Area Council of Governments
Equipment Environmental Impact Survey
Internal Combustion Engines

The Alamo Area Council of Governments (AACOG) is conducting a study to assess and quantify local air quality within the San Antonio Metropolitan area and contiguous counties by performing an emission inventory. AACOG has defined the study area to include Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. Our goal is to provide better information and services to businesses and individuals, and help minimize additional regulation on the community. The purpose of this survey is to gather data on emissions produced by several types of equipment in the region.

The study area does not presently exceed Environmental Protection Agency (EPA) air quality standards. However, if the standards are exceeded in the future we will be classified as nonattainment, which will result in expensive and stringent regulations for your business and the community. By filling out this confidential survey, you will be providing valuable data that will be used to evaluate cost-effective approaches to pollution control. Thank you for taking the time to provide this information.

Instructions:

4. Please look through the equipment types shown on the following page.
5. List any of the equipment types regularly operated at your business.
6. Fill in the appropriate figures for each equipment type you listed. (Estimates are acceptable.)

If you have other internal combustion equipment that is not shown, please include it as well.

NOTE: IF YOUR BUSINESS HAS MORE EQUIPMENT THAN WILL FIT IN THE SPACE PROVIDED, PLEASE MAKE ADDITIONAL COPIES OF THE SURVEY.

Completed surveys can be faxed to (210) 225-5937, or mailed to:
Alamo Area Council of Governments
8700 Tesoro, Suite 700
San Antonio, Texas 78217
Attn: Chris Langston

If you have any questions or comments, please call us at (210) 362-5270.
SURVEY STARTS ON THE OTHER SIDE OF THIS PAGE

	Internal Combustion Equipment Type	Engine Type Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
			Industrial & Commercial Equipment			
1	Generators					
2	Pumps					
3	Compressors					
4	Welders					
5	Pressure Washers					
6	Aerial Lifts					
7	Forklifts					
8	Sweepers/Scrubbers					
9	AC/Refrigeration					
10	Terminal Tractors					
11	Single Board Light Plants					
12	Other General Industrial or Material Handling Eqmt. Type:_____________					

	Internal Combustion Equipment Type	Engine Type Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
Construction Equipment						
1	Bore/Drill Rigs					
2	Excavators					
3	Concrete & Mortar Mixers					
4	Cranes					
5	Graders					
6	Crushing/Processing Eqmt.					
7	Rough Terrain Forklifts					
8	Rubber Tire Loaders					
9	Other Loaders					
10	Dozers					
11	Tractors/Backhoes					
12	Scrapers					
13	Rollers					
14	Trenchers					
15	Pavers					
16	Other Construction Equipment Type: ___________					

Landfill Equipment

The equipment of concern in this study is diesel engine landfill equipment. The following is a list of equipment types and their corresponding source classification code.

- 2270002003 Pavers
- 2270002018 Scrapers
- 2270002036 Excavators
- 2270002048 Graders
- 2270002051 Off-highway Trucks
- 2270002060 Rubber Tire Loaders
- 2270002069 Crawler Tractor/Dozers
- 2270002081 Other Construction Equipment

These equipment types are utilized for other purposes including construction projects. However, the emissions from landfill equipment were calculated separately from construction-generated emissions because of differences in engine populations, HP, and activity levels.

Methodology
The methodology used to estimate landfill equipment emission estimates for the AACOG region relies on local data produced from surveys, equipment estimates from the Austin area, and on national data used in the EPA's NONROAD Emission Inventory Model. The methodology involves the following steps:

1. Conducting a survey of local landfill equipment activity to determine local equipment use rates and equipment characteristics.

2. Determining equipment population and activity for landfills without local data. This is accomplished by using estimated equipment populations and activity from an Eastern Research Group (ERG)[30] study and from the AACOG survey.

3. Conducting a second survey with estimations of equipment activity at each landfill. The landfills were asked to make corrections and send back the survey.

4. Estimating VOC, NOx, and CO annual emissions by using survey responses and NONROAD model defaults and converting the tons/year estimate into an estimate for a typical weekday (tons/day), and a typical weekend day (tons/day) for the summer or ozone season.

These steps are outlined below.

Step 1: Conduct a Survey of Local Landfill Equipment
The preferred method for calculating landfill equipment emissions involves conducting a survey of equipment use within the AACOG region.

The survey provided the following types of local information:

- Activity Rates (HRS) – total annual hours of use by type of equipment
- Temporal Profiles – equipment use on weekdays and equipment use on weekend days for all types of equipment

[30] Eastern Research Group, Inc. April 20, 2000. Development of a Revised Emissions Inventory for Construction Equipment in the Houston-Galveston Ozone Non-Attainment Area. Final Report. Eastern Research Group Inc.

- Engine Characteristics:
  - Engine Type – gasoline 2-stroke, gasoline 4-stroke, diesel, LPG, CNG
  - Engine Horsepower – rated power of the engine

There are seven active landfills or large transfer stations in the AACOG region. These are listed in Table 2-33. Of the seven facilities, only two responded to the initial survey.

Table 2-33 AACOG Regional Landfills and Transfer Stations, 2005

Permit Number	Landfill or Transfer Station Name	Type	County
0066	WASTE MANAGEMENT OF TEXAS, INC.	I	Comal
1410	BFI WASTE SYSTEMS N. AMER. INC.	I	Bexar
1443	TEXAS DISPOSAL SYSTEMS LANDFILL	I / Transfer Station	Bexar
1506	CITY OF KERRVILLE	I	Kerr
1848	NIDO, INC.	IV	Guadalupe
1995	CITY OF FREDERICKSBURG	I	Gillespie
2093	WASTE MANAGEMENT OF TEXAS, INC.	I	Bexar

Step 2: Determine County Level Equipment Population

For the 5-landfills/transfer stations that did not respond to the first survey, equipment populations were estimated. To adjust for local landfill equipment data, AACOG used the CAPCO study completed by ERG[31] and the results from the AACOG survey to estimate equipment population. Activity rates were complied from the AACOG survey responses.

Step 3: Conduct a Second Survey of Landfill Equipment Activity

After analyzing the results from the first survey and the ERG Study estimations for equipment, a second survey was sent out to the local landfills with the estimations of their equipment population, HP, and activity hours. This survey used the same format as the initial survey. The companies were asked to correct the estimations and to send the surveys back to AACOG. There was a 78 percent response rate to the second survey. The increased response rate improved equipment estimations. For the 2 landfills that did not respond to the survey, AACOG used the equipment populations determined in Step 2.

Equipment hours were adjusted upwards to account for the difference in equipment activity between landfills and other typical construction operations. For example, large dozers were typically used 3,349 hours per year at landfill sites that responded to the survey versus 936 hours per year in the default NONROAD model activity file. Table 2-34 lists the differences in HP and hours between the NONROAD 2004 defaults, ERG survey, and AACOG survey.

[31] *Ibid*, p. 14.

Table 2-34. Equipment Population, HP, and Hours per Landfill Based on ERG Study and AACOG Survey*

Equipment Type	SCC	ERG Estimated No. of Units per Landfill	Estimated HP			Estimated Hours per Year		
			NONROAD Default	ERG Study	AACOG Results	NONROAD Default	ERG Study	AACOG Results
Pavers	2270002003	2	178	500	345	821	7200	3268
Scrapers	2270002018	1	409	250	341	914	2000	2100
Excavators	2270002036	-	171	-	225	1092	-	2088
Graders	2270002048	1	204	250	222	962	2000	939
Off-highway Trucks	2270002051	1	783	225	192	1641	1250	1270
Rubber Tire Loaders	2270002060	1	243	125	166	761	2000	1435
Crawler Tractor/Dozers (Large)	2270002069	1	260	250	261	936	2000	3349
Crawler Tractor/Dozers (Small)	2270002069	1	260	80	123	936	2000	3260
Other Construction Equipment	2270002081	1	328	125	207	606	1250	3573

*Excavators were not estimated in the ERG Study

Step 4: Estimate Emissions of Ozone Precursors

The results from the surveys were compiled by county. Once county level equipment populations were calculated, emissions of volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) were calculated using NONROAD 2004. In using the NONROAD model, some adjustments were made for local conditions.

Population File

The equipment population for each landfill was summed and compiled into a master spreadsheet. This master spreadsheet was then converted into the population file for the NONROAD model.

Allocation File

An allocation file was created to properly allocate emissions for each county. The file was made by taking the default construction allocation file for Texas (Tx_const.alo) and replacing values (dollars spent on construction) with zeros for all counties except those in the study area. The values for the AACOG region were allocated based on the number of landfills in each county (Table 2-35). For example, Bexar had 3 of the 7 landfills; therefore this county had 43 percent of the allocation value. The county values were added up and this total was used to replace the Texas state value. This allows the NONROAD model to calculate emissions for the AACOG region as a whole and distribute the emissions to each county appropriately.

Table 2-35. Allocation of Landfill Equipment in the AACOG Region, 2005

Region	FIPS code	Allocation (Indicator value)	Percentage
Bexar	48029	3	43%
Comal	48091	1	14%
Gillispie	48171	1	14%
Guadalupe	48187	1	14%
Kerr	48265	1	14%
Texas	48000	7	100%

Season File

The weekday vs. weekday adjustment factor of 0.1617191 for weekdays and 0.0957023 for weekends was calculated from the returned AACOG surveys for landfills.

DRAFT

[COMPANY NAME]
[STREET ADDRESS]
[CITY] [STATE] [ZIP]

ATTENTION: OPERATIONS MANAGER

Re: San Antonio Emissions Inventory

The Alamo Area Council of Governments (AACOG) requests your assistance in the development of a air quality emission inventory for San Antonio and the surrounding counties. AACOG is conducting this inventory in order to assess and quantify local air quality within the San Antonio Metropolitan area and contiguous counties. This inventory is especially significant because the San Antonio region currently risks being declared in non-attainment of federal air quality standards (NAAQS).

AACOG will calculate the equipment source component of this inventory from information submitted by local organizations involved in equipment activities in and around the San Antonio region using the enclosed survey. With this survey, we are requesting information on equipment used during the calendar year within Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. The purpose of this survey is to provide better information and services to the region, as well as help minimize additional regulation on the community.

Your input is vital to this process and will serve to effect a true and correct emissions inventory for 2002 that will be delivered to the EPA. Please provide your responses on the attached survey and return it to us in the self-addressed envelope by the date indicated. The information you provide will be considered strictly confidential and unavailable to public information requests.

Thank you for your time and participation. If you have any questions or comments please feel free to contact Chris Langston at (210) 362-5270.

Regionally yours,

Al J. Notzon III
Executive Director
Enclosures (2)

	Internal Combustion Equipment Type	Engine Type Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
Construction Equipment						
1	Bore/Drill Rigs					
2	Excavators					
3	Concrete & Mortar Mixers					
4	Cranes					
5	Graders					
6	Crushing/Processing Eqmt.					
7	Rough Terrain Forklifts					
8	Rubber Tire Loaders					
9	Other Loaders					
10	Dozers					
11	Tractors/Backhoes					
12	Scrapers					
13	Rollers					
14	Trenchers					
15	Pavers					
16	Other Construction Equipment Type: ___________					

Logging Equipment

There is no documentation of large scale logging equipment usage in the 12-county AACOG region. Searches were completed to verify the absence of logging activities in the 12-county AACOG region. The U.S. Census Bureau's website lists no logging activities in the AACOG region. None of the SIC codes for businesses in the region matched SIC 2411 (NAICS 11331) for logging. [32]

Mining Equipment

Mining activities in the South-central Texas region include lignite mining as well as rock (primarily limestone) quarrying. However, the methodology used to calculate emissions from lignite mining equipment varied somewhat from that used for quarrying equipment. This section of the 2005 AACOG emissions inventory describes the methodology used to estimate equipment emissions at the surface (lignite) mine in Atascosa County. "Lignite, often referred to as brown coal, is the lowest rank of coal and used almost exclusively as fuel for steam-electric power generation."[33] The lignite mine is the only large active mine in the AACOG region that is not a cement or sand and gravel quarry.

Methodology

The equipment used to operate surface mines typically includes scrapers, crawler dozers, continuous miners, motor graders, end dumps, bottom dumps, cranes, and other large off-road equipment. Mining emissions were estimated using an equipment list provided by the lignite mine operator. Also, for most of the equipment at the mine, hp was also calculated based on the data provided by the mine. Other data needed for the emission calculations were either provided by mining experts or obtained from the NONROAD model, as described later in this section. Personnel in the lignite mining industry provided information on average annual hours of equipment use for the large equipment used at the mine. Values for typical load factor and average emissions of pollutant per unit of use were obtained from the EPA draft NONROAD Emission Inventory Model, version 2004.[34] Load factors are listed in the model's equipment activity file. Emission factors were calculated by determining the default values used in NONROAD 2004. This was accomplished by performing a model run, then solving for the unknown value (EF) in the emissions formula using model output.

Sample Calculations

Equation (1)

VOC, NO_x, and CO emission calculations for mining equipment were based on the formula:[35]

$$AE_A = (EP_A \times HRS_A \times HP_A \times LF_A \times EF_A) / 453.59 / 2{,}000$$

Where,

AE_A = Annual emissions for mining equipment type A (tons/yr)

EP_A = Population of equipment type A (from survey)

[32] US Census Bureau (last access June 15, 2005), 2002 MSA Business Patterns (NAICS) Available on-line: http://censtats.census.gov/cgi-bin/msanaic/msasect.pl http://censtats.census.gov/cgi-bin/msanaic/msadetl.pl

[33] Wikipedia: The Free Encyclopedia. "Lignite", Available online: http://en.wikipedia.org/wiki/Lignite

[34] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

[35] U.S. Environmental Protection Agency (November 1991). Nonroad Engine and Vehicle Emission Study Report. Washington, D.C.

HRS_A	= Annual hours of use for equipment type A (hrs) (from survey)
HP_A	= Average rated horsepower for equipment type A (hp) (from survey)
LF_A	= Typical load factor for equipment type A (from NONROAD model)
EF_A	= Average emissions factor per unit of use for equipment type A (g/hp-hr) (from NONROAD model)

Annual NOx emissions from three off-highway tractors, with horsepower ratings of 180, 460, and 520, were calculated based on annual use. The average hp from these three pieces of equipment is 387. Two of the tractors are operated approximately 24 hours per day and the third is used 8 hours per day for an average of 6,536 hours per year. The two larger tractors are operated seven days a week, the third is used Monday through Friday. The load factor of 0.59 is from the NONROAD model input data and the emission factor of 8.1944 g/hp-hr is calculated from the NONROAD model.

AE_A = (3 x 6,536 hrs/yr x 387 hp x 0.59 x 8.1944 g/hp-hr) /(453.59 g/lbs) / 2,000 (lbs/tons)
= 40.44 tons NO_x/yr

The information used in the sample is representative of lignite mining operations throughout the Central Texas region. This same procedure was used to produce estimates of VOC and CO in tons per year. The process was repeated for each piece of mobile equipment used at the mine.

Seasonal and Daily Adjustments

Since the mine operates year round, a seasonal adjustment is unnecessary to calculate ozone season emissions. Weekday factors were determined using the average hours per day of use for both weekdays and weekends (0.74541). The average hours per day for each large piece of equipment were provided by lignite mining industry for a typical mine. The annual emissions in tons/year were divided by 261 weekdays a year.

Equation (2)

Daily ozone season emissions from mining equipment type A:

$$DE_A = (AE_A \times AF) / WD$$

Where,

DE_A	= Daily ozone season emissions from mining equipment type A (tons/day)
AE_A	= Annual emissions for mining equipment type A (tons/yr) (from equation 1)
AF	= Weekday adjustment factor (0.74541)
WD	= Number of weekdays (261)

Using the annual emission example, the weekday NOx emissions for off-road tractors during the 2002 summer season were calculated as:

DE_A = (40.44 tons NOx/yr * 0.74541) / 261
= 0.115 tons NOx/day

Quarry Equipment

This category consists of emissions produced from equipment used in quarry and mining activities. A variety of minerals are mined in the AACOG region: limestone, aggregate, granite, sand and gravel, and lignite. Emissions from lignite mining are included in the mining section of the non-road chapter. This section of the emissions inventory covers the calculation of emissions from off-road equipment from quarries. Stationary equipment associated with the mines and quarries, including power plants and asphalt plants, are included in the point source inventory developed by TCEQ. Likewise, pickups and other vehicles registered for highway use are included in the on-road inventory; therefore, they are omitted here to avoid double counting.

Emission estimates for the Alamo Area Council of Governments (AACOG) region were calculated from local survey data and national data for diesel vehicles in the following categories of quarry equipment:

- 2270002018 Scrapers
- 2270002036 Excavators
- 2270002048 Graders
- 2270002051 Off-highway Trucks
- 2270002060 Rubber Tire Loaders
- 2270002066 Tractors/Loaders/Backhoes
- 2270002069 Crawler Tractor/Dozers

Methodology

The methodology used in producing quarry equipment emission estimates for the AACOG region is based on local data produced from aerial photography and surveys, and on national data used in EPA's NONROAD 2004 Emission Inventory Model, in the absence of reliable local data. The methodology involves:

1. Conducting a survey of local quarry equipment activity to determine local equipment population, usage rates, and equipment characteristics.

2. Analyzing aerial photography. Analysis was conducted as a result of a low response to the survey. Quarry equipment was identified and counted using available imagery of the Bexar county quarry sites.

3. Determining county equipment population for quarry sites without local data. This was accomplished by applying an average employee to equipment ratio of those quarry sites with available equipment population data to those quarry sites without data.

4. Conducting a second survey with estimations of local quarry equipment activity at each quarry. The quarries were asked to make corrections and send back the survey.

5. Estimating VOC, NOx, and CO annual emissions using survey responses and NONROAD model defaults and converting the tons/year estimate into an estimate for a typical weekday (tons/day) for the summer ozone season.

Equipment emissions were only calculated for Quarries with more than 9 employees. Smaller quarries do not have a significant amount of equipment usage. There are 29 quarries in the San Antonio region that have more then 9 employees (Table 2-36). The steps used to calculate emissions are outlined below

Table 2-36. Allocation of Quarry Equipment in the AACOG Region, 2005

Region	FIPS code	Number of Large Quarries*
Atascosa	48013	1.5
Bexar	48029	15.0
Comal	48091	8.0
Gillespie	48171	2.0
Kerr	48265	1.0
Medina	48325	1.5
12 County Total	AACOG	29.0

*Two quarries cross county boarders. For these two quarries, 50 % of the emissions were allocated to each county.

Step 1: Conduct a Survey of Local Quarry Equipment Activity

The preferred method of calculating quarry equipment emissions involves conducting a survey of equipment use within the AACOG region. Due to a lack of responses, data for only two quarries was collected in the 2003 survey.

The survey provided the following information for the two quarries:

- Activity Rates (HRS) – total annual hours of use by type of equipment
- Temporal Profiles – equipment use on weekdays and equipment use on weekend days for all types of equipment
- Engine Characteristics:
  - Engine Type – gasoline 2-stroke, gasoline 4-stroke, diesel, LPG, CNG
  - Engine Horsepower – rated power of the engine

Step 2: Analysis of aerial photography.

Due to the sparse survey response, an analysis of aerial photography was performed. Available imagery of 6-inch resolution sufficient for analysis was restricted to Bexar County. The equipment for each quarry located in Bexar County was then identified, marked and counted. For example, the aerial photography of one of the quarries in Bexar County shows that there were 3 scrapers, 8 excavators, 1 grader, 11 off-highway trucks, 18 rubber tire loaders, and 3 tractors/loaders/backhoes working in the quarry. These equipment counts were used in the emission estimation formulas for quarries that did not respond to the surveys.

Step 3: Determining county equipment population for quarry sites without local data.

The aerial photography was only available for Bexar County. For quarries outside of Bexar County, the equipment population had to be estimated based on number of employees. To estimate equipment population for the quarries outside of Bexar County, all quarries were separated into two categories:

1. Quarries that had kilns and/or asphalt plants
2. Quarries without kilns

An employee to equipment ratio was made for kiln/asphalt sites and non-kiln sites by dividing the total pieces of equipment counted for the category by the total number of employees.[36] The ratio was then used to calculate estimated equipment populations for the remaining quarry sites.

[36] 2005 Employment data was provided by U.S. Department of Labor: Mine Safety and Health Administration (MSHA), (last accessed June 9. 2005). MSHA's Data Retrieval System. Available online: "http://www.msha.gov/drs/drshome.htm

The number of employees at a quarry was multiplied by the equipment ratio and the result was rounded to the nearest whole number.

Sample Calculations

Equation (1)

Below is the formula for calculating equipment to employee ratio by equipment type. The calculation was done separately for quarries without kilns and for quarries with kilns:

$$ER_A = POP_A / EMP_A$$

Where,

ER_A = Equipment to employee ratio for equipment type A

POP_A = Population of equipment type A from quarries that responded to the survey

EMP_A = Total number of employees from quarries that responded to the survey (from U.S. Department of Labor: Mine Safety and Health Administration)

Equipment to employee ratio for rubber tire loaders at quarry sites with kilns:

ER_A = 32 Rubber Tire Loaders / 541 Employees

= 0.05915 Rubber Tire Loaders per employee

Equation (2)

Estimated population for equipment type A per Quarry type A with a kiln:

$$EQ_A = EMP_A \times ER_A$$

Where,

EQ_A = Estimated population for equipment type A per Quarry A

EMP_A = Number of employees at quarry A (from U.S. Department of Labor: Mine Safety and Health Administration)

ER_A = Equipment to employee ratio for equipment type A (from equation 1)

Estimated number of rubber tire loaders at Quarry A with kilns:

EQ_A = (118) x (0.05915)

= 6.9797

= 7 rubber tire loaders at Quarry A

<u>Step 4: Conduct a Second Survey of Local Quarry Equipment Activity</u>

After analyzing aerial photographs of the quarries and estimating equipment, a second survey in 2004 was sent out to the local quarries with the estimations of their equipment population, HP, and activity hours. This survey used the same format as the initial survey. Companies were asked to correct the estimations and to send the surveys back to AACOG. There was a 34 percent response rate to the second survey. The increased response rate improved equipment estimations. Aerial photography provided population data on 28 percent of the remaining quarries. The combined survey and aerial photograph (62 percent of quarries) provided an excellent estimation of equipment population, activity, and horsepower.

<u>Step 5: Estimating Annual Emissions of Ozone Precursors (tons/yr)</u>

For each type of equipment at each quarry, VOC, NOx, and CO emissions were calculated using the following formula:

Sample Calculations
Equation (3)
Annual emissions for each type of equipment at each quarry:

$$AE_A = (EP_A \times HRS_A \times HP_A \times LF_A \times EF_A) / 453.59 / 2{,}000$$

Where,

AE_A = Annual emissions for each type of equipment A at each quarry (tons/yr)
EP_A = Population of equipment type A for the quarry (from surveys)
HRS_A = Annual hours of use for equipment A (from surveys)
HP_A = Average rated horsepower for equipment type A (from surveys)
LF_A = Typical load factor for equipment type A (from NONROAD model)
EF_A = Average emissions of pollutant per unit of use for equipment type A (g/hp-hr) (from NONROAD model)
453.59 = Conversion factor, (453.59 g/lbs)
2,000 = Conversion factor, (1 ton/2,000 lbs)

Equipment population, horsepower and annual hours of use were developed with local data described above for each quarry. In the absence of reliable local data, the values for HP were taken from the CAPCO study.[37] Table 2-37 below lists estimated HP ratings, by type of equipment used in this study, when survey responses were not available.

Table 2-37. Estimated HP by Equipment Type for San Antonio Quarries

Equipment Type	SCC	NONROAD Model Default HP	ERG Austin Study Estimated HP	AACOG Study Estimated HP
Dozer	2270002018	260	250	250
Excavator	2270002036	171	500	500
Motor Grader	2270002048	204	200	200
Off-Road Truck	2270002051	783	400	**411**
Scraper	2270002060	409	500	**400**
Backhoe	2270002066	93	80	80
Front-end Loader	2270002069	243	250	**400**

In three cases, the off-highway trucks, scrapers, and rubber tire loaders were modified with AACOG emission inventory data. Local surveys indicated that the values used in the CAPCO study were too low for off-road trucks and loaders, while the estimates for scrapers were too high. In all three cases, the HP was changed based on the average HP from the returned surveys.

The hours per equipment type were also updated in the NONROAD model based on the survey responses. The following table (2-38) lists the hours used for equipment type. In all cases the local activity rates were greater than provided by the NONROAD model. Quarry operations tend to have longer operating hours than other facilities that use these types of equipment. Also, there is a significant amount of equipment usage on the weekends.

[37] Eastern Research Group Inc. November 30, 2001. Diesel Construction Equipment Emissions in the Austin Region, Draft 1.4. Texas. p. 15.

Table 2-38. Annual Hours of Use by Quarry Equipment Type

Equipment Category	SCC	NONROAD Model Default Hours/year	AACOG Study Estimated Hours/Year
Scrapers	2270002018	914	2208
Excavators	2270002036	1092	1092*
Graders	2270002048	962	1135
Trucks	2270002051	1641	2138
Loaders	2270002060	761	1692
Backhoes	2270002066	1135	1172
Dozers	2270002069	936	1467

*The NONROAD Model default for hours/year was used for excavators; survey responses were not statistically significant.

The values for load factor (LF), and emission factor (EF) were obtained from the NONROAD model.[38] LF values were easily obtainable from the data files of this model. However, the EF values were not as easily obtainable, and thus had to be obtained through the method described below.

In an effort to find the most recent and specific equipment type emission factors, the EPA's most recent version (2004) of the NONROAD Emission Inventory Model was used. The values for these factors had to be calculated by first determining all of the default values used in the model, performing a run, and then using the results of the run to work in reverse through the formula to determine what EFs were used by the model for an average ozone season day. For example, the EFs for quarry equipment were developed through the following process:

1. A 2005 NONROAD Model run for quarry equipment was performed for the state of Texas using ozone season temperatures. The quarry equipment is in the construction category of the model.

2. The output from this run was used to obtain the following for all types of quarry equipment:
   - VOC, CO, and NOx emissions in tons/year for each type of equipment (results of run).
   - Equipment population used in the NONROAD Model for each type of quarry equipment.

3. The NONROAD Model input file activity.dat, was used to obtain the following values:
   - The activity rate used in the NONROAD Model for each type of quarry equipment in hours/year (HRS).
   - The LF used in the NONROAD Model for each type of quarry equipment.

4. The average horsepower used in the NONROAD Model for each type of equipment was determined from the input file Tx.pop.

5. With all the known factors in place, the EFs for VOC, CO, and NOx were calculated through the use of the following formula:

Equation (4)
Emission factors for ozone precursors by equipment type:

[38] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

EF_A = NRE_A / (EQ_A x HRS_A x HP_A x LF_A)

Where,

EF_A = Emission factor for equipment type A (g/bhp-hr)
NRE_A = VOC, CO, and NOx emissions in tons/year for equipment type A (the results of the NONROAD model)
EQ_A = Equipment population for equipment type A (NONROAD model)
HRS_A = Annual hours of use for equipment type A (NONROAD model)
HP_A = Average rated horsepower for equipment type A (NONROAD model)
LF_A = Typical load factor for equipment type A (NONROAD model)

The resulting EFs were used in the remaining steps to calculate emissions from each type of equipment. A final step in the calculation was determining weekday versus weekend emissions. The equipment hours on weekdays for all survey responses were estimated and divided by the total number of hours. It was determined that 78.1 percent of the equipment hours of operation are during weekdays and 21.5 percent of the equipment hours of operation are on the weekend.

Continuing with our example used above, there are an estimated 7 front-end loaders at Quarry A. These front-end loaders are operated an average of 1,692 hrs/yr (HRS), and have an HP of 400. From the NONROAD Model, the typical LF for front-end loaders is 0.59, and the 2005 EF for NOx is 5.8320 g/hp-hr during the ozone season.

AE_A = (7 x 1,692 hrs/yr x 400 hp x 0.59 x 5.8320 g/hp-hr) / 453.59 g/lbs / 2,000 lbs
= 17.97 tons NOx/yr

Equation (5)
The following formula was used to calculate emissions for an average ozone season weekday for equipment A:

DE_A = AE_A / WD x PER

Where,

DE_A = Daily weekday or weekend day emissions (tons/day)
AE_A = Annual emissions for each type of equipment A at each quarry (tons/yr) (from equation (4))
WD = Activity days per year (261 weekdays/yr)
PER = % of equipment hours of operation (78.1 % for weekdays)

Ozone season weekday emissions for 7 font-end loaders at Quarry A:
DE_A = 17.97 tons NOx/yr / 261 weekdays/yr X 0.781
= 0.0538 tons NOx/weekday

This same procedure was used for CO and VOCs to produce estimates of these pollutants by quarry. The emission estimates were added up for each quarry in a county to get a county emission total.

Alamo Area Council Of Governments

May 1, 2003

[COMPANY NAME]
[STREET ADDRESS]
[CITY] [STATE] [ZIP]

ATTENTION: OPERATIONS MANAGER

Re: 2002 San Antonio Emissions Inventory

The Alamo Area Council of Governments (AACOG) requests your assistance in the development of a 2002, air quality emission inventory for San Antonio and the surrounding counties. AACOG is conducting this inventory in order to assess and quantify local air quality within the San Antonio Metropolitan area and contiguous counties. This inventory is especially significant because the San Antonio region currently risks being declared in non-attainment of federal air quality standards (NAAQS).

AACOG will calculate the equipment source component of this inventory from information submitted by local organizations involved in equipment activities in and around the San Antonio region using the enclosed survey. With this survey, we are requesting information on equipment used during the 2002 calendar year within Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. The purpose of this survey is to provide better information and services to the region, as well as help minimize additional regulation on the community.

Your input is vital to this process and will serve to effect a true and correct emissions inventory for 2002 that will be delivered to the EPA. Please provide your responses on the attached survey and return it to us in the self-addressed envelope by the date indicated. The information you provide will be considered strictly confidential and unavailable to public information requests. Please submit your response by, May 30, 2003.

Thank you for your time and participation. If you have any questions or comments please feel free to contact Steven Smeltzer, Environmental Manager at (210) 362-5266.

Regionally yours,

Al J. Notzon III
Executive Director
Enclosures (2)

Alamo Area Council of Governments
Equipment Environmental Impact Survey
Internal Combustion Engine

The Alamo Area Council of Governments (AACOG) is conducting a study to assess and quantify local air quality within the San Antonio Metropolitan area and contiguous counties by performing an emission inventory. AACOG has defined the study area to include Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. Our goal is to provide better information and services to businesses and individuals, and help minimize additional regulation on the community. The purpose of this survey is to gather data on emissions produced by several types of equipment in the region.

The study area does not presently exceed Environmental Protection Agency (EPA) air quality standards. However, if the standards are exceeded in the future we will be classified as nonattainment, which will result in expensive and stringent regulations for your business and the community. By filling out this confidential survey, you will be providing valuable data that will be used to evaluate cost-effective approaches to pollution control. Thank you for taking the time to provide this information.

Instructions:

7. Please look through the equipment types shown on the following page.
8. List any of the equipment types regularly operated at your business.
9. Fill in the appropriate figures for each equipment type you listed. (Estimates are acceptable.)

If you have other internal combustion equipment that is not shown, please include it as well.

NOTE: IF YOUR BUSINESS HAS MORE EQUIPMENT THAN WILL FIT IN THE SPACE PROVIDED, PLEASE MAKE ADDITIONAL COPIES OF THE SURVEY.

Completed surveys can be faxed to (210) 225-5937, or mailed to:
Alamo Area Council of Governments
8700 Tesoro, Suite 700
San Antonio, Texas 78217
Attn: Chris Langston

If you have any questions or comments, please call us at (210) 362-5270.

SURVEY STARTS ON THE OTHER SIDE OF THIS PAGE

	Internal Combustion Equipment Type	<u>Engine Type</u> Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
			Construction Equipment			
1	Bore/Drill Rigs					
2	Excavators					
3	Concrete & Mortar Mixers					
4	Cranes					
5	Graders					
6	Crushing/Processing Eqmt.					
7	Rough Terrain Forklifts					
8	Rubber Tire Loaders					
9	Other Loaders					
10	Dozers					
11	Tractors/Backhoes					
12	Scrapers					
13	Rollers					
14	Trenchers					
15	Pavers					
16	Other Construction Equipment Type: ____________					

Railroad Locomotives

Many locomotives are powered by a combination of diesel engines and electric generators and motors. This combination allows the diesel engines to produce a substantial amount of horsepower and the electrical current provides enough thrust to propel the locomotive to fast speeds.

Methodology
Railroads can be separated into three classes based on size: Class I, Class II, and Class III. Locomotives within each of these classes can perform two different types of operations: line haul and yard (or switch). Class I represents the type of railroad system in the region of study.[39] In order to determine emissions from railroad operations, the fuel consumed by line-haul and switch locomotives must be obtained and multiplied by their respective emission factor.[40] Fuel consumption data for line-haul and switch locomotives were obtained from the Union Pacific Railroad.[41] The following are the assumptions used in deriving the fuel consumption data:

1. The fuel consumption factor is 1.296 gallons per 1,000 gross ton-miles (GTM) for the Union Pacific Railroad. This is the system average fuel consumption factor for the railroad for 2005 and was calculated by Union Pacific Railroad. The GTM used to calculate the fuel consumption includes locomotive weight.

2. The equation used in calculating the fuel consumption for line haul locomotives is GTM x miles of track for each section of track.

3. Fuel consumption for switching operations was calculated by Union Pacific based on number of hours the switcher operates per year.

The database for locomotive fuel consumption was separated between line-haul and switch locomotives and presented by rail segment in each county. The fuel consumption for each rail segment was added together within each county in order to assess total fuel consumption in each county by operation.

For line-haul locomotives, emissions were calculated by multiplying the fuel consumed in the inventory area by an EF, Table 2-39. To convert from HC to VOC, a factor of 1.053 was used.[42] Emissions for yard operations were calculated in a similar manner to line-haul emissions, multiplying total fuel consumption for yard operations by switch locomotives by the switch EF.

Table 2-39. Line-haul and Switch Locomotive Emissions Factors

Emission	Line-haul EF (lbs/gallon)	Switch EF (lbs/gallon)
VOC	0.01834	0.04036
NOx	0.46550	0.64270
CO	0.07159	0.06946

[39] Sierra Research, Inc., March 2004. Revised Inventory Guidance for Locomotive Emissions SR2004-06-01 (DRAFT). Sacramento, California, p.1. Available online: http://www.metro4-sesarm.org/pubs/railroad/FinalGuidance.pdf
[40] *Ibid*., p.3.
[41] Union Pacific Railroad, Letter and data received from Jon Germer, Manager, Environmental Field Operations-Air Quality, 2006, Omaha, Nebraska.
[42] Sierra Research, Inc., March 2004. Revised Inventory Guidance for Locomotive Emissions SR2004-06-01 (DRAFT). Sacramento, California, p. A-1. Available online: http://www.metro4-sesarm.org/pubs/railroad/FinalGuidance.pdf

Emissions from line-haul and switch locomotives were added together, providing a total emission estimate for all rail yard activities.

Sample Calculation

Equation (1)
Annual line-haul emissions for County A:

ALE = FC x EF / 2,000 lbs

Where,

ALE = Annual line-haul emissions (tons/yr)
FC = Fuel consumption amounts for line-haul locomotives in county A (from Union Pacific)
EF = Emission factor (from Table 2-40)
2,000 = Conversion factor (1 ton / 2,000 lbs)

Annual line-haul VOC emissions for Comal County:

ALE = (1,765,606 x 0.01834 lbs/yr) / 2,000 lbs/ton
= 16.19 tons VOC/yr

Equation (2)
Switch-yards are only located in Bexar and Comal counties for the AACOG region. Annual emissions from switchyards in County A:

ASE = FC x EF / 2,000 lbs

Where,

ASE = Annual switch-yard emissions (tons/yr)
FC = Fuel consumption amounts for switch-yard in county A (from Union Pacific)
EF = Emission factor (from Table 2-40)
2,000 = Conversion factor (1 ton / 2,000 lbs)

Annual switch-yard VOC emissions for Comal County:

ASE = (145,730 x 0.04036 lbs/yr) / 2,000 lbs/ton
= 2.94 tons VOC/yr

Equation (3)
Total annual emissions for locomotives in County A:

TAE = ALE + ASE

Where,

TAE = Total annual emissions for County A (tons/yr)
ALE = Annual line-haul emissions (tons/yr) (from equation (1))
ASE = Annual switch-yard emissions (tons/yr) (from equation (2))

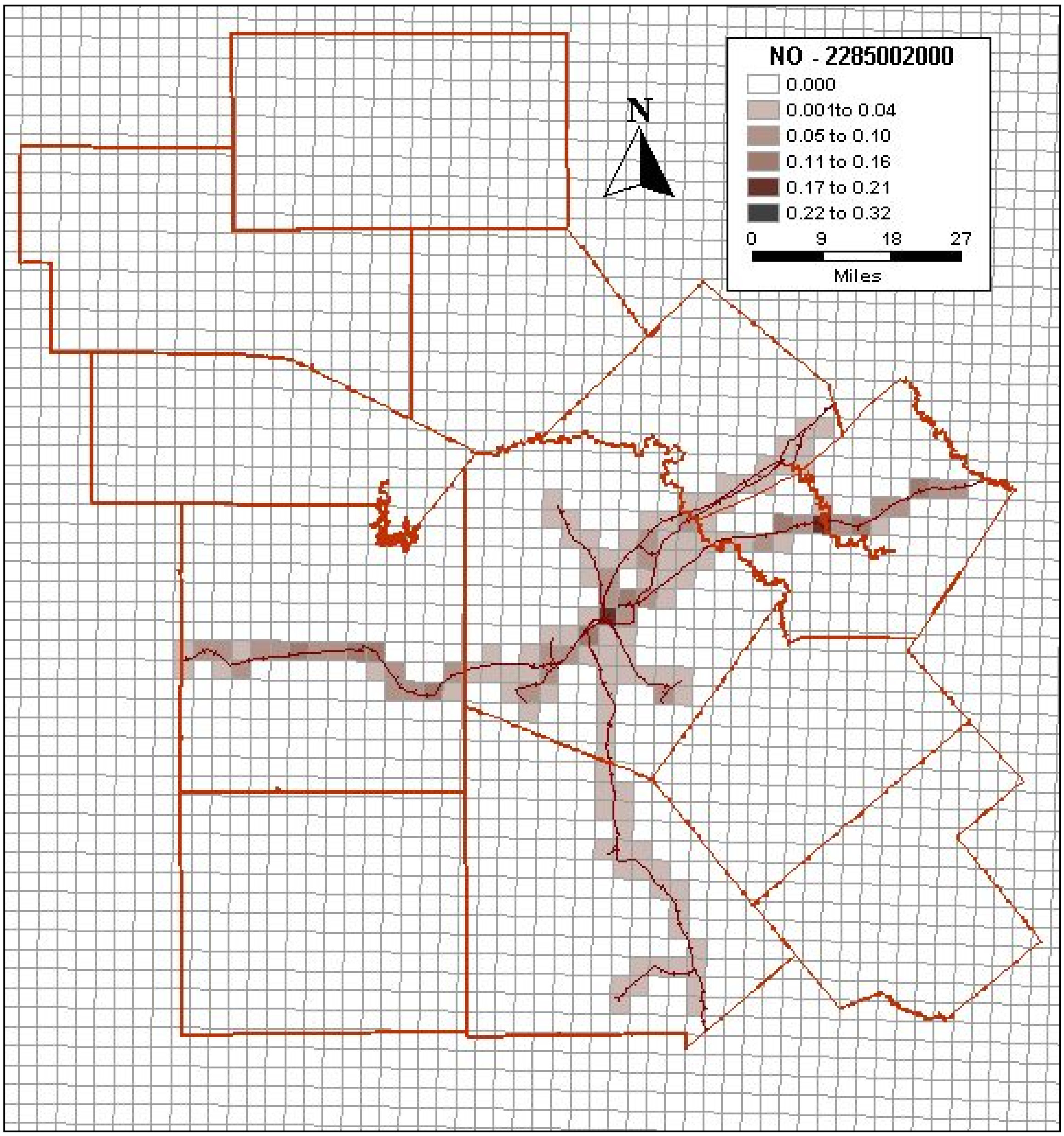
Total annual emissions for locomotives in Comal County:

TAE = 16.19 tons VOC/yr + 2.94 tons VOC/yr
= 19.13 tons VOC/yr

Seasonal Adjustment
Railroad operations are uniform, occurring 7 days a week and 365 days a year.

Spatial Distribution
Railroad emissions were only calculated in counties where railroads exist and are active. The following counties were included in the emission inventory: Atascosa, Bexar, Comal, Guadalupe, and Medina. Emissions are allocated on the 4km grid by the location of active railroad tracks (Figure 2-37).

Figure 2-37. NOx Emissions from Locomotives, 2005



Plot Date: April 18, 2007
Map Compilation: April 18, 2007
Source: Location of active railroad tracks obtained from Union Pacific Railroad, Letter and data received from Jon Germer, Manager, Environmental Field Operations-Air Quality, 2006, Omaha, Nebraska

Railroad Maintenance Equipment

Railroads are subject to constant wear due to locomotives and rail cars constantly driving over the rails. Since railroads transport goods and provide services to customers that are located over large distances, railways must remain in good condition in order to ensure ongoing service of the railroad. Railroad maintenance is performed through the use of railroad maintenance equipment, which are specifically designed for repair, maintenance, and construction of rail lines including ballast handlers, rail/tie handlers, and rail straitening equipment.[43] These sorts of equipment are mobilized and travel by way of the railways.

Methodology

Emissions for railroad maintenance equipment were calculated for the AACOG counties using EPA's NONROAD model, version 2004.[44] The NONROAD model enables the user to manipulate the inputs used to calculate emissions in order to better reflect the conditions within the designated geographical area. Minimum, maximum, and average ambient temperatures for daily and annual emission calculations were determined using local data from the National Weather Service. When determining the average daily ozone season emission estimate for the counties of Atascosa, Bexar, Comal, Guadalupe, and Wilson, gasoline was inputted to reflect an RVP of 7.8. The remaining counties of Bandera, Frio, and Medina use gasoline with an RVP of 8.7. The counties of Gillespie, Karnes, Kendall, and Kerr do not have railroads within their county borders thus do not have any emissions for railroad maintenance equipment. Annual emissions were calculated for the twelve AACOG counties with gasoline with an RVP of 8.7.

Sample Calculation

Exhaust emissions for off-road vehicles are calculated by the NONROAD model using Equation (1). In addition, the model calculates evaporative emissions based on source: diurnal, displacement, or spillage.

Equation (1)
Annual Emissions for each type of equipment:

$$AEE_A = POP_A \times HP_A \times LF_A \times ACT_A \times EF_A$$

Where,

AEE_A = Annual exhaust emissions (tons/yr) for equipment type A
POP_A = Engine population for equipment type A
HP_A = Average power (hp) for equipment type A
LF_A = Load factor for equipment type A
ACT_A = Activity (hrs/yr) for equipment type A
EF_A = Emission factor (g/hp-hr) for equipment type A

Seasonal Adjustment

To determine ozone season weekday emissions, the modeling period in the NONROAD option scenario was set for summer. NONROAD applies adjustments to emissions based on month of the year, region of the country, and equipment category. In order to assess the emissions by season, the default seasonal adjustment factors were used.

[43] ENVIRON, August 2002. NONROAD and NONROAD-AT Training Manual. Novato, California.
[44] U.S. Environmental Protection Agency (Revised April 2004). Geographic Allocation of State Level Nonroad Engine Population Data to the County Level, EPA420-P-04-014, NR-014c, Office of Transportation and Air Quality.

Recreational Equipment

The AACOG 2005 recreational equipment inventory includes emissions from off-road motorcycles, all-terrain vehicles, golf carts, and specialty vehicles/carts. Although this subcategory of non-road equipment encompasses a variety of engine and fuel types, the AACOG inventory is primarily composed of equipment using 2-stroke and 4-stroke gasoline engines.

Methodology

Recreational equipment emissions were calculated, by county, for the AACOG region using EPA's NONROAD model, version 2004. The model was used to estimate exhaust and evaporative emissions for all recreational equipment categories. NONROAD allocates emissions from the state to the county level based on the number of camps and recreational vehicle parks in an area.[45] County emissions were summed by pollutant, VOC, NOx, and CO, for each SCC category within the recreational equipment subset of non-road equipment.

EPA allows users to modify the NONROAD model's activity, allocation, and other default data files with more representative data when available. When modifying the NONROAD internal files, the changes are typically based on local data such as that gathered through surveys or information monitored by governmental agencies. However, surveying is an expensive methodology to obtain equipment use information. Furthermore, although many recreational vehicles are subject to registration requirements, registration data are of little use for allocating recreational equipment emissions geographically. Most equipment is purchased in urban counties, but primarily used in rural and semi-rural areas. As a consequence of lacking adequate local data and an appropriate survey methodology, the NONROAD files were left unmodified for the recreational equipment model runs.

In addition to information provided in the model's data files and tables, the NONROAD emission calculations are based on modifiable inputs, such as ambient temperatures and gasoline RVP. The inputs used in the 2005 annual NONROAD model runs and 2005 summer (ozone season) weekday runs for the 12-county AACOG region are the same as those used for *Additional Gasoline Fueled Construction Equipment* listed in Table 2-30.

Sample Calculations

Equation (1)

The NONROAD model calculates exhaust emissions for recreational equipment using the formula:

$$AEE_A = POP_A \times HP_A \times LF_A \times ACT_A \times EF_A$$

Where,

AEE_A = Annual exhaust emissions (tons/yr) for equipment type A
POP_A = Engine population for equipment type A
HP_A = Average power (hp) for equipment type A
LF_A = Load factor for equipment type A
ACT_A = Activity (hrs/yr) for equipment type A
EF_A = Emission factor (g/hp-hr) for equipment type A

[45] U.S. Environmental Protection Agency, Revised April 2004. Geographic Allocation of State Level Nonroad Engine Population Data to the County Level. EPA420-P-04-014, NR-014c, Office of Transportation and Air Quality.

In addition, the model calculates evaporative emissions based on source: diurnal, displacement, or spillage.

Seasonal Adjustment

To determine ozone season weekday emissions, the modeling period in NONROAD's option scenario was set for summer. NONROAD applies adjustments to emissions based on month of the year, region of the country, and equipment type.

Recreational Marine Vessels

The recreational marine vessel inventory includes pleasure craft powered by inboard or outboard engines, as well as personal watercraft such as jet skis. Although this subcategory of off-road vehicles encompasses a variety of engine and fuel types, most recreational marine vessels are fueled with gasoline and powered by spark-ignition engines.[46] The following is a list of recreational boats with corresponding source classification codes.

- 2282005010 2-Str Outboard
- 2282005015 2-Str Personal Water Craft
- 2282010005 4-Str Inboard
- 2282020005 Dsl - Inboard
- 2282020010 Dsl – Outboards

Methodology

Recreational marine vessel emissions within the AACOG region were calculated using the EPA NONROAD 2005 model. The model provided estimates for exhaust and evaporative emissions for all recreational marine categories. To increase the accuracy of these estimates, a number of updates were applied to the NONROAD input files.

The EPA allows users to modify the NONROAD model activity, allocation, and other default files with data that is more representative of local values when available. Recreational boating emissions represent a small portion of the non-road EI for the San Antonio region making an extensive survey an impractical option. Although boat sales are monitored through registration requirements, registration data are of little use for allocating watercraft emissions geographically; most recreational marine vessels are purchased in urban areas, but often used in rural counties. NONROAD allocates emissions from the state to the county level based on the surface area of water (Figure 2-38),[47] including water surface areas that are not navigable and thus unusable for recreational marine vessel. Therefore, model defaults can be improved upon by refining water surface area data for navigable waters.

Navigable Waters: Surface Area Data

Table 2-40 lists the locations and water surface areas of the primary recreational boating activities occurring in the AACOG region used for emissions calculations.[48] Figure 2-42 shows the location of these lakes in the AACOG region. Boating activities that occur on smaller bodies of water are considered insignificant. Some lakes were not included on this list for a variety of reasons. For example, Mitchell Lake in Bexar County was not included because it is a wildlife

[46] U.S. Environmental Protection Agency (EPA). Gasoline Boats and Personal Watercraft. Available online: http://www.epa.gov/otaq/marinesi.htm, Accessed June 1, 2005.
[47] U.S. EPA. Geographic Allocation of State Level Nonroad Engine Population Data to the County Level (Revised April 2004), EPA420-P-04-014, NR-014c, Office of Transportation and Air Quality.
[48] Acres were calculated using TransCAD or from the Texas Parks and Wildlife Texas Lake Finder. Available online: http://www.tpwd.state.tx.us/fish/infish/regions/index.phtml. Accessed June 1, 2005.

sanctuary, Boerne Lake in Kendall County was not included because motor boats are not allowed on the lake, and Lake Nolte (Meadow Lake) in Guadalupe county was not included because the lake is too small.

Table 2-40. Recreational Marine Vessel Operations by Location

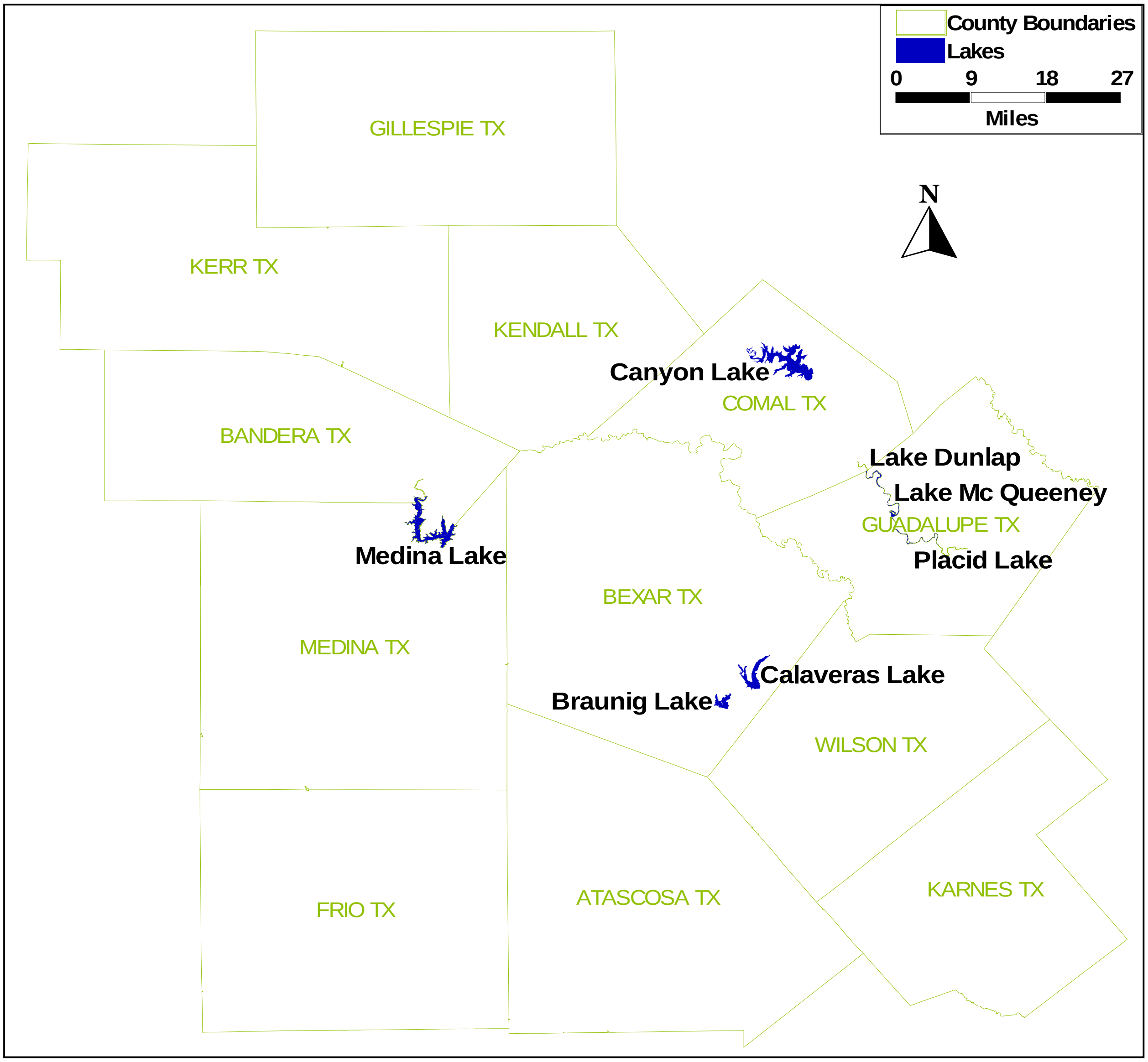
Lake Name	Region	Surface Area in Acres
Canyon Lake	Comal	8,064
Medina Lake	Bandera	5,459
Calaveras Lake	Bexar	2,675
Victor Braunig Lake	Bexar	1,318
Lake Dunlap	Guadalupe	410
Lake McQueeney	Guadalupe	400
Lake Placid	Guadalupe	400

Two methodologies were referenced for refining the surface area data of navigable waters in Texas and the AACOG region: ERG methodology and a Sonoma Technology, Inc. (STI) study. The ERG methodology incorporated water body size and county boat registration (Figure 2-41).[49] However, this methodology did not estimate any boating emissions for Bexar or Guadalupe County. The STI study, which surveyed recreational boat owners for local NONROAD model inputs, did not include Bexar County boat emissions; in addition, there were emissions placed in counties with no navigable waters: Kendall and Atascosa counties (Figure 2-42).[50]

To modify surface area of navigable waters, an approach based on the ERG methodology was used to analyze navigable lakes in Texas. The ERG methodology removed "lakes having a surface area below 30 hectares (approximately 70 acres);"[51] this method, however, still included many water bodies larger than 30 hectares that are not navigable or do not allow motorized vessels. Thus, several updates were made to the surface area of navigable water input data. These include the addition of two counties along the Texas coast (San Patricio and Jefferson counties) and updates to lake acreage with the addition of lakes in Bexar and Guadalupe counties (Figure 2-42).

[49] Sam Wells, Rick Baker, and Rebecca Feldman. August 28, 2002, Recreational Marine Emissions Inventory, Eastern Research Group, Texas, p. 3.
[50] Stephen Reid, Dana Sullivan, Patricia Stiefer, and Lyle Chinkin. October 28, 2004. Development of Emission Inventories of Recreational Boats and Commercial Marine Vessels for the Central States Regional Air Planning Association. Petaluma, CA.
[51] *Ibid*., p. 5.

Figure 2-38: AACOG Lakes Used in Allocating Emissions



Plot Date: February 22, 2007
Map Compilation: February 22, 2007

A summary of the differences in percentage allocation of emissions between the four methodologies is provided in Table 2-41. As shown by the table, the overall percentage comparison for the AACOG region is similar between the AACOG, ERG, and NONROAD allocations; whereas, the STI study allocated more then 5 times the total to the AACOG region.

Table 2-41. Boating Emission Percentage Allocated to AACOG Counties by EPA NONROAD Default, STI, EGR, and AACOG Methodologies as Compared to the State as a Whole

County	FIPS Code	NONROAD 2005		ERG (2002)		STI (2004)		AACOG	
		Allocation Indicator	Percentage	Allocation Indicator	Percentage	Allocation Indicator	Percentage	Allocation Indicator	Percentage
ATASCOSA	48013	9	0.06%	0	0.00%	12	0.16%	0	0.00%
BANDERA	48019	15	0.10%	31	0.15%	17	0.23%	40	0.26%
BEXAR	48029	25	0.16%	0	0.00%	0	0.00%	29	0.19%
COMAL	48091	34	0.22%	84	0.40%	247	3.40%	59	0.39%
FRIO	48163	3	0.02%	0	0.00%	0	0.00%	0	0.00%
GILLESPIE	48171	1	0.01%	0	0.00%	0	0.00%	0	0.00%
GUADALUPE	48187	7	0.05%	0	0.00%	10	0.14%	9	0.06%
KARNES	48255	8	0.05%	0	0.00%	0	0.00%	0	0.00%
KENDALL	48259	1	0.01%	0	0.00%	86	1.18%	0	0.00%
KERR	48265	3	0.02%	0	0.00%	0	0.00%	0	0.00%
MEDINA	48325	17	0.11%	0	0.00%	0	0.00%	0	0.00%
WILSON	48493	3	0.02%	0	0.00%	0	0.00%	0	0.00%
AACOG	-	126	0.82%	115	0.55%	372	5.11%	137	0.90%
TEXAS	48000	15310	100.00%	21016	100.00%	7275	100.00%	15310	100.00%

NONROAD Model Inputs

NONROAD emission calculations are also based on modifiable inputs, such as ambient temperatures and gasoline RVP. Table 2-30 in the *Construction Equipment* methodology lists the inputs used in the 2005 annual NONROAD model runs and 2005 summer (ozone season) weekday runs for the 12-county AACOG region.

Equation (1)

The NONROAD model calculates exhaust emissions for off-road vehicles using the formula:

$$AEE_A = POP_A \times HP_A \times LF_A \times ACT_A \times EF_A$$

Where,

AEE_A = Annual exhaust emissions (tons/yr) for equipment type A
POP_A = Engine population for equipment type A
HP_A = Average power (hp) for equipment type A
LF_A = Load factor for equipment type A
ACT_A = Activity (hrs/yr) for equipment type A (from STI Study)
EF_A = Emission factor (g/hp-hr) for equipment type A

In addition, the model calculates evaporative emissions based on source: diurnal, displacement, or spillage.

Figure 2-39. NONROAD 2004 Default Recreational Boating Allocation (Aug. 28, 2005)

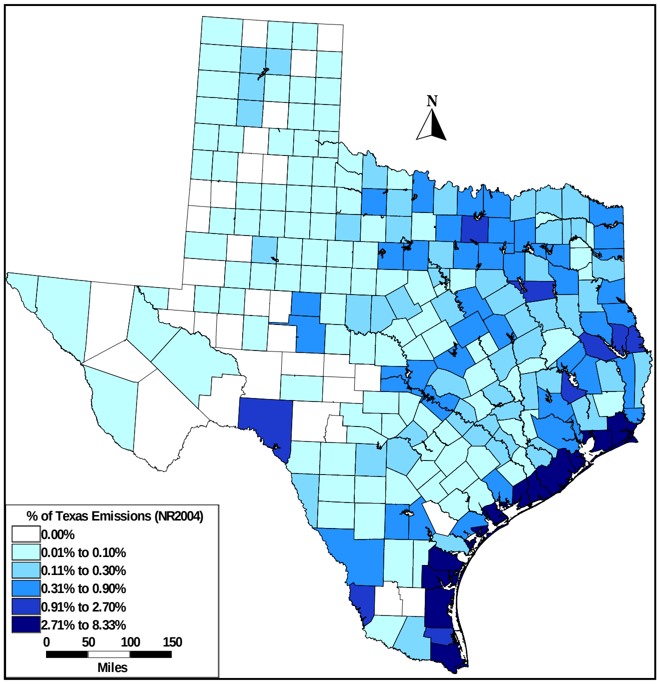


Figure 2-40. ERG Recreational Boating Allocation

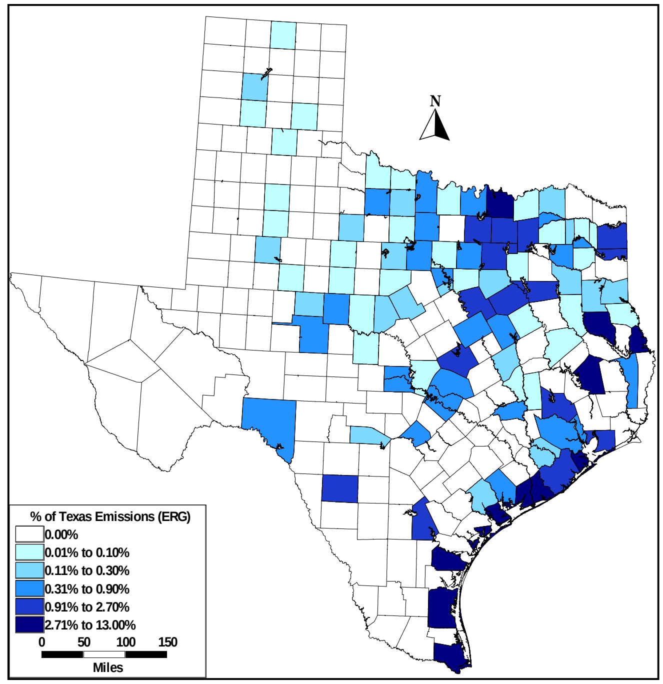


Figure 2-41. STI Recreational Boating Allocation (Oct 28, 2004)

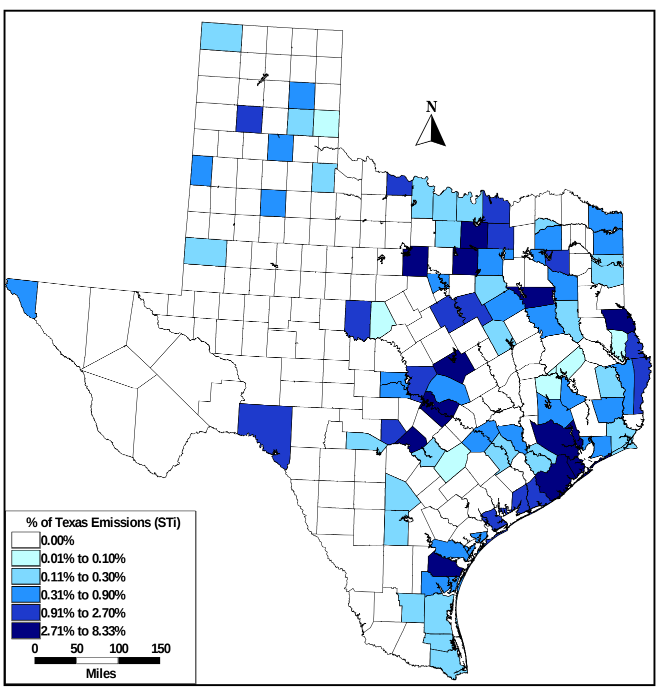


Figure 2-42. AACOG Recreational Boating Allocation (based on ERG navigable water access)

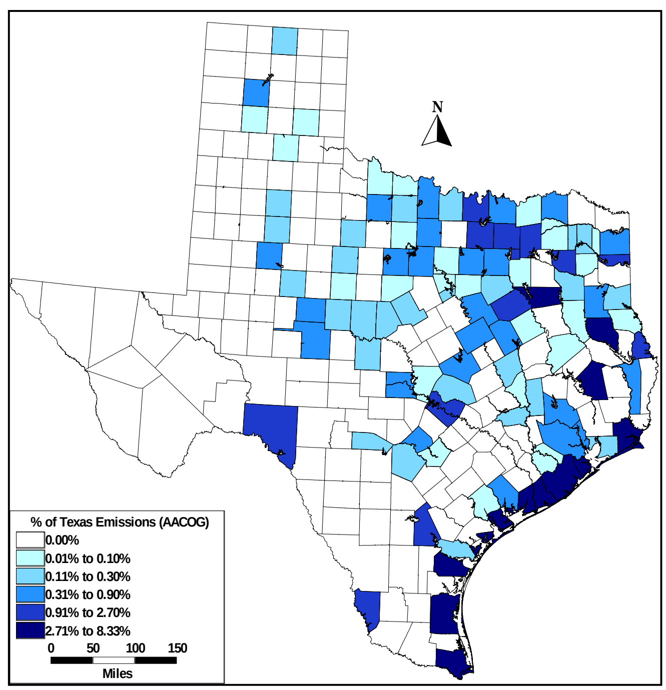
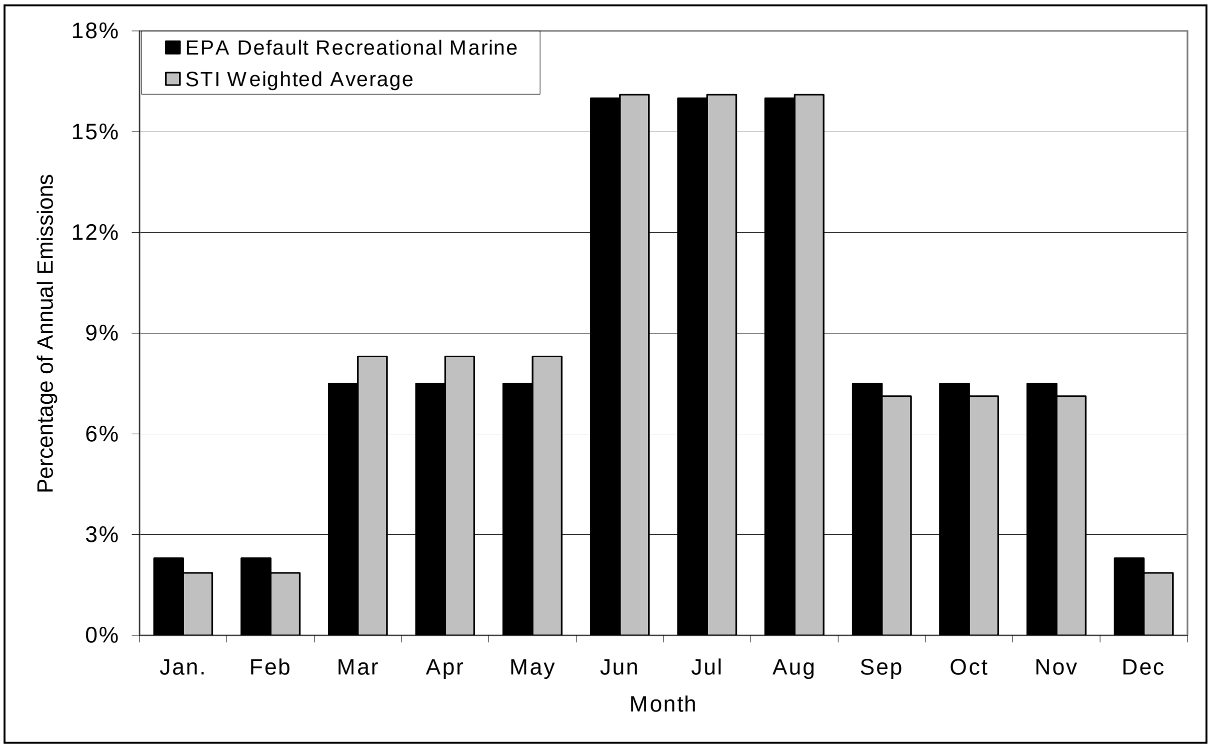
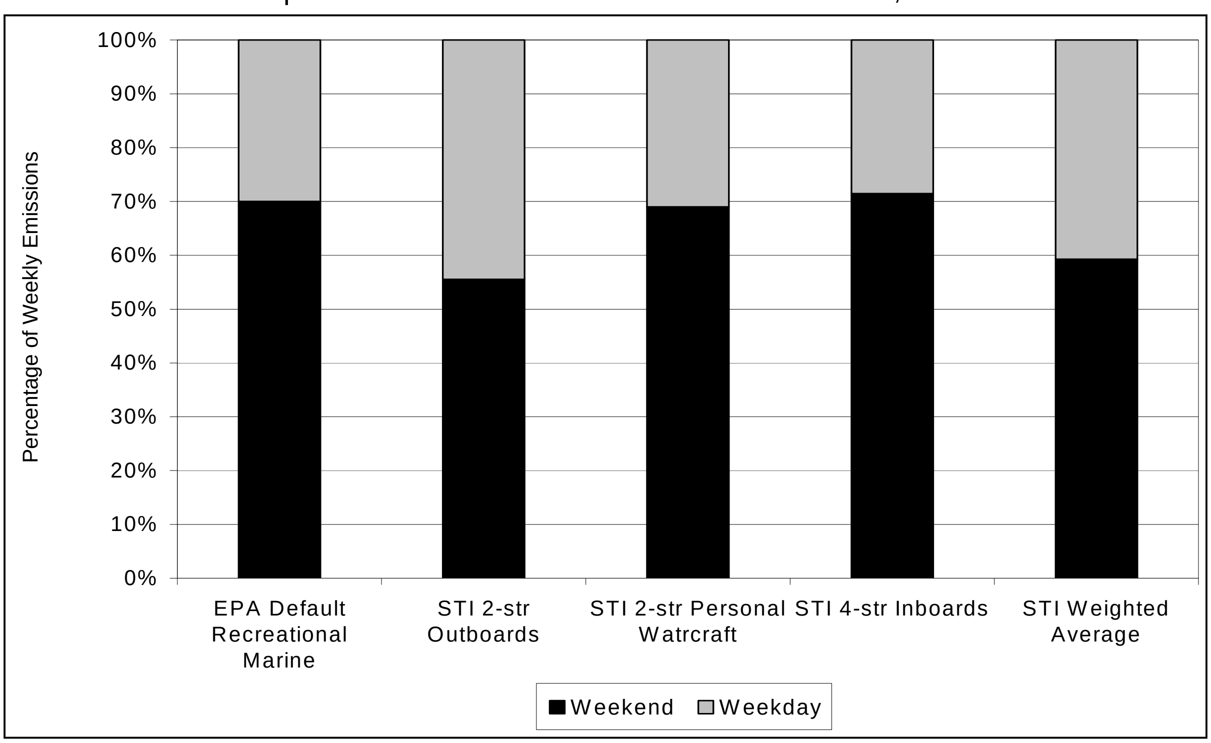


Figure 2-43: STI Study Monthly Variations in Recreational Boating Emissions as Compared to EPA 2005 NONROAD Model Defaults, Texas



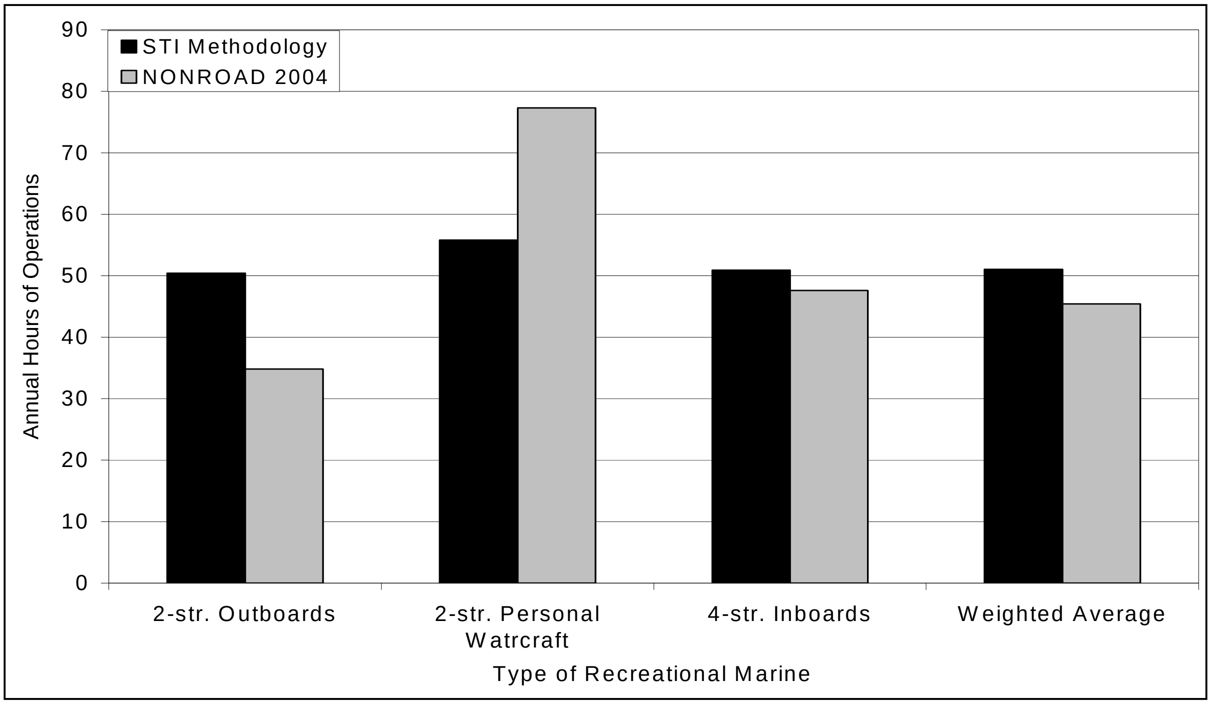
*Data Provided by STI.

Figure 2-44: STI Study Weekend Vs. Weekday Variation in Recreational Boating Emissions as Compared to EPA 2005 NONROAD Model Defaults, Texas



*Data Provided by STI.

Figure 2-45: Comparison of the STI Study Annual Hours of Use with NONROAD Model Defaults, Texas



*Data Provided by STI.

Seasonal and Activity Adjustments
The seasonal and activity files from the STI study were utilized for emissions calculations. These files contain the updated seasonal, weekly, and total hours adjustments from the STI study. STI estimated load factors were not used because of the high values and inconstancies between the documentation and the data files. Figure 2-43 charts the monthly adjustment factor, figure 2-44 shows the weekly adjustment factor, and figure 2-45 illustrates the hours per year adjustment factor for Texas. Each chart compares the NONROAD 2005 default with a weighted average for the STI values used in this emissions inventory. Weighted average illustrated in the charts was calculated based on VOC + NOx.

Residential Lawn and Garden Equipment

Residential equipment can be categorized as equipment operated in residential areas by commercial lawn care service providers and/or residents and landlords for the purpose of residential lawn and garden maintenance. When aggregated, residential equipment represents an important source of emissions that contribute to air pollution. This inventory takes into account the following types and categories of gasoline engine-powered equipment:

- 2260004015 2-stroke residential rotary tillers
- 2265004015 4-stroke residential rotary tillers
- 2260004020 2-stroke residential chain saw
- 2260004025 2-stroke residential trimmer/Edger/Brush Cutter
- 2265004025 4-Stroke residential trimmer/Edger/Brush Cutter
- 2260004030 2-stroke residential leaf blower/vacuums
- 2265004030 4-stroke residential leaf blower/vacuums
- 2265004010 4-stroke residential lawnmower
- 2265004040 4-stroke residential rear engine riding mower

- 2265004055 4-stroke residential Lawn and Garden Tractors
- 2265004075 4-stroke residential other lawn and garden equipment

Methodology
The methodology used in producing residential lawn and garden equipment emission estimates for the AACOG region relies on local data produced from surveys and EPA's NONROAD Emission Inventory Model. The methodology involves the following steps:

1. Conducting a survey of local residential lawn and garden equipment activity to determine local equipment use rates and equipment characteristics.

2. Determining equipment population and activity for all residential lawn and garden equipment based on survey results.

3. Estimating VOC, NOx, and CO annual emissions by combining local data with NONROAD model emission factors for equipment populations and converting the tons/year estimate into an estimate for a typical weekday (tons/day) for the summer ozone season.

Step 1: Conducting a survey of local residential lawn and garden equipment activity
Ipsos-Insight was contracted to conduct "a telephone Computer-Assisted Telephone Interviewing (CATI) survey with 18+ year old household members residing within the 12-county AACOG region. A total of 770 interviews were conducted, 371 in Bexar and 399 in surrounding".[52] The telephone sampling strategy was designed to provide an equal probability that households with telephones would be contacted. Table 2-42 provides an overview of the results of the total telephone calls made: Based on 2,689 respondent contacts that were made, 770 produced a favorable response, for a 29% response rate. A total of 371 respondents were successfully interviewed in Bexar County and 399 interviews were completed in the surrounding counties.

Table 2-42. Residential Lawn and Garden Survey Response Rates, 2005

Survey Responses	Spanish Responses		English Responses		Total Responses	
	Number	Percentage	Number	Percentage	Number	Percentage
Total Completed	70	11.8%	700	33.4%	770	28.6%
Refusals	493	83.3%	1314	62.7%	1807	67.2%
Terminations	29	4.9%	83	4.0%	112	4.2%
Total	592	100%	2097	100%	2689	100%

Sample Survey Questionnaire
A sample of the English survey script developed by AACOG and Ipsos-Insight follows.
AACOG Lawn & Garden Equipment Study

INTRODUCTION
Hello, my name is ____________________ and I'm calling from Ipsos-Insight, a professional research firm. Please be assured we are not selling anything. We are conducting a survey on use of lawn and garden equipment in your area to estimate levels of air pollution in our region. The results of this survey will help us with our goal of finding ways to reduce air pollution.

[52] Ipsos-Insight, December 2005, "Lawn and Garden Study", Houston, Texas.

S1. We would like to speak with someone 18 years of age or older. Is this you?
Yes [CONTINUE]
No [ASK FOR 18 YEAR OLD]

S2. To conduct specialized Hispanic interviewing, we would like to ask a few questions about topics such as ancestry.

S2a. Do you consider yourself or your household to be of Hispanic ancestry or origin?
Yes
No

[RECORD AS HISPANIC OR NON-HISPANIC SAMPLE FOR QUOTAS]

[IF "YES", ASK S2b. IF "NO", GO TO Q1.]

5b. Would you rather continue the interview in English or Spanish?
English [CONTINUE]
Spanish [RECORD CALLBACK FOR SPANISH INTERVIEWER]

Q1. What is the county of your residence? **[DO NOT READ LIST]**
Atascosa
Bandera
Bexar [BEAR]
Comal
Frio
Gillespie
Guadalupe
Karnes
Kendall
Kerr
Medina
Wilson
Other/DK **[TERMINATE]**

Q2. Do you live in a single-family home, a condominium, an apartment, or a townhouse? **[DO NOT READ LIST]**
Single-family home
Condominium
Apartment
Townhouse
Other/DK/Ref **[TERMINATE]**

Q3. Who does most of the lawn and garden maintenance around your home during the summer? **[READ LIST]**
You or another household member
The landlord
Professional company
DK **[TERMINATE]**
None of the above **[DNR- TERMINATE]**

[IF Q3=3 THANK AND TERMINATE]
[ASK Q4 IF Q3=2, OTHERWISE SKIP TO Q7]
Q4. Do you know what types of lawn and garden equipment the landlord uses around your home during the summer?
Yes
No **[TERMINATE]**

Q5. Do you know approximately how much time the landlord spends using the lawn and garden equipment around your home during the summer?
Yes
No **[TERMINATE]**

Q6. Regardless of who is responsible for lawn and garden maintenance around your home, is any gasoline-powered equipment used, such as a lawn mower, leaf blower, chainsaw, tiller, or edge trimmer or brush cutter, during the summer or do you use only electric lawn and garden equipment? **[READ LIST]**

Gasoline equipment only
Electric equipment only **[SKIP TO Q19]**
Both gasoline and electric
No equipment used **[SKIP TO Q20]**
Other/DK/Ref **[TERMINATE]**

Q7. Please tell me if any of the following is used around your home in the summer months. How about…**[INSERT FROM LIST]? [READ LIST; ACCEPT ONE ANSWER FOR EACH]**

Gasoline-powered lawn mower
Gasoline-powered leaf blower
Gasoline-powered chainsaw
Gasoline-powered tiller
Gasoline-powered edge trimmer, brush cutter or weed eater

Yes
No

[ASK Q8 IF Q7_1=1, OTHERWISE SKIP TO Q11]
Q8. What kind of gasoline-powered lawn mower is being used at your home during the summer? **[READ LIST]**
Push mower
Riding mower
None and/or use electric mower
DK/Ref

[ASK Q9 IF Q8=1 OR 2, OTHERWISE SKIP TO Q11]
Q9. How many times a month [do/does] [you/your landlord] use the gasoline-powered lawnmower during the summer?
Range (0-99)

Q10. How long [do/does] [you/your landlord] run the gasoline-powered lawnmower when it is used?
RECORD HOURS AND MINUTES
RANGE (0-3 hours) (0-60 minutes)

[ASK Q11 IF Q7_2=1, OTHERWISE SKIP TO Q13]
Q11. How many times a month [do/does] [you/your landlord] use the gas-powered leaf blower during the summer?
Range (0-99)

[ASK IF Q12>0, OTHERWISE SKIP TO Q13]

Q12. How long [do/does] [you/your landlord] run the gasoline-powered leaf blower when it is used?
RECORD HOURS AND MINUTES
RANGE (0-3 hours) (0-60 minutes)

[ASK Q13 IF Q7_3=1, OTHERWISE SKIP TO Q15]
Q13. How many times a month [do/does] [you/your landlord] use the gasoline-powered chainsaw during the summer?
Range (0-99 times)

[ASK Q14 IF Q13>0, OTHERWISE SKIP TO Q15]
Q14. How long [do/does] [you/your landlord] run the gasoline-powered chainsaw when it is used?
RECORD HOURS AND MINUTES
RANGE (0-3 hours) (0-60 minutes)

[ASK Q15 IF Q7_4=1, OTHERWISE SKIP TO Q17]
Q15. How many times per month [do/does] [you/your landlord] run the gas-powered tiller during the summer?
Range (0-99)

[ASK Q16 IF Q15>0, OTHERWISE SKIP TO Q17]
Q16. How long [do/does] [you/your landlord] run the gas-powered tiller when it is used?
RECORD HOURS AND MINUTES
RANGE (0-3 hours) (0-60 minutes)

[ASK Q17 IF Q7_5=1, OTHERWISE SKIP TO Q19]
Q17. How many times per month [do/does] [you/your landlord] use the edger, trimmer, weed eater or brush cutter during the summer?
Range (0-99)

[ASK Q18 IF Q17>0, OTHERWISE SKIP TO Q19]
Q18. How long [do/does] [you/your landlord] use the edger, trimmer, weed eater or brush cutter when it is used?
RECORD HOURS AND MINUTES
RANGE (0-3 hours) (0-60 minutes)

Q25. What is the zip code of your residence?
[RECORD RESPONSE]

That is the end of our survey. Thank you for taking the time to help us improve the quality of the air in your area.

Ten surveys with unrealistic respondents (i.e. they stated that they used their lawnmower 20 times or more a month) were removed from the final results.[53] In order to make conclusions about the general population, the number of surveys required for an accurate presentation is an important concern. Since initially determining a suitable sample size is not always clear-cut, several major factors must be considered. Due to time and budget constraints, a 95% level of

[53] Kelley Boland e-mail communication, Dec. 12, 2005, "RE: Lawn & Garden Equipment Report", Ipsos-Insight, Houston, Texas.

confidence, which is the risk of error, the researcher is willing to accept, was chosen. Similarly, the confidence interval, which determines the level of sampling accuracy, was set at +/- 6% for Bexar County and 5% for the surrounding AACOG counties, respectively. Since the population is finite, the following equation was used to select the sample size.[54]

Equation (1)

RN = $[CLV^2 \times 0.25 \times POP] / [CLV^2 \times 0.25 + (POP - 1) CIN^2]$

Where,

RN = Number of survey responses needed to accurately represent population in the AACOG region
CLV = 95% confidence level (1.96)
POP = Population size (i.e. 556,760 households for Bexar County and 174,187 for the 11 surrounding counties)
CIN = ± 5% or 6% confidence interval (0.05 or 0.06)

For a 5% confidence interval in Bexar County:

RN = $(1.96)^2 \times (0.25) \times 505{,}721 / (1.96)^2 \times (0.25) + (556{,}760 - 1) \times (0.06)^2$
= 266.4 responses

For a 5% confidence interval in the surrounding counties:

RN = $(1.96)^2 \times (0.25) \times 156{,}122 / (1.96)^2 \times (0.25) + (174{,}187 - 1) \times (0.05)^2$
= 383.2 responses

Thus, 267 survey responses were needed in order to meet the 95% level of confidence, and the ±6% confidence interval for Bexar County. Likewise, 384 survey responses were needed in order to meet the 95% level of confidence, and the ±5% confidence interval for the surrounding counties. There were 371 households responding to the survey in Bexar County and 399 in the surrounding counties. This number satisfies the desired number of responses. Therefore, the survey was statistically significant.

When conducting a survey over a large geographical area, it is also ideal to check to spatial distribution of respondents. Figure 2-46 shows the number of respondents by zip code. There is an excellent spatial distribution of survey respondents. When looking at survey respondents by rural county (Figure 2-47) and per 1000 population for each rural county (Figure 2-48), there is also a good spatial distribution.

<u>Step 2: Determining equipment population and activity for all residential Lawn and Garden Equipment based on survey results</u>

The following steps were used to determine the residential equipment emissions:

1. Estimate the number of single-family households in AACOG counties for 2005.

Table 2-43 illustrates the estimated population and household data for AACOG counties in 2005.[55] The Metropilus forecast model was used to estimate households in 2005 for Bexar,

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[54] Rea, L. M. and Parker, R. A. 1992. Designing and Conducting Survey Research. Jossey-Bass Publishers: San Francisco.

[55] AACOG, 2004, "2005 - 2030 Metropilus forecast for the four county area", San Antonio, Texas.

Comal, Guadalupe, and Wilson counties. These four counties households increased 115 percent. The same percentage increase was applied to the other eight rural counties from the households reported in the 2000 U.S. Census. To calculate the number of single-family homes, the total number of households was multiplied by the percentage of single-family homes from the 2004 American Community Survey for the San Antonio metropolitan statistical area.[56]

Sample Calculations

Equation (2)

Number of single-family households per county:

$$SFH_A = TH_A \times PER$$

Where,

SFH_A = Number of single family households for county A

TH_A = Total number of all types of households in county A (from Table 2-46)

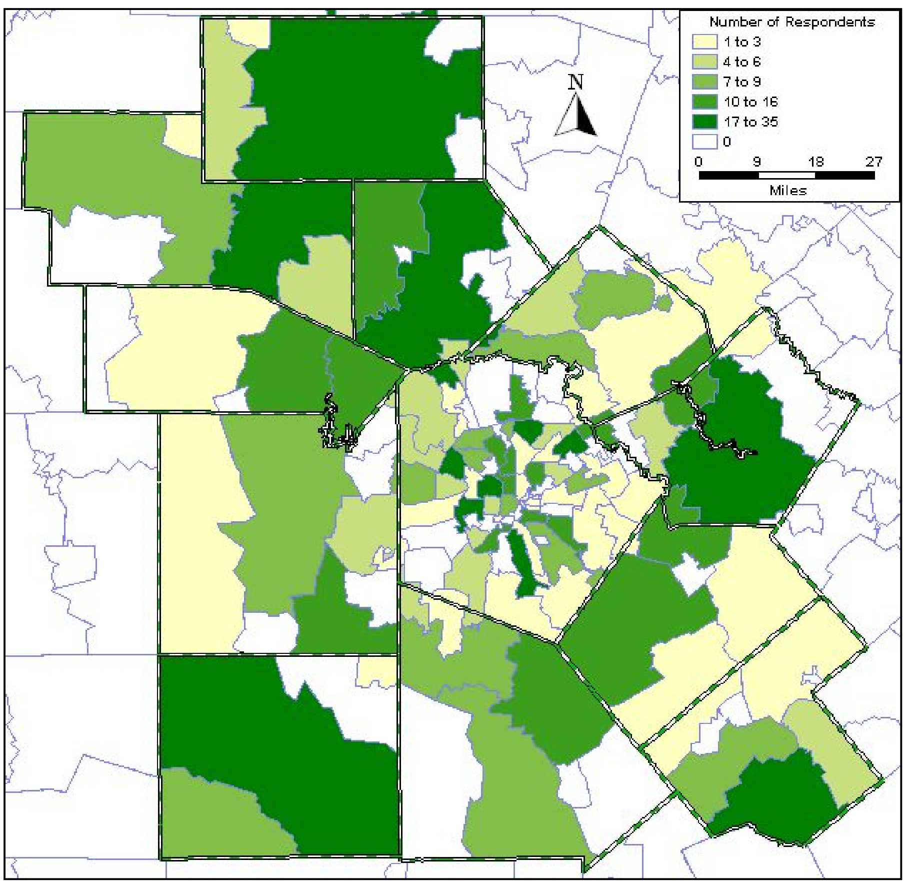
PER = Percentage of households that are single family (68.4%)

The number of single family homes in Bexar County:

SFH_A = 556,760 x 68.4%

= 380,895 single family households

Figure 2-46. Number of Residential Lawn and Garden Respondents by Zip Code, 2005



[56] U.S. Census Bureau, August 30, 2005. 2004 American Community Survey, Available online: http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=ACS&_lang=en&_ts=143547961449

Figure 2-47. Number of Residential Lawn and Garden Respondents for Each Rural County, 2005

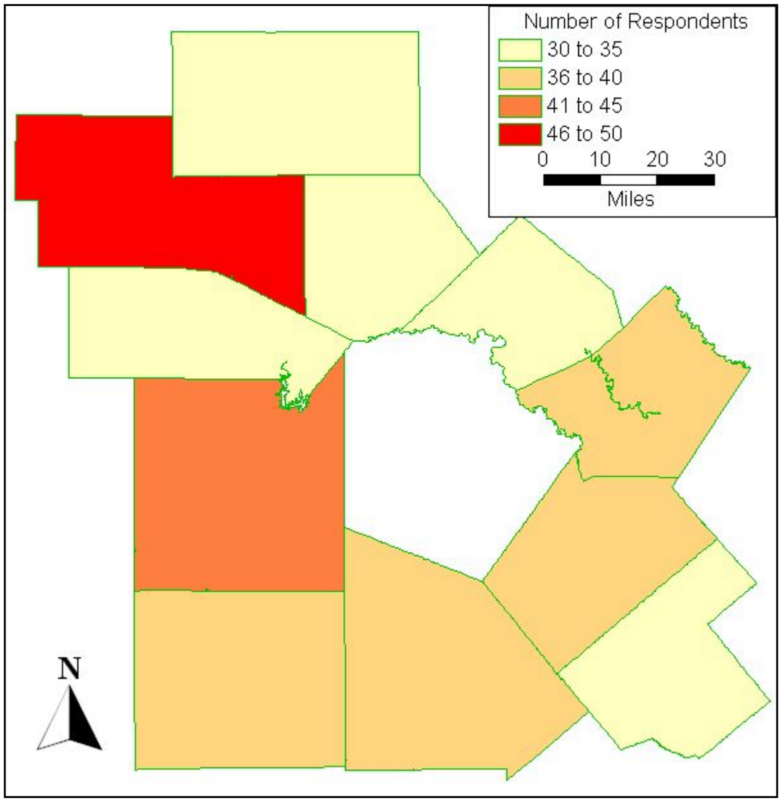


Figure 2-48. Residential Lawn and Garden Respondents per 1,000 Population for Each Rural County, 2005

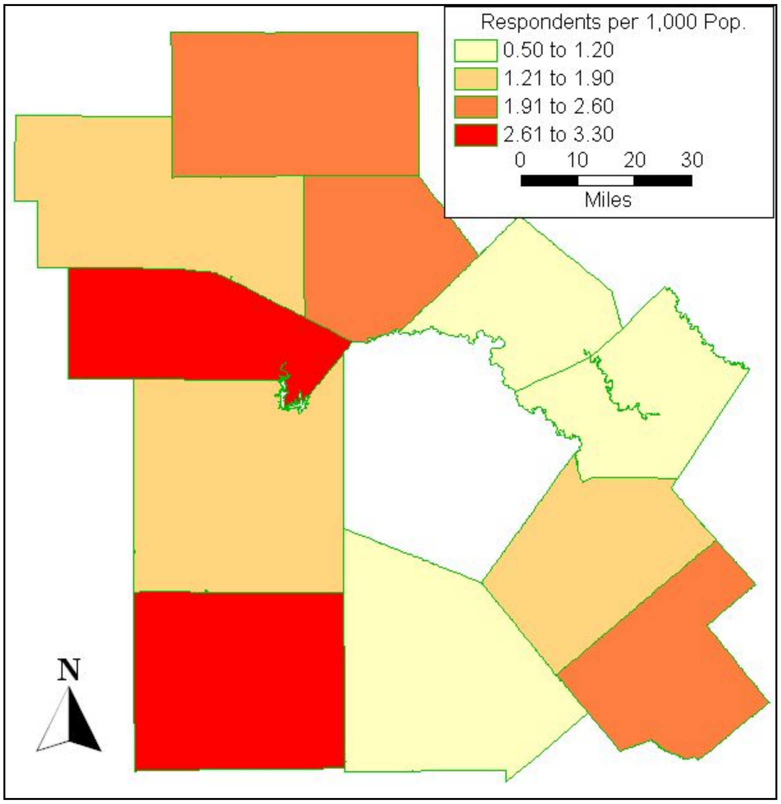


Table 2-43. Households by County, 2000 and 2005

County	2000	2005	
	Number of Households	Number of Households	Number of Single-Family Households
Atascosa	12,816	14,711	10,064
Bandera	7,010	8,046	5,505
Bexar	488,942	556,760	380,895
Comal	29,066	37,335	25,542
Frio	4,743	5,444	3,725
Gillespie	8,521	9,781	6,691
Guadalupe	30,900	36,121	24,711
Karnes	4,454	5,113	3,498
Kendall	8,613	9,886	6,764
Kerr	17,813	20,447	13,988
Medina	12,880	14,784	10,114
Wilson	11,038	12,519	8,565
Total	636,796	730,947	500,062

From the survey response and household data, the percentage of people using each type of lawn and garden equipment was calculated.

Equation (2)
Calculated population of lawn and garden equipment type A by county:

$$EP_A = R_A \times SSFH / CSFH$$

Where,

EP_A = Population of equipment type A by county
R_A = Number of single family homes using equipment type A (from survey)
SSFH = Number of surveyed single family homes (346 single family homes out of 377 respondents for Bexar and 372 single family homes out of 399 respondents for surrounding AACOG counties)
CSFH = Number of single family households in each county (from table 2-46)

Number of gas lawnmowers in Bexar County:

EP_A = 303 / 346 people * 380,895 single family homes
= 333,558 gas lawnmowers in Bexar County

In every category, the survey respondents had higher equipment usage. The NONROAD model defaults were unrealistically low. When examining total equipment population (Table 2-44), the amount of equipment in the AACOG region was almost twice as much as the NONROAD defaults. When the percentage of households using each type of Lawn and Garden equipment is calculated (Table 2-45), it illustrates the unrealistically low the NONROAD defaults.

Table 2-44 Residential Lawn and Garden Equipment Total by Equipment Type, 2005

Equipment Type	Total Equipment Population (Bexar)		Total Equipment Population (Rural Counties)	
	Survey	NONROAD default	Survey	NONROAD default
Lawnmower	333,558	189,606	110,358	63,179
Leaf blower	89,169	40,444	21,098	13,476
Chainsaw	90,270	28,699	56,153	9,563
Tiller	31,925	18,457	24,344	6,150
Edger, Trimmer etc.	188,246	77,015	69,461	25,662

Table 2-45. Residential Lawn and Garden Equipment Percentage by Household, 2005

Equipment Type	Household Equipment Use Ratio (Bexar County)	Household Equipment Use Ratio (Rural Counties)	Household Equipment Use Ratio (NONROAD Default - Bexar)
Lawnmower	60%	66%	34%
Leaf blower	16%	13%	7%
Chainsaw	16%	34%	5%
Tiller	6%	15%	3%
Edger, Trimmer etc.	34%	42%	14%

Also a ratio between push and rider lawn mowers was calculated from the survey responses. For Bexar county the percentage of respondents using push lawnmowers was 87.7 percent, while 12.3 percent used riding lawnmowers. In the rural counties, 46.6 percent use push lawnmowers and 53.4 use riding lawnmowers.

For each type of equipment for residential Lawn and garden equipment average hours usage was calculate separately for Bexar County and the Rural Counties from the survey responses. As Table 2-46 shows, residents in the AACOG region use leaf blowers, chainsaws, and tillers less then NONROAD model defaults. Edger and trimmers are used more often. Also, people in rural counties tend to use their lawnmowers for longer hours then respondents in Bexar County.

Table 2-46. Residential Lawn and Garden Equipment Average Hours/Year by Equipment Type

Equipment Type	Urban Counties (hr/yr)	Rural Counties (hr/yr)	NONROAD Default (hr/yr)
Lawnmower	18	28	25
Leaf blower	5	7	10
Chainsaw	9	10	13
Tiller	3	11	17
Edger, Trimmer etc.	10	17	9

Step 3: Estimate Annual Emissions of Ozone Precursors

For each type of equipment for residential lawn and garden equipment the VOC, NOx, and CO emissions were calculated for each category using the following formula:

Sample Calculations

Equation (3)

Annual emissions for each type of residential lawn and garden equipment:

$$AE_A = (EP_A \times HRS_A \times HP_A \times LF \times EF_A) / 453.59 / 2{,}000$$

Where,

AE_A	= Annual emissions for each type of equipment A (tons/yr)
EP_A	= Equipment population of type A (based on Table 2-47)
HRS_A	= Annual hours of use for equipment A (based on Table 2-49)
HP_A	= Average rated horsepower for equipment type A (NONROAD Model)
LF	= Typical load factor (NONROAD Model)
EF_A	= Average emissions of pollutant per unit of use for equipment type A (g/hp-hr) (NONROAD Model)
453.60	= Conversion factor (453.59 g/lbs)
2,000	= Conversion factor (1 ton/2,000 lbs)

The values for load factor (LF), and emission factor (EF) were obtained from the EPA NONROAD Emission Inventory Model.[57] LF values were easily obtainable from the data files of this model. However, the EF values were not as easily obtainable, and thus had to be obtained through the method described below. The values for the emission factors had to be calculated by first determining all of the default values used in the model, performing a run, and then using the results of the run to work in reverse through the formula to determine what EFs were used by the model for an average ozone season day. For example, the EFs were developed through the following process:

1. A 2005 NONROAD Model run for residential lawn and garden equipment was performed for the state of Texas using ozone season temperatures and yearly average temperatures.

2. The output from this run was used to obtain the following for all types of commercial lawn and garden equipment:
   - VOC, CO, and NOx emissions in tons/year for each type of equipment (the results of the run).
   - Equipment population used in the NONROAD Model for each type of equipment.

3. The NONROAD Model input file activity.dat, was used to obtain the following values:
   - The activity rate used in the NONROAD Model for each type of commercial lawn and garden equipment in hours/year (HRS).
   - The LF used in the NONROAD Model for each type of equipment.

4. The average horsepower used in the NONROAD Model for each type of equipment was determined from the input file Tx.pop.

[57] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

5. With all the known factors in place, the EFs for VOC, CO, and NOx were calculated through the use of the following formula:

Equation (4)

Emission factors for ozone precursors by equipment type:

$$EF = NRE_A / (EQ_A \times HRS_A \times HP_A \times LF_A)$$

Where,

EF_A	= Emission factor for equipment type A (g/bhp-hr)
NRE_A	= VOC, CO, and NOx emissions in tons/year for equipment type A (the results of the NONROAD model)
EQ_A	= Equipment population for equipment type A (NONROAD model)
HRS_A	= Annual hours of use for equipment type A (NONROAD model)
HP_A	= Average rated horsepower for equipment type A (NONROAD model)
LF_A	= Typical load factor for equipment type A (NONROAD model)

The resulting EFs were used in the remaining steps to calculate emissions from each type of equipment. Default NONROAD 2004 emission estimates were used for Residential Lawn & Garden Tractor and Other Lawn/Garden Equipment because local survey data were not available for these categories. A final step in the calculation is to determine weekday versus weekend emissions. The NONROAD 2004 model default values for residential Lawn and Garden equipment was used to calculated the weekly adjustment factor.

Non-Road Mobile Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY NON-ROAD MOBILE SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Construction Equipment							
2-Str Tampers/Rammers	2260002006	0.41	0.00	1.22	0.00190	0.00002	0.00566
2-Str Plate Compactors	2260002009	0.01	0.00	0.04	0.00005	0.00000	0.00020
2-Str Paving Equipment	2260002021	0.01	0.00	0.05	0.00006	0.00000	0.00024
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Concrete/Industrial Saws	2260002039	0.84	0.01	2.98	0.00389	0.00005	0.01388
2-Str Crushing/Proc. Equipment	2260002054	0.00	0.00	0.01	0.00001	0.00000	0.00005
4-Str Pavers	2265002003	0.02	0.01	1.17	0.00011	0.00004	0.00556
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.01	0.00000	0.00000	0.00004
4-Str Plate Compactors	2265002009	0.11	0.01	2.14	0.00051	0.00005	0.01015
4-Str Rollers	2265002015	0.03	0.01	2.19	0.00016	0.00006	0.01040
4-Str Paving Equipment	2265002021	0.14	0.02	4.20	0.00062	0.00010	0.01999
4-Str Surfacing Equipment	2265002024	0.05	0.01	1.93	0.00022	0.00004	0.00916
4-Str Signal Boards/Light Plants	2265002027	0.00	0.00	0.10	0.00002	0.00000	0.00046
4-Str Trenchers	2265002030	0.09	0.03	3.56	0.00044	0.00011	0.01695
4-Str Bore/Drill Rigs	2265002033	0.06	0.01	1.03	0.00029	0.00004	0.00488
4-Str Concrete/Industrial Saws	2265002039	0.12	0.04	8.88	0.00057	0.00018	0.04220
4-Str Cement & Mortar Mixers	2265002042	0.15	0.02	3.57	0.00068	0.00009	0.01699
4-Str Cranes	2265002045	0.00	0.00	0.14	0.00002	0.00002	0.00066
4-Str Crushing/Proc. Equipment	2265002054	0.01	0.00	0.52	0.00006	0.00001	0.00248
4-Str Rough Terrain Forklift	2265002057	0.01	0.01	0.17	0.00003	0.00003	0.00081
4-Str Rubber Tire Loaders	2265002060	0.02	0.02	0.39	0.00008	0.00008	0.00186
4-Str Tractors/Loaders/Backhoes	2265002066	0.04	0.01	2.82	0.00020	0.00006	0.01339
4-Str Skid Steer Loaders	2265002072	0.03	0.02	1.20	0.00015	0.00009	0.00571
4-Str Dumpers/Tenders	2265002078	0.02	0.00	0.56	0.00010	0.00001	0.00265
4-Str Other Construction Equipment	2265002081	0.01	0.01	0.15	0.00003	0.00003	0.00070
LPG - Pavers	2267002003	0.00	0.01	0.03	0.00001	0.00003	0.00013
LPG - Rollers	2267002015	0.00	0.01	0.05	0.00001	0.00004	0.00021
LPG - Paving Equipment	2267002021	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Surfacing Equipment	2267002024	0.00	0.00	0.00	0.00000	0.00000	0.00002
LPG - Trenchers	2267002030	0.00	0.02	0.08	0.00002	0.00008	0.00039
LPG - Bore/Drill Rigs	2267002033	0.00	0.01	0.03	0.00001	0.00003	0.00013
LPG - Concrete/Industrial Saws	2267002039	0.00	0.01	0.08	0.00002	0.00007	0.00037
LPG - Cranes	2267002045	0.00	0.01	0.03	0.00001	0.00003	0.00014
LPG - Rough Terrain Forklifts	2267002057	0.00	0.01	0.05	0.00001	0.00005	0.00025
LPG - Rubber Tire Loaders	2267002060	0.01	0.03	0.13	0.00004	0.00013	0.00062
LPG - Tractors/Loaders/Backhoes	2267002066	0.00	0.00	0.01	0.00000	0.00001	0.00007
LPG - Skid Steer Loaders	2267002072	0.01	0.02	0.11	0.00003	0.00011	0.00051
LPG - Other Construction Equipment	2267002081	0.00	0.01	0.04	0.00001	0.00005	0.00020
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.00	0.00000	0.00000	0.00001
Dsl - Pavers	2270002003	0.07	0.75	0.34	0.00030	0.00340	0.00154
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.15	1.30	0.75	0.00066	0.00587	0.00340
Dsl - Scrapers	2270002018	0.02	0.29	0.12	0.00010	0.00130	0.00052
Dsl - Paving Equipment	2270002021	0.10	1.10	0.63	0.00047	0.00496	0.00283
Dsl - Surfacing Equipment	2270002024	0.08	1.05	0.52	0.00037	0.00474	0.00237
Dsl - Signal Boards/Light Plants	2270002027	0.03	0.15	0.09	0.00011	0.00064	0.00038
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00001	0.00001
Dsl - Bore/Drill Rigs	2270002033	0.00	0.01	0.00	0.00000	0.00004	0.00002
Dsl - Excavators	2270002036	0.32	4.26	1.68	0.00143	0.01928	0.00759
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.01	0.00	0.00000	0.00002	0.00001
Dsl - Cranes	2270002045	0.01	0.16	0.04	0.00006	0.00074	0.00019
Dsl - Graders	2270002048	0.27	2.77	1.12	0.00124	0.01252	0.00505
Dsl - Off-highway Trucks	2270002051	0.04	0.69	0.25	0.00017	0.00314	0.00112
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.02	0.02	0.00002	0.00010	0.00010
Dsl - Rubber Tire Loaders	2270002060	0.29	3.95	1.51	0.00131	0.01788	0.00684
Dsl - Tractors/Loaders/Backhoes	2270002066	1.34	5.35	5.91	0.00607	0.02419	0.02675
Dsl - Crawler Tractor/Dozers	2270002069	0.49	5.92	2.46	0.00221	0.02679	0.01114
Dsl - Skid Steer Loaders	2270002072	0.01	0.02	0.02	0.00003	0.00009	0.00010

Non-Road Mobile Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY NON-ROAD MOBILE SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Dsl - Off-Highway Tractors	2270002075	0.12	1.19	0.64	0.00055	0.00539	0.00289
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**5.59**	**29.39**	**55.79**	**0.02549**	**0.13288**	**0.26101**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.22	0.00	0.81	0.00080	0.00001	0.00291
2-Str Pumps	2260006010	0.66	0.01	2.70	0.00238	0.00004	0.00971
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Hydro Power Units	2260006035	0.00	0.00	0.02	0.00001	0.00000	0.00006
4-Str Generator Sets	2265006005	5.39	1.74	154.28	0.01908	0.00577	0.56780
4-Str Pumps	2265006010	2.14	0.22	44.33	0.00766	0.00073	0.16315
4-Str Air Compressors	2265006015	0.75	0.26	17.91	0.00267	0.00087	0.06590
4-Str Welders	2265006025	0.77	0.19	43.51	0.00276	0.00064	0.16015
4-Str Pressure Washers	2265006030	3.38	0.48	92.66	0.01213	0.00159	0.34104
4-Str Hydro Power Units	2265006035	0.10	0.02	4.13	0.00035	0.00006	0.01519
LPG - Generator Sets	2267006005	0.12	0.60	1.77	0.00044	0.00214	0.00638
LPG - Pumps	2267006010	0.03	0.13	0.42	0.00010	0.00048	0.00150
LPG - Air Compressors	2267006015	0.03	0.15	0.51	0.00012	0.00055	0.00182
LPG - Welders	2267006025	0.05	0.20	0.91	0.00019	0.00071	0.00329
LPG - Pressure Washers	2267006030	0.00	0.00	0.01	0.00000	0.00001	0.00004
LPG - Hydro Power Units	2267006035	0.00	0.00	0.01	0.00000	0.00001	0.00003
CNG - Generator Sets	2268006005	0.00	0.19	0.55	0.00001	0.00068	0.00199
CNG - Pumps	2268006010	0.00	0.01	0.03	0.00000	0.00003	0.00010
CNG - Air Compressors	2268006015	0.00	0.01	0.04	0.00000	0.00004	0.00014
CNG - Gas Compressors	2268006020	0.00	0.16	2.14	0.00001	0.00058	0.00770
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	1.41	15.91	6.01	0.00507	0.05727	0.02162
Dsl - Pumps	2270006010	0.34	3.79	1.46	0.00123	0.01364	0.00524
Dsl - Air Compressors	2270006015	0.19	2.11	0.69	0.00069	0.00760	0.00247
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.25	0.61	0.89	0.00090	0.00219	0.00322
Dsl - Pressure Washers	2270006030	0.01	0.09	0.04	0.00004	0.00031	0.00014
Dsl - Hydro Power Units	2270006035	0.01	0.07	0.03	0.00003	0.00024	0.00011
TOTAL		**15.88**	**26.96**	**375.84**	**0.05668**	**0.09620**	**1.38170**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.00	0.00	0.01	0.00000	0.00000	0.00002
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Aerial Lifts	2265003010	0.02	0.00	0.93	0.00007	0.00002	0.00353
4-Str Forklifts	2265003020	0.04	0.04	0.97	0.00015	0.00015	0.00366
4-Str Sweepers/Scrubbers	2265003030	0.03	0.03	1.09	0.00012	0.00010	0.00414
4-Str Other General Industrial Eqp	2265003040	0.08	0.01	1.91	0.00028	0.00004	0.00724
4-Str Other Material Handling Eqp	2265003050	0.00	0.00	0.06	0.00001	0.00000	0.00022
4-Str AC\Refrigeration	2265003060	0.01	0.00	0.44	0.00002	0.00000	0.00122
4-Str Terminal Tractors	2265003070	0.01	0.01	0.14	0.00002	0.00002	0.00054
LPG - Aerial Lifts	2267003010	0.01	0.04	0.16	0.00004	0.00013	0.00059
LPG - Forklifts	2267003020	0.79	2.86	13.63	0.00294	0.01059	0.05056
LPG - Sweepers/Scrubbers	2267003030	0.01	0.02	0.11	0.00002	0.00008	0.00042
LPG - Other General Industrial Equipment	2267003040	0.00	0.01	0.03	0.00001	0.00003	0.00013
LPG - Other Material Handling Equipment	2267003050	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Terminal Tractors	2267003070	0.00	0.01	0.07	0.00001	0.00005	0.00026
CNG - Forklifts	2268003020	0.00	0.23	1.08	0.00001	0.00084	0.00399
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - AC\Refrigeration	2268003060	0.00	0.00	0.02	0.00000	0.00001	0.00006
CNG - Terminal Tractors	2268003070	0.00	0.00	0.00	0.00000	0.00000	0.00002
Dsl - Aerial Lifts	2270003010	0.01	0.04	0.04	0.00004	0.00014	0.00015
Dsl - Forklifts	2270003020	0.01	0.15	0.10	0.00005	0.00055	0.00035
Dsl - Sweepers/Scrubbers	2270003030	0.02	0.20	0.06	0.00007	0.00075	0.00023
Dsl - Other General Industrial Eqp	2270003040	0.02	0.23	0.07	0.00008	0.00087	0.00027
Dsl - Other Material Handling Eqp	2270003050	0.00	0.01	0.01	0.00001	0.00004	0.00003

Non-Road Mobile Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY NON-ROAD MOBILE SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Dsl - AC\Refrigertion	2270003060	0.63	5.79	2.75	0.00170	0.01574	0.00748
Dsl - Terminal Tractors	2270003070	0.03	0.51	0.19	0.00010	0.00188	0.00070
TOTAL		**1.72**	**10.20**	**23.88**	**0.00575**	**0.03207**	**0.08584**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.08	0.42	0.34	0.00027	0.00142	0.00116
4-Str Railway Maintenance	2285004015	0.02	0.01	0.97	0.00006	0.00002	0.00341
LPG - Railway Maintenance	2285006015	0.00	0.00	0.00	0.00000	0.00000	0.00001
Line-haul Locomotive	228502006	3.96	100.57	15.47	0.01086	0.27553	0.04237
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**4.06**	**100.99**	**16.78**	**0.01119**	**0.27697**	**0.04696**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.01	0.00	0.24	0.00002	0.00000	0.00068
Dsl - Scrapers	2270002018	0.22	3.67	1.52	0.00084	0.01408	0.00583
Dsl - Signal Boards/Light Plants	2270002027	0.01	0.04	0.02	0.00002	0.00011	0.00006
Dsl - Excavators	2270002036	2.13	28.61	9.95	0.00582	0.07839	0.02727
Dsl - Cranes	2270002045	0.04	0.60	0.15	0.00016	0.00228	0.00056
Dsl - Graders	2270002048	0.30	4.03	1.24	0.00082	0.01104	0.00340
Dsl - Off-highway Trucks	2270002051	2.75	47.09	15.24	0.00771	0.13190	0.04269
Dsl - Rough Terrain Forklifts	2270002057	0.03	0.24	0.15	0.00007	0.00067	0.00042
Dsl - Rubber Tire Loaders	2270002060	0.17	2.24	0.92	0.00046	0.00613	0.00252
Dsl - Crawler Tractor/Dozers	2270002069	2.09	29.55	11.58	0.00598	0.08440	0.03307
Dsl - Off-Highway Tractors	2270002075	0.05	0.68	0.32	0.00014	0.00193	0.00092
Dsl - Sprayers	2270005035	0.02	0.07	0.05	0.00005	0.00020	0.00014
TOTAL		**7.80**	**116.81**	**41.38**	**0.02209**	**0.33114**	**0.11756**

Quarry Equipment

Dsl - Scrapers	2270002018	0.02	0.30	0.12	0.00006	0.00102	0.00042
Dsl - Excavators	2270002036	0.08	1.08	0.38	0.00028	0.00373	0.00130
Dsl - Graders	2270002048	0.01	0.07	0.02	0.00002	0.00024	0.00007
Dsl - Off Highway Trucks	2270002051	0.42	7.22	2.34	0.00146	0.02494	0.00807
Dsl - Rubber Tire Loaders	2270002060	0.52	6.92	2.85	0.00179	0.02390	0.00983
Dsl - Tractors/Loaders/Backhoes	2270002066	0.06	0.25	0.24	0.00020	0.00087	0.00082
Dsl - Crawler Tractors/Dozers	2270002069	0.04	0.61	0.24	0.00015	0.00212	0.00083
TOTAL		**1.14**	**16.45**	**6.18**	**0.00395**	**0.05683**	**0.02135**

Landfill Equipment

Dsl - Pavers	2270002003	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Const. Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Boating

2-Str Outboard	2282005010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Personal Water Craft	2282005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Inboard/Sterndrive	2282010005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Inboard	2282020005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Outboards	2282020010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str ATVs	2260001030	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Specialty Vehicles / Carts	2260001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Offroad Motorcycles	2265001010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str ATVs	2265001030	0.00	0.00	0.00	0.00000	0.00000	0.00000

Non-Road Mobile Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY NON-ROAD MOBILE SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
4-Str Golf Carts	2265001050	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Specialty Vehicles / Carts	2265001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Specialty Vehicles / Carts	2267001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Specialty Vehicle Carts	2270001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	0.51	0.00	1.27	0.00144	0.00001	0.00361
2-Str Chain Saws < 6 HP (Res)	2260004020	11.22	0.08	27.46	0.02351	0.00018	0.05756
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	16.94	0.14	44.15	0.04821	0.00040	0.12563
2-Str Leafblowers/Vacuums (Res)	2260004030	2.34	0.02	6.14	0.00666	0.00005	0.01747
4-Str Lawn Mowers (Res)	2265004010	9.07	0.65	120.20	0.02580	0.00185	0.34202
4-Str Rotary Tillers <6 HP (Res)	2265004015	2.21	0.15	27.49	0.00628	0.00043	0.07823
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.31	0.02	3.66	0.00087	0.00006	0.01041
4-Str Leafblowers/Vacuums (Res)	2265004030	0.12	0.01	1.49	0.00034	0.00002	0.00425
4-Str Rear Engine Riding Mower (Res)	2265004040	10.71	2.05	435.33	0.03047	0.00584	1.23866
4-Str Lawn & Garden Tractors (Res)	2265004055	6.86	1.93	361.33	0.01950	0.00510	1.05976
4-Str Other Lawn & Garden Equip. (Res)	2265004075	0.51	0.07	11.42	0.00145	0.00018	0.03351
TOTAL		**60.79**	**5.13**	**1,039.96**	**0.16454**	**0.01411**	**2.97111**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00001	0.00000	0.00003
2-Str Chain Saws < 6 HP (Com)	2260004021	1.20	0.01	3.87	0.00453	0.00005	0.01456
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.24	0.00	0.86	0.00124	0.00002	0.00440
2-Str Leafblowers/Vacuums (Com)	2260004031	0.36	0.01	1.30	0.00185	0.00003	0.00664
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.02	2.80	0.00001	0.00007	0.01465
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.01	0.00	0.13	0.00004	0.00000	0.00068
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.01	0.00	0.11	0.00003	0.00000	0.00058
4-Str Leafblowers/Vacuums (Com)	2265004031	0.12	0.04	5.95	0.00060	0.00021	0.03106
4-Str Rear Engine Riding Mower (Com)	2265004041	0.04	0.01	2.92	0.00020	0.00006	0.01526
4-Str Front Mowers (Com)	2265004046	0.04	0.01	2.22	0.00022	0.00006	0.01162
4-Str Shredders < 6 HP (Com)	2265004051	0.04	0.00	0.61	0.00021	0.00002	0.00317
4-Str Lawn & Garden Tractors (Com)	2265004056	0.01	0.00	0.71	0.00005	0.00002	0.00370
4-Str Chippers/Stump Grinders (Com)	2265004066	0.03	0.02	1.52	0.00013	0.00008	0.00792
4-Str Commercial Turf Equipment (Com)	2265004071	0.01	0.00	0.59	0.00006	0.00001	0.00306
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.05	0.01	1.12	0.00024	0.00003	0.00584
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.05	0.26	0.15	0.00023	0.00134	0.00079
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.02	0.18	0.08	0.00011	0.00090	0.00043
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**2.23**	**0.59**	**24.95**	**0.00975**	**0.00292**	**0.12439**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.01	0.00001	0.00000	0.00005
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.02	0.00	0.07	0.00009	0.00000	0.00033
2-Str Leafblowers/Vacuums (Com)	2260004031	0.01	0.00	0.04	0.00004	0.00000	0.00019
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.02	0.00000	0.00000	0.00008
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.03	0.00001	0.00000	0.00017
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.01	0.00	0.43	0.00003	0.00001	0.00220
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.09	0.00001	0.00000	0.00047
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.03	0.00000	0.00000	0.00014
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000

Non-Road Mobile Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY NON-ROAD MOBILE SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00002
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00002
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00002	0.00001
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.01	0.01	0.00000	0.00003	0.00003
TOTAL		**0.05**	**0.02**	**0.75**	**0.00022**	**0.00008**	**0.00373**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00002	0.00000	0.00004
2-Str Chain Saws < 6 HP (Com)	2260004021	0.09	0.00	0.35	0.00035	0.00001	0.00133
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.94	0.05	10.86	0.01513	0.00024	0.05600
2-Str Leafblowers/Vacuums (Com)	2260004031	0.52	0.01	2.15	0.00267	0.00005	0.01110
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00289	0.00023	0.04550
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.57	0.05	8.63	0.00004	0.00000	0.00067
4-Str Rear Engine Riding Mower (Com)	2265004041	0.01	0.00	0.13	0.00076	0.00024	0.05818
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00080	0.00018	0.03720
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00524	0.00042	0.09299
4-Str Commercial Turf Equipment (Com)	2265004071	0.15	0.05	11.03	0.00011	0.00012	0.00302
4-Str Shredders > 6 HP	2265007010	0.16	0.04	7.05	0.00044	0.00007	0.01691
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00008	0.00041	0.00025
Dsl - Lawn & Garden Tractors (Com)	2270004056	1.03	0.09	17.64	0.00019	0.00114	0.00067
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00002	0.00009	0.00005
Dsl - Commercial Turf Equipment (Com)	2270004071	0.02	0.03	0.57	0.00001	0.00007	0.00004
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00006	0.00036	0.00037
TOTAL		**5.49**	**0.31**	**58.42**	**0.02881**	**0.00365**	**0.32431**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.02	0.00	0.05	0.00005	0.00000	0.00017
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.08	0.00	0.30	0.00037	0.00001	0.00137
2-Str Leafblowers/Vacuums (Com)	2260004031	0.12	0.00	0.51	0.00056	0.00001	0.00231
4-Str Lawn Mowers (Com)	2265004011	0.02	0.00	0.29	0.00009	0.00001	0.00131
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.04	0.00001	0.00000	0.00018
4-Str Rear Engine Riding Mower (Com)	2265004041	0.07	0.02	5.39	0.00032	0.00010	0.02479
4-Str Front Mowers (Com)	2265004046	0.45	0.47	10.15	0.00197	0.00195	0.04671
4-Str Commercial Turf Equipment (Com)	2265004071	0.43	0.15	35.13	0.00189	0.00063	0.16164
Dsl - Front Mowers (Com)	2270004046	0.04	0.23	0.14	0.00019	0.00106	0.00062
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.02	0.12	0.07	0.00009	0.00053	0.00029
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.01	0.00	0.00001	0.00005	0.00002
TOTAL		**1.26**	**1.02**	**52.07**	**0.00554**	**0.00434**	**0.23942**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	1.16	0.01	3.73	0.00445	0.00005	0.01430
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	1.10	0.02	3.93	0.00539	0.00008	0.01916
2-Str Leafblowers/Vacuums (Com)	2260004031	1.06	0.02	3.80	0.00519	0.00008	0.01852
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.79	0.06	12.10	0.00384	0.00030	0.05904
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.42	0.13	31.94	0.00208	0.00063	0.15584
4-Str Front Mowers (Com)	2265004046	0.17	0.05	8.90	0.00087	0.00022	0.04340
4-Str Lawn & Garden Tractors (Com)	2265004056	0.47	0.15	36.15	0.00232	0.00072	0.17637
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000

Non-Road Mobile Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY NON-ROAD MOBILE SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.02	0.00	0.83	0.00008	0.00002	0.00403
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.02	0.01	0.00002	0.00009	0.00005
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.01	0.01	0.00001	0.00006	0.00003
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.03	0.10	0.13	0.00013	0.00039	0.00050
TOTAL		**5.24**	**0.57**	**101.52**	**0.02437**	**0.00264**	**0.49123**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.04	0.00000	0.00000	0.00009
4-Str Tractor - Hay	2265005015	0.00	0.00	0.17	0.00000	0.00000	0.00013
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.05	0.00001	0.00001	0.00027
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.02	0.00001	0.00001	0.00020
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.02	0.00000	0.00000	0.00008
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.02	0.00000	0.00000	0.00011
Dsl - Tractor - Corn	2270005015	0.13	1.20	0.66	0.00035	0.00308	0.00171
Dsl - Tractor - Hay	2270005015	0.62	5.71	3.17	0.00050	0.00430	0.00239
Dsl - Tractor - Peanuts	2270005015	0.18	1.65	0.92	0.00104	0.00905	0.00503
Dsl - Tractor - Small Grains	2270005015	0.08	0.73	0.40	0.00075	0.00651	0.00362
Dsl - Tractor - Sorghum	2270005015	0.08	0.75	0.42	0.00030	0.00262	0.00146
Dsl - Tractor - Cotton	2270005015	0.07	0.67	0.37	0.00042	0.00366	0.00203
Dsl - Combine - Corn	2270005020	0.09	1.01	0.36	0.00058	0.00596	0.00210
Dsl - Combine - Hay	2270005020	0.18	1.96	0.69	0.00112	0.01155	0.00407
Dsl - Combine - Peanuts	2270005020	0.29	3.15	1.11	0.00269	0.02780	0.00980
Dsl - Combine - Small Grains	2270005020	0.13	1.46	0.52	0.00083	0.00860	0.00303
Dsl - Combine - Sorghum	2270005020	0.06	0.64	0.22	0.00036	0.00375	0.00132
Dsl - Combine - Cotton	2270005020	0.15	1.65	0.58	0.00047	0.00485	0.00171
2-Str Sprayers	2260005035	0.11	0.00	0.29	0.00045	0.00000	0.00126
4-Str Balers	2265005025	0.09	0.06	1.30	0.00032	0.00025	0.00571
4-Str Agricultural Mowers	2265005030	0.03	0.01	1.18	0.00012	0.00003	0.00519
4-Str Sprayers	2265005035	0.47	0.11	9.81	0.00190	0.00042	0.04316
4-Str Tillers > 6 HP	2265005040	0.95	0.11	24.46	0.00394	0.00044	0.10759
4-Str Swathers	2265005045	0.12	0.10	2.06	0.00046	0.00040	0.00905
4-Str Other Agriculture Equipment	2265005055	0.17	0.12	4.40	0.00070	0.00048	0.01934
4-Str Irrigation Sets	2265005060	0.15	0.15	3.60	0.00064	0.00059	0.01583
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.01	0.00000	0.00001	0.00004
LPG - Irrigation Sets	2267005060	0.00	0.00	0.01	0.00000	0.00000	0.00002
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.01	0.00000	0.00001	0.00004
CNG - Irrigation Sets	2268005060	0.00	0.08	0.36	0.00001	0.00035	0.00156
Dsl - Balers	2270005025	0.01	0.04	0.03	0.00003	0.00016	0.00011
Dsl - Agricultural Mowers	2270005030	0.00	0.01	0.01	0.00000	0.00003	0.00003
Dsl - Sprayers	2270005035	0.10	0.60	0.33	0.00042	0.00257	0.00143
Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Swathers	2270005045	0.07	0.58	0.32	0.00029	0.00249	0.00136

Non-Road Mobile Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY NON-ROAD MOBILE SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - Other Agriculture Equipment	2270005055	0.20	1.67	0.91	0.00086	0.00718	0.00391
Dsl - Irrigation Sets	2270005060	0.12	1.06	0.42	0.00053	0.00458	0.00179
TOTAL		**4.67**	**25.29**	**59.23**	**0.02010**	**0.11177**	**0.25657**
TOTAL NONROAD SOURCES		115.93	333.73	1,856.75	0.37848	1.06560	6.32519

Non-Road Mobile Source Emissions - Bandera County, 2005

BANDERA COUNTY NON-ROAD MOBILE SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Construction Equipment							
2-Str Tampers/Rammers	2260002006	0.45	0.01	1.35	0.00190	0.00002	0.00566
2-Str Plate Compactors	2260002009	0.01	0.00	0.05	0.00005	0.00000	0.00020
2-Str Paving Equipment	2260002021	0.01	0.00	0.06	0.00006	0.00000	0.00024
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Concrete/Industrial Saws	2260002039	0.93	0.01	3.31	0.00389	0.00005	0.01388
2-Str Crushing/Proc. Equipment	2260002054	0.00	0.00	0.01	0.00001	0.00000	0.00005
4-Str Pavers	2265002003	0.03	0.01	1.30	0.00011	0.00004	0.00556
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.01	0.00000	0.00000	0.00004
4-Str Plate Compactors	2265002009	0.12	0.01	2.37	0.00051	0.00005	0.01015
4-Str Rollers	2265002015	0.04	0.02	2.43	0.00016	0.00006	0.01040
4-Str Paving Equipment	2265002021	0.15	0.03	4.67	0.00062	0.00010	0.01999
4-Str Surfacing Equipment	2265002024	0.05	0.01	2.14	0.00022	0.00004	0.00916
4-Str Signal Boards/Light Plants	2265002027	0.00	0.00	0.11	0.00002	0.00000	0.00046
4-Str Trenchers	2265002030	0.11	0.03	3.96	0.00044	0.00011	0.01695
4-Str Bore/Drill Rigs	2265002033	0.07	0.01	1.14	0.00029	0.00004	0.00488
4-Str Concrete/Industrial Saws	2265002039	0.14	0.05	9.85	0.00057	0.00018	0.04220
4-Str Cement & Mortar Mixers	2265002042	0.17	0.02	3.97	0.00068	0.00009	0.01699
4-Str Cranes	2265002045	0.01	0.01	0.15	0.00002	0.00002	0.00066
4-Str Crushing/Proc. Equipment	2265002054	0.01	0.00	0.58	0.00006	0.00001	0.00248
4-Str Rough Terrain Forklift	2265002057	0.01	0.01	0.19	0.00003	0.00003	0.00081
4-Str Rubber Tire Loaders	2265002060	0.02	0.02	0.43	0.00008	0.00008	0.00186
4-Str Tractors/Loaders/Backhoes	2265002066	0.05	0.01	3.13	0.00020	0.00006	0.01339
4-Str Skid Steer Loaders	2265002072	0.04	0.02	1.33	0.00015	0.00009	0.00571
4-Str Dumpers/Tenders	2265002078	0.02	0.00	0.62	0.00010	0.00001	0.00265
4-Str Other Construction Equipment	2265002081	0.01	0.01	0.16	0.00003	0.00003	0.00070
LPG - Pavers	2267002003	0.00	0.01	0.03	0.00001	0.00003	0.00013
LPG - Rollers	2267002015	0.00	0.01	0.05	0.00001	0.00004	0.00021
LPG - Paving Equipment	2267002021	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Surfacing Equipment	2267002024	0.00	0.00	0.01	0.00000	0.00000	0.00002
LPG - Trenchers	2267002030	0.01	0.02	0.09	0.00002	0.00008	0.00039
LPG - Bore/Drill Rigs	2267002033	0.00	0.01	0.03	0.00001	0.00003	0.00013
LPG - Concrete/Industrial Saws	2267002039	0.00	0.02	0.09	0.00002	0.00007	0.00037
LPG - Cranes	2267002045	0.00	0.01	0.03	0.00001	0.00003	0.00014
LPG - Rough Terrain Forklifts	2267002057	0.00	0.01	0.06	0.00001	0.00005	0.00025
LPG - Rubber Tire Loaders	2267002060	0.01	0.03	0.15	0.00004	0.00013	0.00062
LPG - Tractors/Loaders/Backhoes	2267002066	0.00	0.00	0.02	0.00000	0.00001	0.00007
LPG - Skid Steer Loaders	2267002072	0.01	0.03	0.12	0.00003	0.00011	0.00051
LPG - Other Construction Equipment	2267002081	0.00	0.01	0.05	0.00001	0.00005	0.00020
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.00	0.00000	0.00000	0.00001
Dsl - Pavers	2270002003	0.03	0.37	0.17	0.00015	0.00168	0.00077
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.06	0.54	0.33	0.00029	0.00242	0.00148
Dsl - Scrapers	2270002018	0.01	0.18	0.07	0.00006	0.00083	0.00032
Dsl - Paving Equipment	2270002021	0.05	0.55	0.32	0.00024	0.00250	0.00144
Dsl - Surfacing Equipment	2270002024	0.03	0.37	0.19	0.00013	0.00169	0.00085
Dsl - Signal Boards/Light Plants	2270002027	0.03	0.17	0.10	0.00012	0.00071	0.00042
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Bore/Drill Rigs	2270002033	0.00	0.01	0.00	0.00000	0.00002	0.00001
Dsl - Excavators	2270002036	0.17	2.33	0.94	0.00076	0.01053	0.00423
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Cranes	2270002045	0.01	0.09	0.02	0.00003	0.00039	0.00010
Dsl - Graders	2270002048	0.14	1.41	0.58	0.00064	0.00640	0.00260
Dsl - Off-highway Trucks	2270002051	0.03	0.64	0.23	0.00015	0.00290	0.00103
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.01	0.01	0.00001	0.00005	0.00005
Dsl - Rubber Tire Loaders	2270002060	0.14	1.85	0.74	0.00062	0.00835	0.00335
Dsl - Tractors/Loaders/Backhoes	2270002066	0.70	2.77	3.07	0.00316	0.01252	0.01389
Dsl - Crawler Tractor/Dozers	2270002069	0.29	3.59	1.50	0.00132	0.01626	0.00677
Dsl - Skid Steer Loaders	2270002072	0.00	0.01	0.01	0.00001	0.00005	0.00005

Non-Road Mobile Source Emissions - Bandera County, 2005

BANDERA COUNTY NON-ROAD MOBILE SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - Off-Highway Tractors	2270002075	0.06	0.62	0.33	0.00029	0.00282	0.00151
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**4.26**	**15.96**	**52.66**	**0.01837**	**0.07190**	**0.22705**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.04	0.00	0.16	0.00015	0.00000	0.00056
2-Str Pumps	2260006010	0.13	0.00	0.52	0.00046	0.00001	0.00188
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Hydro Power Units	2260006035	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Generator Sets	2265006005	1.04	0.34	29.86	0.00381	0.00112	0.10990
4-Str Pumps	2265006010	0.41	0.04	8.58	0.00149	0.00014	0.03158
4-Str Air Compressors	2265006015	0.15	0.05	3.47	0.00052	0.00017	0.01275
4-Str Welders	2265006025	0.15	0.04	8.42	0.00054	0.00012	0.03100
4-Str Pressure Washers	2265006030	0.65	0.09	17.94	0.00238	0.00031	0.06601
4-Str Hydro Power Units	2265006035	0.02	0.00	0.80	0.00007	0.00001	0.00294
LPG - Generator Sets	2267006005	0.02	0.12	0.34	0.00008	0.00041	0.00123
LPG - Pumps	2267006010	0.01	0.03	0.08	0.00002	0.00009	0.00029
LPG - Air Compressors	2267006015	0.01	0.03	0.10	0.00002	0.00011	0.00035
LPG - Welders	2267006025	0.01	0.04	0.18	0.00004	0.00014	0.00064
LPG - Pressure Washers	2267006030	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Hydro Power Units	2267006035	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Generator Sets	2268006005	0.00	0.04	0.11	0.00000	0.00013	0.00038
CNG - Pumps	2268006010	0.00	0.00	0.01	0.00000	0.00001	0.00002
CNG - Air Compressors	2268006015	0.00	0.00	0.01	0.00000	0.00001	0.00003
CNG - Gas Compressors	2268006020	0.00	0.03	0.41	0.00000	0.00011	0.00149
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	0.27	3.08	1.16	0.00098	0.01108	0.00418
Dsl - Pumps	2270006010	0.07	0.73	0.28	0.00024	0.00264	0.00101
Dsl - Air Compressors	2270006015	0.04	0.41	0.13	0.00013	0.00147	0.00048
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.05	0.12	0.17	0.00017	0.00042	0.00062
Dsl - Pressure Washers	2270006030	0.00	0.02	0.01	0.00001	0.00006	0.00003
Dsl - Hydro Power Units	2270006035	0.00	0.01	0.01	0.00001	0.00005	0.00002
TOTAL		**3.07**	**5.22**	**72.74**	**0.01114**	**0.01862**	**0.26743**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.00	0.00	0.00	0.00000	0.00000	0.00001
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Aerial Lifts	2265003010	0.01	0.00	0.52	0.00004	0.00001	0.00196
4-Str Forklifts	2265003020	0.02	0.02	0.54	0.00008	0.00008	0.00203
4-Str Sweepers/Scrubbers	2265003030	0.02	0.02	0.60	0.00007	0.00006	0.00229
4-Str Other General Industrial Eqp	2265003040	0.04	0.01	1.06	0.00015	0.00002	0.00401
4-Str Other Material Handling Eqp	2265003050	0.00	0.00	0.03	0.00000	0.00000	0.00012
4-Str AC\Refrigeration	2265003060	0.00	0.00	0.20	0.00001	0.00000	0.00056
4-Str Terminal Tractors	2265003070	0.00	0.00	0.08	0.00001	0.00001	0.00030
LPG - Aerial Lifts	2267003010	0.01	0.02	0.09	0.00002	0.00007	0.00033
LPG - Forklifts	2267003020	0.44	1.58	7.55	0.00163	0.00587	0.02801
LPG - Sweepers/Scrubbers	2267003030	0.00	0.01	0.06	0.00001	0.00004	0.00023
LPG - Other General Industrial Equipment	2267003040	0.00	0.00	0.02	0.00000	0.00001	0.00007
LPG - Other Material Handling Equipment	2267003050	0.00	0.00	0.00	0.00000	0.00000	0.00002
LPG - Terminal Tractors	2267003070	0.00	0.01	0.04	0.00001	0.00003	0.00014
CNG - Forklifts	2268003020	0.00	0.13	0.60	0.00001	0.00046	0.00221
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - AC\Refrigeration	2268003060	0.00	0.00	0.01	0.00000	0.00001	0.00003
CNG - Terminal Tractors	2268003070	0.00	0.00	0.00	0.00000	0.00000	0.00001
Dsl - Aerial Lifts	2270003010	0.01	0.02	0.02	0.00002	0.00008	0.00008
Dsl - Forklifts	2270003020	0.01	0.08	0.05	0.00003	0.00031	0.00020
Dsl - Sweepers/Scrubbers	2270003030	0.01	0.11	0.03	0.00004	0.00042	0.00013
Dsl - Other General Industrial Eqp	2270003040	0.01	0.13	0.04	0.00004	0.00048	0.00015
Dsl - Other Material Handling Eqp	2270003050	0.00	0.01	0.00	0.00000	0.00002	0.00001

Non-Road Mobile Source Emissions - Bandera County, 2005

BANDERA COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Code	tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	0.29	2.67	1.27	0.00079	0.00726	0.00345
Dsl - Terminal Tractors	2270003070	0.01	0.28	0.10	0.00006	0.00104	0.00039
TOTAL		**0.89**	**5.11**	**12.93**	**0.00303**	**0.01630**	**0.04674**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.03	0.18	0.14	0.00012	0.00061	0.00050
4-Str Railway Maintenance	2285004015	0.01	0.00	0.41	0.00003	0.00001	0.00145
LPG - Railway Maintenance	2285006015	0.00	0.00	0.00	0.00000	0.00000	0.00001
Line-haul Locomotive	2285002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.04**	**0.18**	**0.56**	**0.00014**	**0.00061**	**0.00195**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractors/Loaders/Backhoes	2270002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Landfill Equipment

Dsl - Pavers	2270002003	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Const. Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Boating

2-Str Outboard	2282005010	79.12	2.31	190.69	0.18862	0.00507	0.41827
2-Str Personal Water Craft	2282005015	17.83	0.43	42.16	0.04032	0.00095	0.09249
4-Str Inboard/Sterndrive	2282010005	7.09	3.47	83.07	0.02133	0.00700	0.18628
Dsl - Inboard	2282020005	0.22	5.83	0.92	0.00048	0.01280	0.00202
Dsl - Outboards	2282020010	0.00	0.02	0.01	0.00001	0.00004	0.00003
TOTAL		**104.26**	**12.07**	**316.85**	**0.25075**	**0.02586**	**0.69909**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	163.36	0.39	156.21	0.51101	0.00123	0.48778
2-Str ATVs	2260001030	205.29	0.50	196.59	0.64208	0.00155	0.61388
2-Str Specialty Vehicles / Carts	2260001060	1.80	0.41	82.74	0.00584	0.00127	0.25836
4-Str Offroad Motorcycles	2265001010	4.62	0.56	69.13	0.01464	0.00161	0.22069
BANDERA COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Bandera County, 2005

NON-ROAD MOBILE SOURCES	Code	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	44.09	5.35	658.38	0.13988	0.01535	2.10185
4-Str Golf Carts	2265001050	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Specialty Vehicles / Carts	2265001060	2.05	0.44	70.47	0.00643	0.00126	0.22496
LPG - Specialty Vehicles / Carts	2267001060	0.04	0.16	0.67	0.00014	0.00050	0.00209
Dsl - Specialty Vehicle Carts	2270001060	0.64	1.86	2.52	0.00199	0.00580	0.00786
TOTAL		**421.88**	**9.66**	**1,236.69**	**1.32200**	**0.02856**	**3.91747**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	0.28	0.00	0.69	0.00079	0.00001	0.00197
2-Str Chain Saws < 6 HP (Res)	2260004020	6.14	0.05	15.02	0.01286	0.00010	0.03148
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	9.27	0.08	24.15	0.02637	0.00022	0.06872
2-Str Leafblowers/Vacuums (Res)	2260004030	1.28	0.01	3.36	0.00364	0.00003	0.00956
4-Str Lawn Mowers (Res)	2265004010	4.96	0.35	65.75	0.01411	0.00101	0.18708
4-Str Rotary Tillers <6 HP (Res)	2265004015	1.21	0.08	15.04	0.00343	0.00023	0.04279
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.17	0.01	2.00	0.00048	0.00003	0.00569
4-Str Leafblowers/Vacuums (Res)	2265004030	0.06	0.00	0.82	0.00018	0.00001	0.00232
4-Str Rear Engine Riding Mower (Res)	2265004040	5.86	1.12	238.11	0.01667	0.00319	0.67751
4-Str Lawn & Garden Tractors (Res)	2265004055	4.80	1.35	252.66	0.01441	0.00356	0.74105
4-Str Other Lawn & Garden Equip. (Res)	2265004075	0.36	0.05	7.99	0.00106	0.00012	0.02343
TOTAL		**34.37**	**3.11**	**625.59**	**0.09401**	**0.00852**	**1.79160**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00001	0.00000	0.00003
2-Str Chain Saws < 6 HP (Com)	2260004021	1.38	0.02	4.42	0.00518	0.00006	0.01664
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.28	0.00	0.98	0.00141	0.00002	0.00503
2-Str Leafblowers/Vacuums (Com)	2260004031	0.42	0.01	1.48	0.00212	0.00003	0.00759
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.02	3.20	0.00001	0.00009	0.01674
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.01	0.00	0.15	0.00005	0.00000	0.00078
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.01	0.00	0.13	0.00003	0.00000	0.00066
4-Str Leafblowers/Vacuums (Com)	2265004031	0.14	0.05	6.79	0.00069	0.00024	0.03549
4-Str Rear Engine Riding Mower (Com)	2265004041	0.05	0.02	3.34	0.00023	0.00007	0.01744
4-Str Front Mowers (Com)	2265004046	0.05	0.01	2.54	0.00026	0.00007	0.01328
4-Str Shredders < 6 HP (Com)	2265004051	0.05	0.00	0.69	0.00024	0.00002	0.00363
4-Str Lawn & Garden Tractors (Com)	2265004056	0.01	0.00	0.81	0.00006	0.00002	0.00423
4-Str Chippers/Stump Grinders (Com)	2265004066	0.03	0.02	1.73	0.00015	0.00010	0.00905
4-Str Commercial Turf Equipment (Com)	2265004071	0.01	0.00	0.67	0.00006	0.00002	0.00349
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.06	0.01	1.28	0.00028	0.00004	0.00667
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.05	0.30	0.18	0.00026	0.00153	0.00090
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.02	0.20	0.10	0.00012	0.00103	0.00049
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**2.55**	**0.67**	**28.51**	**0.01117**	**0.00334**	**0.14216**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
BANDERA COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Code	tons/year			tons/day (Mon. - Fri.)		

Non-Road Mobile Source Emissions - Bandera County, 2005

4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00001
2-Str Chain Saws < 6 HP (Com)	2260004021	0.02	0.00	0.09	0.00009	0.00000	0.00033
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.73	0.01	2.71	0.00379	0.00006	0.01400
2-Str Leafblowers/Vacuums (Com)	2260004031	0.13	0.00	0.54	0.00067	0.00001	0.00278
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00072	0.00006	0.01137
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.14	0.01	2.16	0.00001	0.00000	0.00017
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.03	0.00019	0.00006	0.01455
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00020	0.00004	0.00930
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00131	0.00011	0.02325
4-Str Commercial Turf Equipment (Com)	2265004071	0.04	0.01	2.76	0.00003	0.00003	0.00075
4-Str Shredders > 6 HP	2265007010	0.04	0.01	1.76	0.00011	0.00002	0.00423
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00002	0.00010	0.00006
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.26	0.02	4.41	0.00005	0.00029	0.00017
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00002	0.00001
Dsl - Commercial Turf Equipment (Com)	2270004071	0.01	0.01	0.14	0.00000	0.00002	0.00001
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00002	0.00009	0.00009
TOTAL		**1.37**	**0.08**	**14.61**	**0.00722**	**0.00091**	**0.08108**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.07	0.00	0.22	0.00023	0.00023	0.00023
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.34	0.01	1.28	0.00155	0.00155	0.00155
2-Str Leafblowers/Vacuums (Com)	2260004031	0.52	0.01	2.15	0.00233	0.00233	0.00233
4-Str Lawn Mowers (Com)	2265004011	0.08	0.01	1.20	0.00036	0.00036	0.00036
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.01	0.00	0.16	0.00005	0.00005	0.00005
4-Str Rear Engine Riding Mower (Com)	2265004041	0.30	0.10	22.57	0.00136	0.00136	0.00136
4-Str Front Mowers (Com)	2265004046	1.90	1.98	42.53	0.00844	0.00844	0.00844
4-Str Commercial Turf Equipment (Com)	2265004071	1.79	0.64	147.19	0.00801	0.00801	0.00801
Dsl - Front Mowers (Com)	2270004046	0.18	0.98	0.58	0.00081	0.00081	0.00081
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.08	0.49	0.27	0.00037	0.00037	0.00037
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.05	0.02	0.00002	0.00002	0.00002
TOTAL		**5.29**	**4.26**	**218.17**	**0.02353**	**0.02353**	**0.02353**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.27	0.00	0.86	0.00103	0.00001	0.00330
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.04	0.00	0.13	0.00019	0.00000	0.00066
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
BANDERA COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Code	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	0.02	0.01	1.33	0.00009	0.00003	0.00648

Non-Road Mobile Source Emissions - Bandera County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.50	0.31	29.66	0.00246	0.00152	0.14471
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.82**	**0.32**	**31.99**	**0.00375**	**0.00156**	**0.15515**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Hay	2265005015	0.00	0.00	0.03	0.00000	0.00000	0.00002
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Corn	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Hay	2270005015	0.11	0.98	0.54	0.00008	0.00074	0.00041
Dsl - Tractor - Peanuts	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Small Grains	2270005015	0.00	0.02	0.01	0.00002	0.00017	0.00009
Dsl - Tractor - Sorghum	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Cotton	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Corn	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Hay	2270005020	0.03	0.34	0.12	0.00018	0.00185	0.00065
Dsl - Combine - Peanuts	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Small Grains	2270005020	0.00	0.04	0.01	0.00002	0.00021	0.00007
Dsl - Combine - Sorghum	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Cotton	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Sprayers	2260005035	0.01	0.00	0.04	0.00006	0.00000	0.00016
4-Str Balers	2265005025	0.01	0.01	0.17	0.00005	0.00003	0.00073
4-Str Agricultural Mowers	2265005030	0.00	0.00	0.15	0.00002	0.00000	0.00067
4-Str Sprayers	2265005035	0.06	0.01	1.26	0.00025	0.00005	0.00554
4-Str Tillers > 6 HP	2265005040	0.12	0.01	3.14	0.00051	0.00006	0.01381
4-Str Swathers	2265005045	0.02	0.01	0.26	0.00006	0.00005	0.00116
4-Str Other Agriculture Equipment	2265005055	0.02	0.02	0.56	0.00009	0.00006	0.00248
4-Str Irrigation Sets	2265005060	0.02	0.02	0.46	0.00008	0.00008	0.00203
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Irrigation Sets	2267005060	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - Irrigation Sets	2268005060	0.00	0.01	0.05	0.00000	0.00005	0.00020
Dsl - Balers	2270005025	0.00	0.00	0.00	0.00000	0.00002	0.00001
Dsl - Agricultural Mowers	2270005030	0.00	0.00	0.00	0.00000	0.00000	0.00000
BANDERA COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Code	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.01	0.08	0.04	0.00005	0.00033	0.00018

Non-Road Mobile Source Emissions - Bandera County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Swathers	2270005045	0.01	0.07	0.04	0.00004	0.00032	0.00017
Dsl - Other Agriculture Equipment	2270005055	0.03	0.21	0.12	0.00011	0.00092	0.00050
Dsl - Irrigation Sets	2270005060	0.02	0.14	0.05	0.00007	0.00059	0.00023
TOTAL		**0.48**	**1.98**	**7.07**	**0.00170**	**0.00553**	**0.02915**
TOTAL NONROAD SOURCES		579.29	58.62	2,618.37	1.74681	0.20525	7.38240

Non-Road Mobile Source Emissions - Bexar County, 2005

BEXAR COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Construction Equipment							
2-Str Tampers/Rammers	2260002006	41.70	0.50	124.15	0.17422	0.00210	0.52005
2-Str Plate Compactors	2260002009	1.19	0.02	4.40	0.00495	0.00007	0.01843
2-Str Paving Equipment	2260002021	1.34	0.02	5.22	0.00557	0.00009	0.02188
2-Str Signal Boards/Light Plants	2260002027	0.01	0.00	0.04	0.00003	0.00000	0.00015
2-Str Concrete/Industrial Saws	2260002039	85.26	1.08	304.20	0.35674	0.00454	1.27426
2-Str Crushing/Proc. Equipment	2260002054	0.20	0.00	0.99	0.00083	0.00002	0.00415
4-Str Pavers	2265002003	2.55	0.87	119.30	0.01044	0.00334	0.51091
4-Str Tampers/Rammers	2265002006	0.02	0.00	0.95	0.00009	0.00002	0.00405
4-Str Plate Compactors	2265002009	11.34	1.16	217.70	0.04666	0.00445	0.93233
4-Str Rollers	2265002015	3.57	1.44	222.90	0.01458	0.00555	0.95460
4-Str Paving Equipment	2265002021	13.95	2.33	428.68	0.05645	0.00898	1.83585
4-Str Surfacing Equipment	2265002024	4.88	0.92	196.45	0.01999	0.00353	0.84131
4-Str Signal Boards/Light Plants	2265002027	0.35	0.04	9.96	0.00145	0.00017	0.04266
4-Str Trenchers	2265002030	9.66	2.69	363.45	0.03958	0.01036	1.55652
4-Str Bore/Drill Rigs	2265002033	6.42	0.96	104.65	0.02604	0.00370	0.44816
4-Str Concrete/Industrial Saws	2265002039	12.64	4.28	904.90	0.05182	0.01645	3.87529
4-Str Cement & Mortar Mixers	2265002042	15.41	2.07	364.28	0.06125	0.00796	1.56004
4-Str Cranes	2265002045	0.51	0.47	14.16	0.00204	0.00182	0.06065
4-Str Crushing/Proc. Equipment	2265002054	1.27	0.30	53.28	0.00519	0.00115	0.22818
4-Str Rough Terrain Forklift	2265002057	0.73	0.79	17.40	0.00297	0.00304	0.07452
4-Str Rubber Tire Loaders	2265002060	1.68	1.87	39.89	0.00685	0.00719	0.17085
4-Str Tractors/Loaders/Backhoes	2265002066	4.34	1.36	287.15	0.01776	0.00525	1.22976
4-Str Skid Steer Loaders	2265002072	3.32	2.09	122.47	0.01335	0.00803	0.52451
4-Str Dumpers/Tenders	2265002078	2.21	0.33	56.78	0.00876	0.00128	0.24317
4-Str Other Construction Equipment	2265002081	0.68	0.72	15.08	0.00271	0.00275	0.06460
LPG - Pavers	2267002003	0.16	0.59	2.78	0.00068	0.00247	0.01163
LPG - Rollers	2267002015	0.26	0.92	4.70	0.00108	0.00386	0.01968
LPG - Paving Equipment	2267002021	0.05	0.17	0.73	0.00019	0.00070	0.00306
LPG - Surfacing Equipment	2267002024	0.03	0.10	0.49	0.00012	0.00043	0.00204
LPG - Trenchers	2267002030	0.51	1.83	8.53	0.00212	0.00766	0.03574
LPG - Bore/Drill Rigs	2267002033	0.18	0.66	2.79	0.00075	0.00277	0.01169
LPG - Concrete/Industrial Saws	2267002039	0.41	1.46	8.11	0.00174	0.00610	0.03396
LPG - Cranes	2267002045	0.19	0.68	2.99	0.00078	0.00286	0.01254
LPG - Rough Terrain Forklifts	2267002057	0.33	1.19	5.42	0.00137	0.00498	0.02271
LPG - Rubber Tire Loaders	2267002060	0.79	2.83	13.51	0.00330	0.01187	0.05659
LPG - Tractors/Loaders/Backhoes	2267002066	0.08	0.29	1.43	0.00034	0.00121	0.00599
LPG - Skid Steer Loaders	2267002072	0.68	2.49	11.13	0.00286	0.01045	0.04664
LPG - Other Construction Equipment	2267002081	0.28	1.03	4.48	0.00118	0.00432	0.01878
CNG - Other Construction Equipment	2268002081	0.00	0.04	0.17	0.00000	0.00017	0.00073
Dsl - Pavers	2270002003	3.30	38.44	16.22	0.01493	0.17389	0.07339
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	7.92	76.43	39.62	0.03578	0.34498	0.17896
Dsl - Scrapers	2270002018	1.21	15.82	5.99	0.00526	0.06844	0.02620
Dsl - Paving Equipment	2270002021	3.84	40.49	22.96	0.01736	0.18316	0.10389
Dsl - Surfacing Equipment	2270002024	6.61	85.95	42.80	0.02984	0.38831	0.19341
Dsl - Signal Boards/Light Plants	2270002027	2.71	15.55	9.16	0.01135	0.06512	0.03836
Dsl - Trenchers	2270002030	0.01	0.04	0.04	0.00004	0.00020	0.00019
Dsl - Bore/Drill Rigs	2270002033	0.14	1.68	0.49	0.00030	0.00361	0.00111
Dsl - Excavators	2270002036	18.12	256.15	99.91	0.08199	1.15885	0.45201
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.03	0.02	0.00002	0.00013	0.00010
Dsl - Cement & Mortar Mixers	2270002042	0.02	0.20	0.07	0.00008	0.00089	0.00031
Dsl - Cranes	2270002045	0.53	6.07	1.53	0.00234	0.02684	0.00682
Dsl - Graders	2270002048	11.47	118.73	46.67	0.05187	0.53717	0.21112
Dsl - Off-highway Trucks	2270002051	1.00	18.24	6.91	0.00453	0.08254	0.03124
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.15	0.81	0.80	0.00068	0.00367	0.00364
Dsl - Rubber Tire Loaders	2270002060	15.60	211.03	80.04	0.07059	0.95471	0.36211
Dsl - Tractors/Loaders/Backhoes	2270002066	62.74	244.96	272.54	0.28377	1.10778	1.23273
Dsl - Crawler Tractor/Dozers	2270002069	25.86	323.01	132.32	0.11681	1.45812	0.59742
Dsl - Skid Steer Loaders	2270002072	0.22	0.69	0.78	0.00098	0.00314	0.00355

Non-Road Mobile Source Emissions - Bexar County, 2005

BEXAR COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Dsl - Off-Highway Tractors	2270002075	4.35	42.88	23.00	0.01969	0.19400	0.10406
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**394.96**	**1,537.82**	**4,847.59**	**1.69504**	**6.91721**	**20.89932**

Light Commercial Equipment

2-Str Generator Sets	2260006005	11.63	0.16	42.45	0.04184	0.00058	0.15281
2-Str Pumps	2260006010	34.72	0.65	141.88	0.12495	0.00234	0.51076
2-Str Air Compressors	2260006015	0.01	0.00	0.06	0.00004	0.00000	0.00021
2-Str Hydro Power Units	2260006035	0.17	0.00	0.89	0.00061	0.00001	0.00320
4-Str Generator Sets	2265006005	283.66	91.75	8,111.99	1.00333	0.30336	29.85525
4-Str Pumps	2265006010	112.62	11.62	2,330.88	0.40287	0.03842	8.57856
4-Str Air Compressors	2265006015	39.49	13.78	941.51	0.14047	0.04556	3.46511
4-Str Welders	2265006025	40.50	10.23	2,288.01	0.14527	0.03382	8.42078
4-Str Pressure Washers	2265006030	177.91	25.24	4,872.38	0.63796	0.08347	17.93225
4-Str Hydro Power Units	2265006035	5.18	1.03	216.95	0.01852	0.00339	0.79845
LPG - Generator Sets	2267006005	6.38	31.32	93.11	0.02295	0.11274	0.33520
LPG - Pumps	2267006010	1.43	6.95	21.91	0.00516	0.02501	0.07888
LPG - Air Compressors	2267006015	1.68	8.10	26.59	0.00607	0.02915	0.09574
LPG - Welders	2267006025	2.84	10.38	48.03	0.01022	0.03737	0.17290
LPG - Pressure Washers	2267006030	0.04	0.14	0.63	0.00014	0.00051	0.00226
LPG - Hydro Power Units	2267006035	0.03	0.13	0.43	0.00009	0.00045	0.00155
CNG - Generator Sets	2268006005	0.12	9.87	29.02	0.00043	0.03554	0.10446
CNG - Pumps	2268006010	0.01	0.48	1.48	0.00002	0.00174	0.00533
CNG - Air Compressors	2268006015	0.01	0.65	2.10	0.00003	0.00235	0.00757
CNG - Gas Compressors	2268006020	0.16	8.44	112.48	0.00059	0.03037	0.40493
CNG - Hydro Power Units	2268006035	0.00	0.00	0.01	0.00000	0.00001	0.00003
Dsl - Generator Sets	2270006005	74.08	836.52	315.79	0.26667	3.01141	1.13682
Dsl - Pumps	2270006010	17.95	199.22	76.56	0.06462	0.71717	0.27562
Dsl - Air Compressors	2270006015	10.14	111.05	36.07	0.03650	0.39976	0.12984
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	13.11	31.94	47.02	0.04719	0.11498	0.16926
Dsl - Pressure Washers	2270006030	0.61	4.53	2.07	0.00219	0.01629	0.00746
Dsl - Hydro Power Units	2270006035	0.41	3.44	1.59	0.00146	0.01237	0.00571
TOTAL		**834.87**	**1,417.61**	**19,761.89**	**2.98017**	**5.05821**	**72.65092**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.17	0.00	0.87	0.00063	0.00001	0.00322
2-Str Other General Industrial Eqp	2260003040	0.01	0.00	0.07	0.00005	0.00000	0.00025
4-Str Aerial Lifts	2265003010	3.22	0.79	153.19	0.01182	0.00269	0.58096
4-Str Forklifts	2265003020	6.67	7.39	158.73	0.02439	0.02519	0.60200
4-Str Sweepers/Scrubbers	2265003030	5.21	4.81	179.27	0.01901	0.01640	0.67987
4-Str Other General Industrial Eqp	2265003040	12.39	1.88	313.71	0.04548	0.00642	1.18976
4-Str Other Material Handling Eqp	2265003050	0.28	0.20	9.67	0.00102	0.00067	0.03666
4-Str AC\Refrigeration	2265003060	0.28	0.07	15.39	0.00081	0.00017	0.04276
4-Str Terminal Tractors	2265003070	0.93	1.05	23.32	0.00339	0.00359	0.08844
LPG - Aerial Lifts	2267003010	1.61	5.92	26.02	0.00598	0.02197	0.09651
LPG - Forklifts	2267003020	130.16	469.32	2,240.01	0.48284	1.74099	8.30952
LPG - Sweepers/Scrubbers	2267003030	1.01	3.59	18.78	0.00375	0.01333	0.06965
LPG - Other General Industrial Equipment	2267003040	0.32	1.16	5.74	0.00120	0.00429	0.02131
LPG - Other Material Handling Equipment	2267003050	0.09	0.32	1.41	0.00032	0.00118	0.00522
LPG - Terminal Tractors	2267003070	0.59	2.07	11.40	0.00218	0.00767	0.04228
CNG - Forklifts	2268003020	0.61	37.09	176.71	0.00225	0.13759	0.65552
CNG - Sweepers/Scrubbers	2268003030	0.00	0.04	0.21	0.00000	0.00016	0.00078
CNG - Other General Industrial Equipment	2268003040	0.00	0.03	0.13	0.00000	0.00010	0.00050
CNG - AC\Refrigeration	2268003060	0.00	0.15	0.77	0.00001	0.00042	0.00209
CNG - Terminal Tractors	2268003070	0.00	0.15	0.81	0.00001	0.00055	0.00301
Dsl - Aerial Lifts	2270003010	1.83	6.36	6.65	0.00680	0.02360	0.02466
Dsl - Forklifts	2270003020	2.32	24.59	15.63	0.00860	0.09121	0.05799
Dsl - Sweepers/Scrubbers	2270003030	2.89	33.32	10.14	0.01071	0.12361	0.03760
Dsl - Other General Industrial Eqp	2270003040	3.37	38.48	11.86	0.01251	0.14273	0.04400
Dsl - Other Material Handling Eqp	2270003050	0.34	1.83	1.18	0.00125	0.00679	0.00439

Non-Road Mobile Source Emissions - Bexar County, 2005

BEXAR COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	21.98	203.07	96.50	0.05972	0.55183	0.26223
Dsl - Terminal Tractors	2270003070	4.45	83.40	31.10	0.01650	0.30937	0.11535
TOTAL		**200.74**	**927.10**	**3,509.26**	**0.72124**	**3.23256**	**12.97652**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	3.02	15.71	12.84	0.01033	0.05379	0.04398
4-Str Railway Maintenance	2285004015	0.72	0.20	36.81	0.00239	0.00064	0.12884
LPG - Railway Maintenance	2285006015	0.01	0.04	0.16	0.00003	0.00012	0.00054
Line-haul Locomotive	2285002006	44.93	1,140.52	175.40	0.12311	3.12471	0.48055
Switch Locomotive	2285002010	18.17	289.30	31.27	0.04977	0.79261	0.08566
TOTAL		**66.84**	**1,445.77**	**256.48**	**0.18564**	**3.97186**	**0.73957**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	1.08	18.03	7.46	0.00373	0.06225	0.02577
Dsl - Excavators	2270002036	2.68	36.04	12.54	0.00924	0.12445	0.04329
Dsl - Graders	2270002048	0.24	3.18	0.98	0.00081	0.01098	0.00338
Dsl - Off Highway Trucks	2270002051	13.61	233.06	75.43	0.04702	0.80485	0.26048
Dsl - Rubber Tire Loaders	2270002060	16.71	223.19	91.85	0.05769	0.77077	0.31720
Dsl - Tractors/Loaders/Backhoes	2270002066	1.77	7.84	7.35	0.00611	0.02707	0.02537
Dsl - Crawler Tractors/Dozers	2270002069	1.55	21.82	8.55	0.00534	0.07537	0.02953
TOTAL		**37.63**	**543.16**	**204.15**	**0.12994**	**1.87574**	**0.70502**

Landfill Equipment

Dsl - Pavers	2270002003	0.72	14.14	4.69	0.00294	0.05746	0.01908
Dsl - Scrapers	2270002018	0.48	8.41	2.72	0.00196	0.03418	0.01104
Dsl - Excavators	2270002036	0.04	0.54	0.15	0.00018	0.00218	0.00062
Dsl - Graders	2270002048	0.11	1.48	0.41	0.00045	0.00602	0.00166
Dsl - Off Highway Trucks	2270002051	0.16	2.17	0.58	0.00067	0.00881	0.00234
Dsl - Rubber Tire Loaders	2270002060	0.17	2.07	0.61	0.00069	0.00841	0.00247
Dsl - Crawler Tractors/Dozers	2270002069	0.79	9.56	3.18	0.00320	0.03886	0.01294
Dsl - Other Const. Equipment	2270002081	0.39	4.44	1.59	0.00159	0.01806	0.00648
TOTAL		**2.87**	**42.81**	**13.93**	**0.01168**	**0.17399**	**0.05663**

Recreational Boating

2-Str Outboard	2282005010	57.36	1.68	138.25	0.13033	0.00367	0.30325
2-Str Personal Water Craft	2282005015	12.93	0.32	30.57	0.02872	0.00069	0.06705
4-Str Inboard/Sterndrive	2282010005	5.14	2.52	60.22	0.01297	0.00507	0.13505
Dsl - Inboard	2282020005	0.16	4.23	0.67	0.00035	0.00928	0.00147
Dsl - Outboards	2282020010	0.00	0.01	0.01	0.00001	0.00003	0.00002
TOTAL		**75.59**	**8.75**	**229.72**	**0.17237**	**0.01875**	**0.50684**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	163.36	0.39	156.21	0.50988	0.00123	0.48778
2-Str ATVs	2260001030	205.29	0.50	196.59	0.64070	0.00155	0.61388
2-Str Specialty Vehicles / Carts	2260001060	1.80	0.41	82.74	0.00549	0.00127	0.25836
4-Str Offroad Motorcycles	2265001010	4.62	0.56	69.13	0.01417	0.00161	0.22069
BEXAR COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Bexar County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	44.09	5.35	658.38	0.13539	0.01535	2.10185
4-Str Golf Carts	2265001050	10.52	3.45	945.79	0.03246	0.00989	3.01942
4-Str Specialty Vehicles / Carts	2265001060	2.05	0.44	70.47	0.00630	0.00126	0.22496
LPG - Specialty Vehicles / Carts	2267001060	0.04	0.16	0.67	0.00014	0.00050	0.00209
Dsl - Specialty Vehicle Carts	2270001060	0.64	1.86	2.52	0.00199	0.00580	0.00786
TOTAL		**432.40**	**13.11**	**2,182.48**	**1.34651**	**0.03845**	**6.93689**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	2.11	0.01	5.31	0.00004	0.00004	0.01510
2-Str Chain Saws < 6 HP (Res)	2260004020	191.62	1.44	469.09	0.40049	0.00302	0.98331
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	297.59	2.48	775.42	0.83619	0.00706	2.20633
2-Str Leafblowers/Vacuums (Res)	2260004030	78.81	0.64	206.64	0.21681	0.00182	0.58797
4-Str Lawn Mowers (Res)	2265004010	380.98	27.26	5,049.73	1.06131	0.07757	14.36813
4-Str Rotary Tillers <6 HP (Res)	2265004015	9.23	0.63	115.04	0.02585	0.00178	0.32732
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	5.37	0.34	64.22	0.01510	0.00098	0.18274
4-Str Leafblowers/Vacuums (Res)	2265004030	3.97	0.27	50.24	0.01090	0.00077	0.14294
4-Str Rear Engine Riding Mower (Res)	2265004040	54.94	10.53	2,233.48	0.14322	0.02996	6.35500
4-Str Lawn & Garden Tractors (Res)	2265004055	257.73	72.67	13,571.47	0.73247	0.19149	39.80407
4-Str Other Lawn & Garden Equip. (Res)	2265004075	19.23	2.50	429.11	0.05457	0.00659	1.25854
TOTAL		**1,301.60**	**118.78**	**22,969.74**	**3.49695**	**0.32108**	**66.23144**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.98	0.01	2.74	0.00500	0.00004	0.01400
2-Str Chain Saws < 6 HP (Com)	2260004021	584.80	6.80	1,879.69	2.20181	0.02558	7.07573
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	117.59	1.74	418.73	0.60027	0.00891	2.13953
2-Str Leafblowers/Vacuums (Com)	2260004031	176.66	2.57	631.34	0.90149	0.01314	3.22585
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	1.13	7.73	1,362.83	0.00569	0.03628	7.11903
4-Str Rotary Tillers <6 HP (Com)	2265004016	4.29	0.38	63.40	0.02171	0.00177	0.33117
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	2.80	0.27	53.64	0.01422	0.00128	0.28020
4-Str Leafblowers/Vacuums (Com)	2265004031	57.49	21.70	2,889.37	0.29160	0.10185	15.09322
4-Str Rear Engine Riding Mower (Com)	2265004041	19.22	6.43	1,419.49	0.09644	0.03016	7.41500
4-Str Front Mowers (Com)	2265004046	21.72	6.16	1,080.87	0.10732	0.02891	5.64614
4-Str Shredders < 6 HP (Com)	2265004051	20.00	1.76	295.33	0.10088	0.00826	1.54272
4-Str Lawn & Garden Tractors (Com))	2265004056	4.61	1.57	344.70	0.02325	0.00737	1.80059
4-Str Chippers/Stump Grinders (Com)	2265004066	12.61	8.63	736.66	0.06290	0.04051	3.84811
4-Str Commercial Turf Equipment (Com)	2265004071	5.35	1.53	284.43	0.02688	0.00718	1.48576
4-Str Other Lawn & Garden Equip. (Com)	2265004076	24.36	3.21	543.39	0.11539	0.01506	2.83849
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.01	0.01	0.00001	0.00004	0.00003
Dsl - Front Mowers (Com)	2270004046	21.92	127.60	75.00	0.11201	0.65197	0.38324
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.12	0.66	0.39	0.00059	0.00338	0.00200
Dsl - Chippers/Stump Grinders (Com)	2270004066	10.15	85.60	41.12	0.05188	0.43736	0.21010
Dsl - Commercial Turf Equipment (Com)	2270004071	0.01	0.11	0.04	0.00005	0.00056	0.00021
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.04	0.26	0.15	0.00020	0.00131	0.00074
TOTAL		**1,085.84**	**284.72**	**12,123.30**	**4.73959**	**1.42092**	**60.45184**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.94	0.02	3.55	0.00343	0.00006	0.01300
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	4.37	0.07	16.17	0.02170	0.00034	0.08032
2-Str Leafblowers/Vacuums (Com)	2260004031	2.16	0.04	8.96	0.01071	0.00019	0.04451
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.18	0.21	4.58	0.00075	0.00082	0.01960
4-Str Lawn Mowers (Com)	2265004011	0.41	0.04	8.05	0.00200	0.00019	0.04088
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.02	0.00	0.32	0.00011	0.00001	0.00163
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	1.67	0.49	104.17	0.00816	0.00223	0.52894
4-Str Front Mowers (Com)	2265004046	0.47	0.19	22.08	0.00226	0.00086	0.11213
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
BEXAR COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

Non-Road Mobile Source Emissions - Bexar County, 2005

4-Str Lawn & Garden Tractors (Com))	2265004056	0.09	0.03	6.85	0.00044	0.00014	0.03480
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.02	0.01	0.90	0.00010	0.00002	0.00459
4-Str Tillers > 6 HP	2265005040	0.01	0.00	0.35	0.00004	0.00001	0.00154
4-Str Shredders > 6 HP	2265007010	0.04	0.01	1.18	0.00013	0.00002	0.00382
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.20	1.11	0.65	0.00100	0.00550	0.00325
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.03	0.19	0.11	0.00016	0.00094	0.00052
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.01	0.05	0.02	0.00002	0.00026	0.00011
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.34	2.39	2.02	0.00107	0.00759	0.00640
TOTAL		**10.96**	**4.84**	**179.98**	**0.05209**	**0.01917**	**0.89604**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.04	0.00	0.13	0.00023	0.00000	0.00065
2-Str Chain Saws < 6 HP (Com)	2260004021	1.34	0.02	5.13	0.00511	0.00009	0.01950
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	43.21	0.67	159.75	0.22263	0.00346	0.82395
2-Str Leafblowers/Vacuums (Com)	2260004031	7.64	0.13	31.68	0.03931	0.00069	0.16338
4-Str Lawn Mowers (Com)	2265004011	8.33	0.72	126.96	0.04254	0.00340	0.66946
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.13	0.01	1.88	0.00065	0.00005	0.00992
4-Str Rear Engine Riding Mower (Com)	2265004041	2.20	0.76	162.37	0.01120	0.00358	0.85614
4-Str Front Mowers (Com)	2265004046	2.36	0.56	103.80	0.01179	0.00264	0.54730
4-Str Lawn & Garden Tractors (Com))	2265004056	15.16	1.31	259.51	0.07715	0.00622	1.36834
4-Str Commercial Turf Equipment (Com)	2265004071	0.32	0.37	8.42	0.00162	0.00176	0.04441
4-Str Shredders > 6 HP	2265007010	1.73	0.31	64.03	0.00652	0.00110	0.24875
Dsl - Front Mowers (Com)	2270004046	0.22	1.18	0.71	0.00111	0.00610	0.00368
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.54	3.27	1.91	0.00280	0.01685	0.00983
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.05	0.26	0.16	0.00025	0.00135	0.00081
Dsl - Commercial Turf Equipment (Com)	2270004071	0.02	0.20	0.10	0.00013	0.00104	0.00052
Dsl - Shredders > 6 HP	2270007010	0.23	1.41	1.42	0.00089	0.00535	0.00540
TOTAL		**83.54**	**11.19**	**927.95**	**0.42393**	**0.05369**	**4.77204**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.48	0.01	1.50	0.00158	0.00002	0.00497
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.36	0.04	8.74	0.01059	0.00017	0.03932
2-Str Leafblowers/Vacuums (Com)	2260004031	3.55	0.06	14.71	0.01594	0.00028	0.06623
4-Str Lawn Mowers (Com)	2265004011	0.55	0.05	8.20	0.00244	0.00019	0.03772
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.08	0.01	1.11	0.00034	0.00003	0.00512
4-Str Rear Engine Riding Mower (Com)	2265004041	2.09	0.70	154.60	0.00922	0.00289	0.71139
4-Str Front Mowers (Com)	2265004046	13.03	13.55	291.28	0.05647	0.05601	1.34032
4-Str Commercial Turf Equipment (Com)	2265004071	12.27	4.36	1,008.09	0.05421	0.01805	4.63871
Dsl - Front Mowers (Com)	2270004046	1.23	6.73	3.97	0.00553	0.03030	0.01787
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.56	3.37	1.88	0.00254	0.01517	0.00846
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.03	0.34	0.13	0.00015	0.00152	0.00058
TOTAL		**36.22**	**29.21**	**1,494.21**	**0.15900**	**0.12461**	**6.87070**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.12	0.00	0.34	0.00042	0.00000	0.00117
2-Str Chain Saws < 6 HP (Com)	2260004021	23.60	0.27	75.86	0.08944	0.00104	0.28738
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	32.87	0.49	117.05	0.15477	0.00229	0.55083
2-Str Leafblowers/Vacuums (Com)	2260004031	23.17	0.34	82.81	0.10528	0.00153	0.37606
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Lawn Mowers (Com)	2265004011	6.44	0.50	98.52	0.02730	0.00215	0.42130
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.11	0.01	1.59	0.00040	0.00003	0.00604
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.31	0.03	6.08	0.00112	0.00010	0.02206
4-Str Leafblowers/Vacuums (Com)	2265004031	0.37	0.13	19.26	0.00135	0.00047	0.06955
4-Str Rear Engine Riding Mower (Com)	2265004041	2.94	0.90	221.92	0.01426	0.00440	1.08262
4-Str Front Mowers (Com)	2265004046	1.00	0.26	50.97	0.00486	0.00127	0.24863
BEXAR COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	2.32	0.73	177.65	0.01127	0.00355	0.86664

Non-Road Mobile Source Emissions - Bexar County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.41	0.26	24.59	0.00196	0.00124	0.11777
4-Str Commercial Turf Equipment (Com)	2265004071	2.46	0.65	133.76	0.01069	0.00284	0.58427
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.03	0.00	0.74	0.00015	0.00002	0.00339
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	5.95	1.55	302.59	0.02801	0.00734	1.43267
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.14	0.80	0.47	0.00067	0.00387	0.00229
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.35	2.96	1.42	0.00171	0.01444	0.00694
Dsl - Commercial Turf Equipment (Com)	2270004071	0.11	1.17	0.45	0.00056	0.00572	0.00218
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.07	0.48	0.28	0.00036	0.00235	0.00134
Dsl - Shredders > 6 HP	2270007010	0.05	0.16	0.20	0.00020	0.00060	0.00076
TOTAL		**102.84**	**11.69**	**1,316.54**	**0.45477**	**0.05525**	**6.08390**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.47	0.01	1.52	0.00132	0.00002	0.00423
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.89	0.01	3.17	0.00382	0.00006	0.01360
2-Str Leafblowers/Vacuums (Com)	2260004031	0.32	0.00	1.15	0.00146	0.00002	0.00523
4-Str Lawn Mowers (Com)	2265004011	1.03	0.08	15.69	0.00417	0.00033	0.06431
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.04	0.00	0.84	0.00021	0.00002	0.00411
4-Str Rear Engine Riding Mower (Com)	2265004041	0.01	0.00	0.92	0.00002	0.00001	0.00150
4-Str Front Mowers (Com)	2265004046	0.03	0.01	1.40	0.00013	0.00003	0.00682
4-Str Shredders > 6 HP	2265007010	0.16	0.01	2.39	0.00077	0.00006	0.01165
4-Str Lawn & Garden Tractors (Com)	2265004056	0.06	0.02	4.92	0.00017	0.00005	0.01297
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.01	0.03	0.02	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.51	3.38	1.93	0.00251	0.01648	0.00941
Dsl - Shredders > 6 HP	2270007010	0.07	0.20	0.25	0.00023	0.00067	0.00086
TOTAL		**3.60**	**3.76**	**34.19**	**0.01480**	**0.01775**	**0.13469**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.12	0.00001	0.00001	0.00031
4-Str Tractor - Hay	2265005015	0.00	0.00	0.17	0.00000	0.00000	0.00013
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.06	0.00001	0.00002	0.00057
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.05	0.00001	0.00001	0.00037
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.01	0.00000	0.00000	0.00006
Dsl - Tractor - Corn	2270005015	0.44	3.99	2.22	0.00118	0.01026	0.00570
Dsl - Tractor - Hay	2270005015	0.61	5.61	3.12	0.00049	0.00423	0.00235
Dsl - Tractor - Peanuts	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Small Grains	2270005015	0.23	2.10	1.17	0.00217	0.01885	0.01048
Dsl - Tractor - Sorghum	2270005015	0.16	1.49	0.83	0.00142	0.01232	0.00685
Dsl - Tractor - Cotton	2270005015	0.04	0.39	0.22	0.00025	0.00216	0.00120
Dsl - Combine - Corn	2270005020	0.31	3.38	1.19	0.00179	0.01855	0.00654
Dsl - Combine - Hay	2270005020	0.18	1.93	0.68	0.00103	0.01061	0.00374
Dsl - Combine - Peanuts	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Small Grains	2270005020	0.39	4.24	1.49	0.00225	0.02329	0.00821
Dsl - Combine - Sorghum	2270005020	0.28	3.00	1.06	0.00160	0.01649	0.00581
Dsl - Combine - Cotton	2270005020	0.04	0.49	0.17	0.00026	0.00268	0.00094
2-Str Sprayers	2260005035	0.14	0.00	0.39	0.00060	0.00001	0.00168
4-Str Balers	2265005025	0.12	0.09	1.74	0.00043	0.00034	0.00764
4-Str Agricultural Mowers	2265005030	0.04	0.01	1.58	0.00016	0.00003	0.00694
4-Str Sprayers	2265005035	0.63	0.14	13.13	0.00254	0.00057	0.05776
4-Str Tillers > 6 HP	2265005040	1.27	0.15	32.73	0.00527	0.00058	0.14398
4-Str Swathers	2265005045	0.16	0.14	2.75	0.00062	0.00053	0.01211
4-Str Other Agriculture Equipment	2265005055	0.23	0.16	5.88	0.00094	0.00064	0.02588
4-Str Irrigation Sets	2265005060	0.20	0.20	4.82	0.00085	0.00079	0.02119
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.01	0.00000	0.00001	0.00005
LPG - Irrigation Sets	2267005060	0.00	0.00	0.01	0.00000	0.00001	0.00003
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.01	0.00000	0.00001	0.00005
CNG - Irrigation Sets	2268005060	0.00	0.11	0.49	0.00001	0.00047	0.00209
Dsl - Balers	2270005025	0.01	0.05	0.03	0.00004	0.00021	0.00015
Dsl - Agricultural Mowers	2270005030	0.00	0.01	0.01	0.00001	0.00004	0.00003
BEXAR COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.13	0.80	0.44	0.00056	0.00344	0.00191

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Swathers	2270005045	0.09	0.77	0.42	0.00038	0.00333	0.00182
Dsl - Other Agriculture Equipment	2270005055	0.27	2.23	1.22	0.00116	0.00961	0.00524
Dsl - Irrigation Sets	2270005060	0.16	1.42	0.56	0.00070	0.00613	0.00239
TOTAL		**6.15**	**32.92**	**78.77**	**0.02675**	**0.14625**	**0.34420**
TOTAL NONROAD SOURCES		4,676.65	6,433.23	70,130.18	16.61046	23.44549	261.25657

Non-Road Mobile Source Emissions - Comal County, 2005

COMAL COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Construction Equipment							
2-Str Tampers/Rammers	2260002006	4.75	0.06	14.15	0.01985	0.00024	0.05926
2-Str Plate Compactors	2260002009	0.14	0.00	0.50	0.00056	0.00001	0.00210
2-Str Paving Equipment	2260002021	0.15	0.00	0.60	0.00063	0.00001	0.00249
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00002
2-Str Concrete/Industrial Saws	2260002039	9.72	0.12	34.66	0.04065	0.00052	0.14521
2-Str Crushing/Proc. Equipment	2260002054	0.02	0.00	0.11	0.00009	0.00000	0.00047
4-Str Pavers	2265002003	0.29	0.10	13.59	0.00119	0.00038	0.05822
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.11	0.00001	0.00000	0.00046
4-Str Plate Compactors	2265002009	1.29	0.13	24.81	0.00532	0.00051	0.10624
4-Str Rollers	2265002015	0.41	0.16	25.40	0.00166	0.00063	0.10878
4-Str Paving Equipment	2265002021	1.59	0.27	48.85	0.00643	0.00102	0.20920
4-Str Surfacing Equipment	2265002024	0.56	0.10	22.39	0.00228	0.00040	0.09587
4-Str Signal Boards/Light Plants	2265002027	0.04	0.01	1.14	0.00017	0.00002	0.00486
4-Str Trenchers	2265002030	1.10	0.31	41.42	0.00451	0.00118	0.17737
4-Str Bore/Drill Rigs	2265002033	0.73	0.11	11.92	0.00297	0.00042	0.05107
4-Str Concrete/Industrial Saws	2265002039	1.44	0.49	103.12	0.00590	0.00187	0.44160
4-Str Cement & Mortar Mixers	2265002042	1.76	0.24	41.51	0.00698	0.00091	0.17777
4-Str Cranes	2265002045	0.06	0.05	1.61	0.00023	0.00021	0.00691
4-Str Crushing/Proc. Equipment	2265002054	0.15	0.03	6.07	0.00059	0.00013	0.02600
4-Str Rough Terrain Forklift	2265002057	0.08	0.09	1.98	0.00034	0.00035	0.00849
4-Str Rubber Tire Loaders	2265002060	0.19	0.21	4.55	0.00078	0.00082	0.01947
4-Str Tractors/Loaders/Backhoes	2265002066	0.49	0.16	32.72	0.00202	0.00060	0.14014
4-Str Skid Steer Loaders	2265002072	0.38	0.24	13.96	0.00152	0.00091	0.05977
4-Str Dumpers/Tenders	2265002078	0.25	0.04	6.47	0.00100	0.00015	0.02771
4-Str Other Construction Equipment	2265002081	0.08	0.08	1.72	0.00031	0.00031	0.00736
LPG - Pavers	2267002003	0.02	0.07	0.32	0.00008	0.00028	0.00133
LPG - Rollers	2267002015	0.03	0.11	0.54	0.00012	0.00044	0.00224
LPG - Paving Equipment	2267002021	0.01	0.02	0.08	0.00002	0.00008	0.00035
LPG - Surfacing Equipment	2267002024	0.00	0.01	0.06	0.00001	0.00005	0.00023
LPG - Trenchers	2267002030	0.06	0.21	0.97	0.00024	0.00087	0.00407
LPG - Bore/Drill Rigs	2267002033	0.02	0.08	0.32	0.00009	0.00032	0.00133
LPG - Concrete/Industrial Saws	2267002039	0.05	0.17	0.92	0.00020	0.00070	0.00387
LPG - Cranes	2267002045	0.02	0.08	0.34	0.00009	0.00033	0.00143
LPG - Rough Terrain Forklifts	2267002057	0.04	0.14	0.62	0.00016	0.00057	0.00259
LPG - Rubber Tire Loaders	2267002060	0.09	0.32	1.54	0.00038	0.00135	0.00645
LPG - Tractors/Loaders/Backhoes	2267002066	0.01	0.03	0.16	0.00004	0.00014	0.00068
LPG - Skid Steer Loaders	2267002072	0.08	0.28	1.27	0.00033	0.00119	0.00531
LPG - Other Construction Equipment	2267002081	0.03	0.12	0.51	0.00013	0.00049	0.00214
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.02	0.00000	0.00002	0.00008
Dsl - Pavers	2270002003	0.30	3.56	1.38	0.00134	0.01611	0.00623
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.81	8.58	3.86	0.00365	0.03882	0.01745
Dsl - Scrapers	2270002018	0.10	1.28	0.48	0.00045	0.00578	0.00219
Dsl - Paving Equipment	2270002021	0.23	2.38	1.37	0.00103	0.01079	0.00619
Dsl - Surfacing Equipment	2270002024	0.69	8.87	4.41	0.00313	0.04015	0.01993
Dsl - Signal Boards/Light Plants	2270002027	0.31	1.77	1.04	0.00129	0.00742	0.00437
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00001	0.00001
Dsl - Bore/Drill Rigs	2270002033	0.00	0.02	0.01	0.00001	0.00010	0.00003
Dsl - Excavators	2270002036	2.27	32.89	12.54	0.01026	0.14878	0.05671
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00001	0.00001
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.01	0.00	0.00000	0.00005	0.00002
Dsl - Cranes	2270002045	0.03	0.36	0.09	0.00014	0.00163	0.00042
Dsl - Graders	2270002048	0.79	8.31	3.24	0.00357	0.03758	0.01467
Dsl - Off-highway Trucks	2270002051	0.13	2.35	0.88	0.00058	0.01064	0.00400
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.01	0.05	0.05	0.00004	0.00023	0.00022
Dsl - Rubber Tire Loaders	2270002060	1.59	21.33	8.03	0.00718	0.09651	0.03632
Dsl - Tractors/Loaders/Backhoes	2270002066	5.08	19.94	22.16	0.02297	0.09023	0.10026
Dsl - Crawler Tractor/Dozers	2270002069	2.59	32.88	13.16	0.01173	0.14874	0.05952
Dsl - Skid Steer Loaders	2270002072	0.01	0.04	0.05	0.00006	0.00019	0.00022

Non-Road Mobile Source Emissions - Comal County, 2005

COMAL COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - Off-Highway Tractors	2270002075	0.27	2.64	1.42	0.00121	0.01194	0.00641
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**41.31**	**151.91**	**535.19**	**0.17656**	**0.68414**	**2.30415**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.77	0.01	2.81	0.00277	0.00004	0.01013
2-Str Pumps	2260006010	2.30	0.04	9.40	0.00828	0.00016	0.03384
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00001
2-Str Hydro Power Units	2260006035	0.01	0.00	0.06	0.00004	0.00000	0.00021
4-Str Generator Sets	2265006005	18.79	6.08	537.48	0.06648	0.02010	1.97814
4-Str Pumps	2265006010	7.46	0.77	154.44	0.02669	0.00255	0.56840
4-Str Air Compressors	2265006015	2.62	0.91	62.38	0.00931	0.00302	0.22959
4-Str Welders	2265006025	2.68	0.68	151.60	0.00963	0.00224	0.55794
4-Str Pressure Washers	2265006030	11.79	1.67	322.83	0.04227	0.00553	1.18815
4-Str Hydro Power Units	2265006035	0.34	0.07	14.37	0.00123	0.00022	0.05290
LPG - Generator Sets	2267006005	0.42	2.07	6.17	0.00152	0.00747	0.02221
LPG - Pumps	2267006010	0.09	0.46	1.45	0.00034	0.00166	0.00523
LPG - Air Compressors	2267006015	0.11	0.54	1.76	0.00040	0.00193	0.00634
LPG - Welders	2267006025	0.19	0.69	3.18	0.00068	0.00248	0.01146
LPG - Pressure Washers	2267006030	0.00	0.01	0.04	0.00001	0.00003	0.00015
LPG - Hydro Power Units	2267006035	0.00	0.01	0.03	0.00001	0.00003	0.00010
CNG - Generator Sets	2268006005	0.01	0.65	1.92	0.00003	0.00235	0.00692
CNG - Pumps	2268006010	0.00	0.03	0.10	0.00000	0.00012	0.00035
CNG - Air Compressors	2268006015	0.00	0.04	0.14	0.00000	0.00016	0.00050
CNG - Gas Compressors	2268006020	0.01	0.56	7.45	0.00004	0.00201	0.02683
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	4.91	55.43	20.92	0.01767	0.19953	0.07532
Dsl - Pumps	2270006010	1.19	13.20	5.07	0.00428	0.04752	0.01826
Dsl - Air Compressors	2270006015	0.67	7.36	2.39	0.00242	0.02649	0.00860
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.87	2.12	3.12	0.00313	0.00762	0.01121
Dsl - Pressure Washers	2270006030	0.04	0.30	0.14	0.00015	0.00108	0.00049
Dsl - Hydro Power Units	2270006035	0.03	0.23	0.11	0.00010	0.00082	0.00038
TOTAL		**55.32**	**93.93**	**1,309.38**	**0.19746**	**0.33515**	**4.81368**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.02	0.00	0.08	0.00006	0.00000	0.00029
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.01	0.00000	0.00000	0.00002
4-Str Aerial Lifts	2265003010	0.29	0.07	13.64	0.00105	0.00024	0.05173
4-Str Forklifts	2265003020	0.59	0.66	14.13	0.00217	0.00224	0.05360
4-Str Sweepers/Scrubbers	2265003030	0.46	0.43	15.96	0.00169	0.00146	0.06053
4-Str Other General Industrial Eqp	2265003040	1.10	0.17	27.93	0.00405	0.00057	0.10593
4-Str Other Material Handling Eqp	2265003050	0.02	0.02	0.86	0.00009	0.00006	0.00326
4-Str AC\Refrigeration	2265003060	0.02	0.00	0.90	0.00005	0.00001	0.00251
4-Str Terminal Tractors	2265003070	0.08	0.09	2.08	0.00030	0.00032	0.00787
LPG - Aerial Lifts	2267003010	0.14	0.53	2.32	0.00053	0.00196	0.00859
LPG - Forklifts	2267003020	11.59	41.79	199.44	0.04299	0.15501	0.73983
LPG - Sweepers/Scrubbers	2267003030	0.09	0.32	1.67	0.00033	0.00119	0.00620
LPG - Other General Industrial Equipment	2267003040	0.03	0.10	0.51	0.00011	0.00038	0.00190
LPG - Other Material Handling Equipment	2267003050	0.01	0.03	0.13	0.00003	0.00011	0.00046
LPG - Terminal Tractors	2267003070	0.05	0.18	1.01	0.00019	0.00068	0.00376
CNG - Forklifts	2268003020	0.05	3.30	15.73	0.00020	0.01225	0.05836
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.02	0.00000	0.00001	0.00007
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.01	0.00000	0.00001	0.00004
CNG - AC\Refrigeration	2268003060	0.00	0.01	0.05	0.00000	0.00002	0.00012
CNG - Terminal Tractors	2268003070	0.00	0.01	0.07	0.00000	0.00005	0.00027
Dsl - Aerial Lifts	2270003010	0.16	0.57	0.59	0.00061	0.00210	0.00220
Dsl - Forklifts	2270003020	0.21	2.19	1.39	0.00077	0.00812	0.00516
Dsl - Sweepers/Scrubbers	2270003030	0.26	2.97	0.90	0.00095	0.01101	0.00335
Dsl - Other General Industrial Eqp	2270003040	0.30	3.43	1.06	0.00111	0.01271	0.00392
Dsl - Other Material Handling Eqp	2270003050	0.03	0.16	0.11	0.00011	0.00060	0.00039

Non-Road Mobile Source Emissions - Comal County, 2005

COMAL COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Dsl - AC\Refrigertion	2270003060	1.29	11.93	5.67	0.00351	0.03243	0.01541
Dsl - Terminal Tractors	2270003070	0.40	7.43	2.77	0.00147	0.02754	0.01027
TOTAL		**17.20**	**76.39**	**309.03**	**0.06238**	**0.27109**	**1.14606**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.16	0.83	0.68	0.00055	0.00285	0.00233
4-Str Railway Maintenance	2285004015	0.04	0.01	1.95	0.00013	0.00003	0.00683
LPG - Railway Maintenance	2285006015	0.00	0.00	0.01	0.00000	0.00001	0.00003
Line-haul Locomotive	2285002006	16.19	410.94	63.20	0.04436	1.12588	0.17315
Switch Locomotive	2285002010	2.94	46.83	5.06	0.00806	0.12830	0.01387
TOTAL		**19.33**	**458.62**	**70.90**	**0.05309**	**1.25707**	**0.19621**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.69	11.50	4.76	0.00238	0.03971	0.01644
Dsl - Excavators	2270002036	1.86	25.05	8.72	0.00643	0.08652	0.03010
Dsl - Graders	2270002048	0.15	2.02	0.62	0.00052	0.00698	0.00215
Dsl - Off Highway Trucks	2270002051	8.76	149.93	48.52	0.03025	0.51776	0.16757
Dsl - Rubber Tire Loaders	2270002060	9.14	122.09	50.25	0.03156	0.42163	0.17352
Dsl - Tractors/Loaders/Backhoes	2270002066	1.36	6.03	5.65	0.00470	0.02082	0.01951
Dsl - Crawler Tractors/Dozers	2270002069	1.06	15.03	5.89	0.00368	0.05191	0.02034
TOTAL		**23.02**	**331.66**	**124.40**	**0.07950**	**1.14534**	**0.42961**

Landfill Equipment

Dsl - Pavers	2270002003	0.24	4.71	1.56	0.00098	0.01915	0.00636
Dsl - Scrapers	2270002018	0.16	2.80	0.91	0.00065	0.01139	0.00368
Dsl - Excavators	2270002036	0.01	0.18	0.05	0.00006	0.00073	0.00021
Dsl - Graders	2270002048	0.04	0.49	0.14	0.00015	0.00201	0.00055
Dsl - Off Highway Trucks	2270002051	0.05	0.72	0.19	0.00022	0.00294	0.00078
Dsl - Rubber Tire Loaders	2270002060	0.06	0.69	0.20	0.00023	0.00280	0.00082
Dsl - Crawler Tractors/Dozers	2270002069	0.26	3.19	1.06	0.00107	0.01295	0.00431
Dsl - Other Const. Equipment	2270002081	0.13	1.48	0.53	0.00053	0.00602	0.00216
TOTAL		**0.96**	**14.27**	**4.64**	**0.00389**	**0.05800**	**0.01888**

Recreational Boating

2-Str Outboard	2282005010	116.70	3.41	281.26	0.26515	0.00748	0.61695
2-Str Personal Water Craft	2282005015	26.31	0.64	62.19	0.05842	0.00141	0.13642
4-Str Inboard/Sterndrive	2282010005	10.45	5.12	122.52	0.02638	0.01032	0.27476
Dsl - Inboard	2282020005	0.32	8.61	1.36	0.00070	0.01888	0.00298
Dsl - Outboards	2282020010	0.01	0.03	0.02	0.00001	0.00006	0.00004
TOTAL		**153.78**	**17.81**	**467.36**	**0.35067**	**0.03814**	**1.03115**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	224.62	0.54	214.78	0.70108	0.00169	0.67070
2-Str ATVs	2260001030	282.27	0.68	270.31	0.88096	0.00213	0.84409
2-Str Specialty Vehicles / Carts	2260001060	2.47	0.56	113.76	0.00755	0.00175	0.35525
4-Str Offroad Motorcycles	2265001010	6.35	0.77	95.05	0.01948	0.00221	0.30345
COMAL COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Comal County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	60.63	7.36	905.27	0.18617	0.02110	2.89004
4-Str Golf Carts	2265001050	1.50	0.49	135.11	0.00464	0.00141	0.43135
4-Str Specialty Vehicles / Carts	2265001060	2.81	0.60	96.89	0.00866	0.00173	0.30932
LPG - Specialty Vehicles / Carts	2267001060	0.06	0.22	0.92	0.00019	0.00068	0.00288
Dsl - Specialty Vehicle Carts	2270001060	0.88	2.56	3.46	0.00273	0.00798	0.01080
TOTAL		**581.58**	**13.78**	**1,835.56**	**1.81145**	**0.04068**	**5.81787**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	1.28	0.01	3.22	0.00361	0.00002	0.00916
2-Str Chain Saws < 6 HP (Res)	2260004020	28.47	0.21	69.69	0.05950	0.00045	0.14609
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	43.00	0.36	112.06	0.12084	0.00102	0.31884
2-Str Leafblowers/Vacuums (Res)	2260004030	5.94	0.05	15.58	0.01635	0.00014	0.04434
4-Str Lawn Mowers (Res)	2265004010	23.02	1.65	305.07	0.06412	0.00469	0.86802
4-Str Rotary Tillers <6 HP (Res)	2265004015	5.60	0.38	69.78	0.01568	0.00108	0.19855
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.78	0.05	9.28	0.00218	0.00014	0.02641
4-Str Leafblowers/Vacuums (Res)	2265004030	0.30	0.02	3.79	0.00082	0.00006	0.01078
4-Str Rear Engine Riding Mower (Res)	2265004040	27.18	5.21	1,104.84	0.07084	0.01482	3.14362
4-Str Lawn & Garden Tractors (Res)	2265004055	17.40	4.91	916.08	0.04944	0.01293	2.68680
4-Str Other Lawn & Garden Equip. (Res)	2265004075	1.30	0.17	28.97	0.00368	0.00044	0.08495
TOTAL		**154.26**	**13.01**	**2,638.35**	**0.40707**	**0.03579**	**7.53755**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.02	0.00	0.06	0.00011	0.00000	0.00030
2-Str Chain Saws < 6 HP (Com)	2260004021	12.72	0.15	40.89	0.04789	0.00056	0.15391
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.56	0.04	9.11	0.01306	0.00019	0.04654
2-Str Leafblowers/Vacuums (Com)	2260004031	3.84	0.06	13.73	0.01961	0.00029	0.07017
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.02	0.17	29.64	0.00012	0.00079	0.15485
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.09	0.01	1.38	0.00047	0.00004	0.00720
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.06	0.01	1.17	0.00031	0.00003	0.00609
4-Str Leafblowers/Vacuums (Com)	2265004031	1.25	0.47	62.85	0.00634	0.00222	0.32831
4-Str Rear Engine Riding Mower (Com)	2265004041	0.42	0.14	30.88	0.00210	0.00066	0.16129
4-Str Front Mowers (Com)	2265004046	0.47	0.13	23.51	0.00233	0.00063	0.12281
4-Str Shredders < 6 HP (Com)	2265004051	0.43	0.04	6.42	0.00219	0.00018	0.03356
4-Str Lawn & Garden Tractors (Com)	2265004056	0.10	0.03	7.50	0.00051	0.00016	0.03917
4-Str Chippers/Stump Grinders (Com)	2265004066	0.27	0.19	16.02	0.00137	0.00088	0.08370
4-Str Commercial Turf Equipment (Com)	2265004071	0.12	0.03	6.19	0.00058	0.00016	0.03232
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.53	0.07	11.82	0.00251	0.00033	0.06174
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.48	2.78	1.63	0.00244	0.01418	0.00834
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.01	0.01	0.00001	0.00007	0.00004
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.22	1.86	0.89	0.00113	0.00951	0.00457
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.01	0.00	0.00000	0.00003	0.00002
TOTAL		**23.62**	**6.19**	**263.70**	**0.10310**	**0.03091**	**1.31494**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
COMAL COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

Non-Road Mobile Source Emissions - Comal County, 2005

4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00002	0.00000	0.00005
2-Str Chain Saws < 6 HP (Com)	2260004021	0.11	0.00	0.41	0.00041	0.00001	0.00156
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	3.46	0.05	12.80	0.01783	0.00028	0.06600
2-Str Leafblowers/Vacuums (Com)	2260004031	0.61	0.01	2.54	0.00315	0.00006	0.01309
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00341	0.00027	0.05362
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.67	0.06	10.17	0.00005	0.00000	0.00079
4-Str Rear Engine Riding Mower (Com)	2265004041	0.01	0.00	0.15	0.00090	0.00029	0.06857
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00094	0.00021	0.04384
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00618	0.00050	0.10960
4-Str Commercial Turf Equipment (Com)	2265004071	0.18	0.06	13.01	0.00013	0.00014	0.00356
4-Str Shredders > 6 HP	2265007010	0.19	0.04	8.31	0.00052	0.00009	0.01992
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00009	0.00049	0.00029
Dsl - Lawn & Garden Tractors (Com)	2270004056	1.21	0.11	20.79	0.00022	0.00135	0.00079
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00002	0.00011	0.00006
Dsl - Commercial Turf Equipment (Com)	2270004071	0.03	0.03	0.67	0.00001	0.00008	0.00004
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00007	0.00043	0.00043
TOTAL		**6.47**	**0.36**	**68.85**	**0.03396**	**0.00430**	**0.38223**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.06	0.00	0.19	0.00020	0.00000	0.00062
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.30	0.00	1.10	0.00133	0.00002	0.00493
2-Str Leafblowers/Vacuums (Com)	2260004031	0.45	0.01	1.85	0.00200	0.00003	0.00831
4-Str Lawn Mowers (Com)	2265004011	0.07	0.01	1.03	0.00031	0.00002	0.00473
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.01	0.00	0.14	0.00004	0.00000	0.00064
4-Str Rear Engine Riding Mower (Com)	2265004041	0.26	0.09	19.39	0.00116	0.00036	0.08921
4-Str Front Mowers (Com)	2265004046	1.63	1.70	36.53	0.00708	0.00702	0.16808
4-Str Commercial Turf Equipment (Com)	2265004071	1.54	0.55	126.41	0.00680	0.00226	0.58169
Dsl - Front Mowers (Com)	2270004046	0.15	0.84	0.50	0.00069	0.00380	0.00224
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.07	0.42	0.24	0.00032	0.00190	0.00106
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.04	0.02	0.00002	0.00019	0.00007
TOTAL		**4.54**	**3.66**	**187.37**	**0.01994**	**0.01563**	**0.86158**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	1.94	0.02	6.25	0.00694	0.00008	0.02231
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	1.05	0.02	3.72	0.00510	0.00008	0.01816
2-Str Leafblowers/Vacuums (Com)	2260004031	3.59	0.05	12.81	0.01261	0.00018	0.04505
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.23	0.02	3.50	0.00110	0.00009	0.01697
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.01	0.00	0.27	0.00007	0.00001	0.00133
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.03	0.01	2.56	0.00016	0.00005	0.01250
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
COMAL COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	0.21	0.07	15.92	0.00082	0.00026	0.06344

Non-Road Mobile Source Emissions - Comal County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.03	0.02	1.96	0.00016	0.00010	0.00954
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.08	0.00002	0.00000	0.00040
4-Str Water Pumps	2265006010	0.05	0.01	1.45	0.00020	0.00003	0.00558
Dsl - Front Mowers (Com)	2270004046	0.02	0.00	0.83	0.00008	0.00002	0.00403
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.02	0.01	0.00002	0.00009	0.00005
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.01	0.01	0.00001	0.00006	0.00003
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**7.17**	**0.25**	**49.37**	**0.02729**	**0.00105**	**0.19939**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.06	0.00	0.96	0.00030	0.00002	0.00471
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.06**	**0.00**	**0.96**	**0.00030**	**0.00002**	**0.00471**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.02	0.00000	0.00000	0.00004
4-Str Tractor - Hay	2265005015	0.00	0.00	0.05	0.00000	0.00000	0.00003
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.01	0.00000	0.00000	0.00004
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Corn	2270005015	0.06	0.58	0.32	0.00017	0.00148	0.00082
Dsl - Tractor - Hay	2270005015	0.16	1.50	0.83	0.00013	0.00113	0.00063
Dsl - Tractor - Peanuts	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Small Grains	2270005015	0.00	0.02	0.01	0.00002	0.00017	0.00009
Dsl - Tractor - Sorghum	2270005015	0.04	0.35	0.20	0.00014	0.00123	0.00068
Dsl - Tractor - Cotton	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Corn	2270005020	0.04	0.49	0.17	0.00026	0.00268	0.00094
Dsl - Combine - Hay	2270005020	0.05	0.52	0.18	0.00027	0.00284	0.00100
Dsl - Combine - Peanuts	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Small Grains	2270005020	0.00	0.04	0.01	0.00002	0.00021	0.00007
Dsl - Combine - Sorghum	2270005020	0.03	0.30	0.11	0.00016	0.00165	0.00058
Dsl - Combine - Cotton	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Sprayers	2260005035	0.02	0.00	0.07	0.00010	0.00000	0.00028
4-Str Balers	2265005025	0.02	0.01	0.29	0.00007	0.00006	0.00129
4-Str Agricultural Mowers	2265005030	0.01	0.00	0.27	0.00003	0.00001	0.00117
4-Str Sprayers	2265005035	0.11	0.02	2.21	0.00043	0.00010	0.00973
4-Str Tillers > 6 HP	2265005040	0.21	0.02	5.51	0.00089	0.00010	0.02424
4-Str Swathers	2265005045	0.03	0.02	0.46	0.00010	0.00009	0.00204
4-Str Other Agriculture Equipment	2265005055	0.04	0.03	0.99	0.00016	0.00011	0.00436
4-Str Irrigation Sets	2265005060	0.03	0.03	0.81	0.00014	0.00013	0.00357
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Irrigation Sets	2267005060	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Irrigation Sets	2268005060	0.00	0.02	0.08	0.00000	0.00008	0.00035
Dsl - Balers	2270005025	0.00	0.01	0.01	0.00001	0.00004	0.00003
Dsl - Agricultural Mowers	2270005030	0.00	0.00	0.00	0.00000	0.00001	0.00001
COMAL COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.02	0.13	0.07	0.00009	0.00058	0.00032

Non-Road Mobile Source Emissions - Comal County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Swathers	2270005045	0.01	0.13	0.07	0.00006	0.00056	0.00031
Dsl - Other Agriculture Equipment	2270005055	0.05	0.38	0.20	0.00019	0.00162	0.00088
Dsl - Irrigation Sets	2270005060	0.03	0.24	0.09	0.00012	0.00103	0.00040
TOTAL		**0.97**	**4.85**	**13.06**	**0.00358**	**0.01589**	**0.05394**
TOTAL NONROAD SOURCES		1,089.60	1,186.69	7,878.14	3.33025	3.93318	26.11194

Non-Road Mobile Source Emissions - Frio County, 2005

FRIO COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Construction Equipment							
2-Str Tampers/Rammers	2260002006	0.09	0.00	0.27	0.00039	0.00000	0.00115
2-Str Plate Compactors	2260002009	0.00	0.00	0.01	0.00001	0.00000	0.00004
2-Str Paving Equipment	2260002021	0.00	0.00	0.01	0.00001	0.00000	0.00005
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Concrete/Industrial Saws	2260002039	0.19	0.00	0.67	0.00079	0.00001	0.00281
2-Str Crushing/Proc. Equipment	2260002054	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Pavers	2265002003	0.01	0.00	0.26	0.00002	0.00001	0.00113
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Plate Compactors	2265002009	0.03	0.00	0.48	0.00010	0.00001	0.00206
4-Str Rollers	2265002015	0.01	0.00	0.49	0.00003	0.00001	0.00211
4-Str Paving Equipment	2265002021	0.03	0.01	0.95	0.00013	0.00002	0.00405
4-Str Surfacing Equipment	2265002024	0.01	0.00	0.43	0.00004	0.00001	0.00186
4-Str Signal Boards/Light Plants	2265002027	0.00	0.00	0.02	0.00000	0.00000	0.00009
4-Str Trenchers	2265002030	0.02	0.01	0.80	0.00009	0.00002	0.00344
4-Str Bore/Drill Rigs	2265002033	0.01	0.00	0.23	0.00006	0.00001	0.00099
4-Str Concrete/Industrial Saws	2265002039	0.03	0.01	2.00	0.00012	0.00004	0.00856
4-Str Cement & Mortar Mixers	2265002042	0.03	0.00	0.80	0.00014	0.00002	0.00344
4-Str Cranes	2265002045	0.00	0.00	0.03	0.00000	0.00000	0.00013
4-Str Crushing/Proc. Equipment	2265002054	0.00	0.00	0.12	0.00001	0.00000	0.00050
4-Str Rough Terrain Forklift	2265002057	0.00	0.00	0.04	0.00001	0.00001	0.00016
4-Str Rubber Tire Loaders	2265002060	0.00	0.00	0.09	0.00002	0.00002	0.00038
4-Str Tractors/Loaders/Backhoes	2265002066	0.01	0.00	0.63	0.00004	0.00001	0.00272
4-Str Skid Steer Loaders	2265002072	0.01	0.00	0.27	0.00003	0.00002	0.00116
4-Str Dumpers/Tenders	2265002078	0.00	0.00	0.13	0.00002	0.00000	0.00054
4-Str Other Construction Equipment	2265002081	0.00	0.00	0.03	0.00001	0.00001	0.00014
LPG - Pavers	2267002003	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Rollers	2267002015	0.00	0.00	0.01	0.00000	0.00001	0.00004
LPG - Paving Equipment	2267002021	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Surfacing Equipment	2267002024	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Trenchers	2267002030	0.00	0.00	0.02	0.00000	0.00002	0.00008
LPG - Bore/Drill Rigs	2267002033	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Concrete/Industrial Saws	2267002039	0.00	0.00	0.02	0.00000	0.00001	0.00007
LPG - Cranes	2267002045	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Rough Terrain Forklifts	2267002057	0.00	0.00	0.01	0.00000	0.00001	0.00005
LPG - Rubber Tire Loaders	2267002060	0.00	0.01	0.03	0.00001	0.00003	0.00012
LPG - Tractors/Loaders/Backhoes	2267002066	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Skid Steer Loaders	2267002072	0.00	0.01	0.02	0.00001	0.00002	0.00010
LPG - Other Construction Equipment	2267002081	0.00	0.00	0.01	0.00000	0.00001	0.00004
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Pavers	2270002003	0.03	0.36	0.17	0.00015	0.00163	0.00076
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.10	0.85	0.50	0.00043	0.00384	0.00225
Dsl - Scrapers	2270002018	0.01	0.14	0.05	0.00005	0.00065	0.00025
Dsl - Paving Equipment	2270002021	0.05	0.55	0.30	0.00023	0.00247	0.00134
Dsl - Surfacing Equipment	2270002024	0.09	1.12	0.57	0.00040	0.00506	0.00257
Dsl - Signal Boards/Light Plants	2270002027	0.01	0.03	0.02	0.00003	0.00014	0.00008
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Bore/Drill Rigs	2270002033	0.00	0.00	0.00	0.00000	0.00002	0.00001
Dsl - Excavators	2270002036	0.14	1.92	0.77	0.00062	0.00868	0.00350
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Cranes	2270002045	0.01	0.07	0.02	0.00003	0.00030	0.00008
Dsl - Graders	2270002048	0.16	1.68	0.63	0.00071	0.00761	0.00285
Dsl - Off-highway Trucks	2270002051	0.04	0.82	0.29	0.00020	0.00373	0.00131
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.01	0.01	0.00001	0.00004	0.00004
Dsl - Rubber Tire Loaders	2270002060	0.23	3.09	1.20	0.00103	0.01398	0.00543
Dsl - Tractors/Loaders/Backhoes	2270002066	0.60	2.38	2.64	0.00272	0.01079	0.01195
Dsl - Crawler Tractor/Dozers	2270002069	0.35	4.18	1.78	0.00157	0.01892	0.00806
Dsl - Skid Steer Loaders	2270002072	0.00	0.01	0.01	0.00001	0.00004	0.00004

Non-Road Mobile Source Emissions - Frio County, 2005

FRIO COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - Off-Highway Tractors	2270002075	0.05	0.49	0.26	0.00022	0.00221	0.00118
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**2.37**	**17.80**	**18.15**	**0.01052**	**0.08049**	**0.07986**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.10	0.00	0.36	0.00036	0.00000	0.00131
2-Str Pumps	2260006010	0.30	0.01	1.22	0.00108	0.00002	0.00439
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Hydro Power Units	2260006035	0.00	0.00	0.01	0.00001	0.00000	0.00003
4-Str Generator Sets	2265006005	2.44	0.79	69.67	0.00889	0.00261	0.25643
4-Str Pumps	2265006010	0.97	0.10	20.02	0.00348	0.00033	0.07368
4-Str Air Compressors	2265006015	0.34	0.12	8.09	0.00122	0.00039	0.02976
4-Str Welders	2265006025	0.35	0.09	19.65	0.00126	0.00029	0.07233
4-Str Pressure Washers	2265006030	1.53	0.22	41.85	0.00554	0.00072	0.15402
4-Str Hydro Power Units	2265006035	0.04	0.01	1.86	0.00016	0.00003	0.00686
LPG - Generator Sets	2267006005	0.05	0.27	0.80	0.00020	0.00097	0.00288
LPG - Pumps	2267006010	0.01	0.06	0.19	0.00004	0.00021	0.00068
LPG - Air Compressors	2267006015	0.01	0.07	0.23	0.00005	0.00025	0.00082
LPG - Welders	2267006025	0.02	0.09	0.41	0.00009	0.00032	0.00148
LPG - Pressure Washers	2267006030	0.00	0.00	0.01	0.00000	0.00000	0.00002
LPG - Hydro Power Units	2267006035	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Generator Sets	2268006005	0.00	0.08	0.25	0.00000	0.00031	0.00090
CNG - Pumps	2268006010	0.00	0.00	0.01	0.00000	0.00001	0.00005
CNG - Air Compressors	2268006015	0.00	0.01	0.02	0.00000	0.00002	0.00007
CNG - Gas Compressors	2268006020	0.00	0.07	0.97	0.00001	0.00026	0.00348
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	0.64	7.18	2.71	0.00229	0.02586	0.00976
Dsl - Pumps	2270006010	0.15	1.71	0.66	0.00056	0.00616	0.00237
Dsl - Air Compressors	2270006015	0.09	0.95	0.31	0.00031	0.00343	0.00112
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.11	0.27	0.40	0.00041	0.00099	0.00145
Dsl - Pressure Washers	2270006030	0.01	0.04	0.02	0.00002	0.00014	0.00006
Dsl - Hydro Power Units	2270006035	0.00	0.03	0.01	0.00001	0.00011	0.00005
TOTAL		**7.17**	**12.18**	**169.73**	**0.02599**	**0.04344**	**0.62400**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.00	0.00	0.00	0.00000	0.00000	0.00001
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Aerial Lifts	2265003010	0.01	0.00	0.26	0.00002	0.00000	0.00098
4-Str Forklifts	2265003020	0.01	0.01	0.27	0.00004	0.00004	0.00101
4-Str Sweepers/Scrubbers	2265003030	0.01	0.01	0.30	0.00003	0.00003	0.00115
4-Str Other General Industrial Eqp	2265003040	0.02	0.00	0.53	0.00008	0.00001	0.00201
4-Str Other Material Handling Eqp	2265003050	0.00	0.00	0.02	0.00000	0.00000	0.00006
4-Str AC\Refrigeration	2265003060	0.00	0.00	0.17	0.00001	0.00000	0.00049
4-Str Terminal Tractors	2265003070	0.00	0.00	0.04	0.00001	0.00001	0.00015
LPG - Aerial Lifts	2267003010	0.00	0.01	0.04	0.00001	0.00004	0.00016
LPG - Forklifts	2267003020	0.22	0.79	3.78	0.00081	0.00293	0.01400
LPG - Sweepers/Scrubbers	2267003030	0.00	0.01	0.03	0.00001	0.00002	0.00012
LPG - Other General Industrial Equipment	2267003040	0.00	0.00	0.01	0.00000	0.00001	0.00004
LPG - Other Material Handling Equipment	2267003050	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Terminal Tractors	2267003070	0.00	0.00	0.02	0.00000	0.00001	0.00007
CNG - Forklifts	2268003020	0.00	0.06	0.30	0.00000	0.00023	0.00110
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - AC\Refrigeration	2268003060	0.00	0.00	0.01	0.00000	0.00000	0.00002
CNG - Terminal Tractors	2268003070	0.00	0.00	0.00	0.00000	0.00000	0.00001
Dsl - Aerial Lifts	2270003010	0.00	0.01	0.01	0.00001	0.00004	0.00004
Dsl - Forklifts	2270003020	0.00	0.04	0.03	0.00001	0.00015	0.00010
Dsl - Sweepers/Scrubbers	2270003030	0.00	0.06	0.02	0.00002	0.00021	0.00006
Dsl - Other General Industrial Eqp	2270003040	0.01	0.06	0.02	0.00002	0.00024	0.00007
Dsl - Other Material Handling Eqp	2270003050	0.00	0.00	0.00	0.00000	0.00001	0.00001

Non-Road Mobile Source Emissions - Frio County, 2005

FRIO COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	0.25	2.31	1.10	0.00068	0.00626	0.00298
Dsl - Terminal Tractors	2270003070	0.01	0.14	0.05	0.00003	0.00052	0.00019
TOTAL		**0.55**	**3.53**	**7.00**	**0.00180**	**0.01079**	**0.02484**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.04	0.19	0.15	0.00012	0.00064	0.00052
4-Str Railway Maintenance	2285004015	0.01	0.00	0.44	0.00003	0.00001	0.00153
LPG - Railway Maintenance	2285006015	0.00	0.00	0.00	0.00000	0.00000	0.00001
Line-haul Locomotive	2285002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.04**	**0.19**	**0.59**	**0.00015**	**0.00065**	**0.00207**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractors/Loaders/Backhoes	2270002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Landfill Equipment

Dsl - Pavers	2270002003	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Const. Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Boating

2-Str Outboard	2282005010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Personal Water Craft	2282005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Inboard/Sterndrive	2282010005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Inboard	2282020005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Outboards	2282020010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	20.42	0.05	19.53	0.06388	0.00015	0.06097
2-Str ATVs	2260001030	25.66	0.06	24.57	0.08026	0.00019	0.07674
2-Str Specialty Vehicles / Carts	2260001060	0.22	0.05	10.34	0.00073	0.00016	0.03230
4-Str Offroad Motorcycles	2265001010	0.58	0.07	8.64	0.00183	0.00020	0.02759
FRIO COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Frio County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	5.51	0.67	82.30	0.01749	0.00192	0.26273
4-Str Golf Carts	2265001050	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Specialty Vehicles / Carts	2265001060	0.26	0.05	8.81	0.00080	0.00016	0.02812
LPG - Specialty Vehicles / Carts	2267001060	0.01	0.02	0.08	0.00002	0.00006	0.00026
Dsl - Specialty Vehicle Carts	2270001060	0.08	0.23	0.31	0.00025	0.00073	0.00098
TOTAL		**52.73**	**1.21**	**154.59**	**0.16525**	**0.00357**	**0.48968**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	0.19	0.00	0.47	0.00053	0.00000	0.00134
2-Str Chain Saws < 6 HP (Res)	2260004020	4.15	0.03	10.16	0.00870	0.00007	0.02130
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	6.27	0.05	16.34	0.01784	0.00015	0.04649
2-Str Leafblowers/Vacuums (Res)	2260004030	0.87	0.01	2.27	0.00247	0.00002	0.00647
4-Str Lawn Mowers (Res)	2265004010	3.36	0.24	44.49	0.00955	0.00068	0.12658
4-Str Rotary Tillers <6 HP (Res)	2265004015	0.82	0.06	10.18	0.00232	0.00016	0.02895
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.11	0.01	1.35	0.00032	0.00002	0.00385
4-Str Leafblowers/Vacuums (Res)	2265004030	0.04	0.00	0.55	0.00012	0.00001	0.00157
4-Str Rear Engine Riding Mower (Res)	2265004040	3.96	0.76	161.11	0.01128	0.00216	0.45841
4-Str Lawn & Garden Tractors (Res)	2265004055	3.21	0.91	169.11	0.00964	0.00239	0.49598
4-Str Other Lawn & Garden Equip. (Res)	2265004075	0.24	0.03	5.35	0.00071	0.00008	0.01568
TOTAL		**23.22**	**2.09**	**421.38**	**0.06349**	**0.00574**	**1.20662**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
FRIO COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

Non-Road Mobile Source Emissions - Frio County, 2005

4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00002	0.00000	0.00005
2-Str Chain Saws < 6 HP (Com)	2260004021	0.03	0.00	0.12	0.00041	0.00001	0.00156
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	1.05	0.02	3.88	0.01783	0.00028	0.06600
2-Str Leafblowers/Vacuums (Com)	2260004031	0.19	0.00	0.77	0.00315	0.00006	0.01309
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00341	0.00027	0.05362
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.20	0.02	3.08	0.00005	0.00000	0.00079
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.05	0.00090	0.00029	0.06857
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00094	0.00021	0.04384
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00618	0.00050	0.10960
4-Str Commercial Turf Equipment (Com)	2265004071	0.05	0.02	3.94	0.00013	0.00014	0.00356
4-Str Shredders > 6 HP	2265007010	0.06	0.01	2.52	0.00052	0.00009	0.01992
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00009	0.00049	0.00029
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.37	0.03	6.30	0.00022	0.00135	0.00079
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00002	0.00011	0.00006
Dsl - Commercial Turf Equipment (Com)	2270004071	0.01	0.01	0.20	0.00001	0.00008	0.00004
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00007	0.00043	0.00043
TOTAL		**1.96**	**0.11**	**20.86**	**0.03396**	**0.00430**	**0.38223**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.48	0.01	1.53	0.00183	0.00002	0.00586
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.33	0.03	8.31	0.01141	0.00017	0.04053
2-Str Leafblowers/Vacuums (Com)	2260004031	0.07	0.00	0.23	0.00032	0.00000	0.00114
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.07	0.01	1.05	0.00033	0.00003	0.00512
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.28	0.00002	0.00001	0.00137
4-Str Front Mowers (Com)	2265004046	0.04	0.01	2.15	0.00021	0.00005	0.01050
FRIO COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes		tons/year			tons/day (Mon. - Fri.)	
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000

Non-Road Mobile Source Emissions - Frio County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.24	0.06	13.17	0.00119	0.00031	0.06426
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.03	0.02	0.00002	0.00017	0.00008
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**3.24**	**0.16**	**26.74**	**0.01532**	**0.00076**	**0.12887**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.05	0.00000	0.00000	0.00013
4-Str Tractor - Hay	2265005015	0.00	0.00	0.08	0.00000	0.00000	0.00006
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.13	0.00002	0.00002	0.00071
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.04	0.00001	0.00001	0.00040
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.10	0.00001	0.00001	0.00036
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.05	0.00001	0.00001	0.00019
Dsl - Tractor - Corn	2270005015	0.18	1.68	0.94	0.00050	0.00433	0.00241
Dsl - Tractor - Hay	2270005015	0.28	2.55	1.42	0.00022	0.00192	0.00107
Dsl - Tractor - Peanuts	2270005015	0.47	4.33	2.40	0.00274	0.02377	0.01321
Dsl - Tractor - Small Grains	2270005015	0.16	1.47	0.82	0.00152	0.01318	0.00733
Dsl - Tractor - Sorghum	2270005015	0.37	3.41	1.90	0.00137	0.01186	0.00659
Dsl - Tractor - Cotton	2270005015	0.19	1.73	0.96	0.00075	0.00649	0.00361
Dsl - Combine - Corn	2270005020	0.13	1.43	0.50	0.00076	0.00783	0.00276
Dsl - Combine - Hay	2270005020	0.08	0.88	0.31	0.00047	0.00483	0.00170
Dsl - Combine - Peanuts	2270005020	0.76	8.27	2.91	0.00659	0.06816	0.02402
Dsl - Combine - Small Grains	2270005020	0.27	2.96	1.04	0.00158	0.01628	0.00574
Dsl - Combine - Sorghum	2270005020	0.27	2.89	1.02	0.00154	0.01587	0.00559
Dsl - Combine - Cotton	2270005020	0.13	1.46	0.52	0.00078	0.00804	0.00283
2-Str Sprayers	2260005035	0.09	0.00	0.24	0.00037	0.00000	0.00104
4-Str Balers	2265005025	0.07	0.05	1.07	0.00029	0.00021	0.00471
4-Str Agricultural Mowers	2265005030	0.02	0.01	0.97	0.00010	0.00002	0.00428
4-Str Sprayers	2265005035	0.39	0.09	8.09	0.00161	0.00035	0.03561
4-Str Tillers > 6 HP	2265005040	0.78	0.09	20.18	0.00328	0.00036	0.08877
4-Str Swathers	2265005045	0.10	0.08	1.70	0.00041	0.00033	0.00746
4-Str Other Agriculture Equipment	2265005055	0.14	0.10	3.63	0.00060	0.00039	0.01596
4-Str Irrigation Sets	2265005060	0.13	0.12	2.97	0.00053	0.00049	0.01306
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Irrigation Sets	2267005060	0.00	0.00	0.00	0.00000	0.00000	0.00002
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.01	0.00000	0.00001	0.00003
CNG - Irrigation Sets	2268005060	0.00	0.07	0.30	0.00001	0.00029	0.00129
Dsl - Balers	2270005025	0.01	0.03	0.02	0.00002	0.00013	0.00009
Dsl - Agricultural Mowers	2270005030	0.00	0.01	0.00	0.00000	0.00003	0.00002
FRIO COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.08	0.49	0.27	0.00035	0.00212	0.00118

Non-Road Mobile Source Emissions - Frio County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Swathers	2270005045	0.05	0.48	0.26	0.00024	0.00205	0.00112
Dsl - Other Agriculture Equipment	2270005055	0.17	1.38	0.75	0.00071	0.00593	0.00323
Dsl - Irrigation Sets	2270005060	0.10	0.88	0.34	0.00043	0.00378	0.00147
TOTAL		**5.44**	**36.95**	**56.02**	**0.02780**	**0.19911**	**0.25808**
TOTAL NONROAD SOURCES		96.73	74.21	875.08	0.34428	0.34885	3.19624

Non-Road Mobile Source Emissions - Gillespie County, 2005

GILLESPIE COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Construction Equipment							
2-Str Tampers/Rammers	2260002006	0.36	0.00	1.08	0.00151	0.00002	0.00451
2-Str Plate Compactors	2260002009	0.01	0.00	0.04	0.00004	0.00000	0.00016
2-Str Paving Equipment	2260002021	0.01	0.00	0.05	0.00005	0.00000	0.00019
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Concrete/Industrial Saws	2260002039	0.74	0.01	2.64	0.00310	0.00004	0.01106
2-Str Crushing/Proc. Equipment	2260002054	0.00	0.00	0.01	0.00001	0.00000	0.00004
4-Str Pavers	2265002003	0.02	0.01	1.04	0.00009	0.00003	0.00443
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.01	0.00000	0.00000	0.00004
4-Str Plate Compactors	2265002009	0.10	0.01	1.89	0.00041	0.00004	0.00809
4-Str Rollers	2265002015	0.03	0.01	1.93	0.00013	0.00005	0.00828
4-Str Paving Equipment	2265002021	0.12	0.02	3.72	0.00050	0.00008	0.01593
4-Str Surfacing Equipment	2265002024	0.04	0.01	1.70	0.00018	0.00003	0.00730
4-Str Signal Boards/Light Plants	2265002027	0.00	0.00	0.09	0.00001	0.00000	0.00037
4-Str Trenchers	2265002030	0.08	0.02	3.15	0.00035	0.00009	0.01351
4-Str Bore/Drill Rigs	2265002033	0.06	0.01	0.91	0.00023	0.00003	0.00389
4-Str Concrete/Industrial Saws	2265002039	0.11	0.04	7.85	0.00045	0.00014	0.03363
4-Str Cement & Mortar Mixers	2265002042	0.13	0.02	3.16	0.00055	0.00007	0.01354
4-Str Cranes	2265002045	0.00	0.00	0.12	0.00002	0.00002	0.00053
4-Str Crushing/Proc. Equipment	2265002054	0.01	0.00	0.46	0.00005	0.00001	0.00198
4-Str Rough Terrain Forklift	2265002057	0.01	0.01	0.15	0.00003	0.00003	0.00065
4-Str Rubber Tire Loaders	2265002060	0.01	0.02	0.35	0.00006	0.00006	0.00148
4-Str Tractors/Loaders/Backhoes	2265002066	0.04	0.01	2.49	0.00016	0.00005	0.01067
4-Str Skid Steer Loaders	2265002072	0.03	0.02	1.06	0.00012	0.00007	0.00455
4-Str Dumpers/Tenders	2265002078	0.02	0.00	0.49	0.00008	0.00001	0.00211
4-Str Other Construction Equipment	2265002081	0.01	0.01	0.13	0.00002	0.00002	0.00056
LPG - Pavers	2267002003	0.00	0.01	0.02	0.00001	0.00002	0.00010
LPG - Rollers	2267002015	0.00	0.01	0.04	0.00001	0.00003	0.00017
LPG - Paving Equipment	2267002021	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Surfacing Equipment	2267002024	0.00	0.00	0.00	0.00000	0.00000	0.00002
LPG - Trenchers	2267002030	0.00	0.02	0.07	0.00002	0.00007	0.00031
LPG - Bore/Drill Rigs	2267002033	0.00	0.01	0.02	0.00001	0.00002	0.00010
LPG - Concrete/Industrial Saws	2267002039	0.00	0.01	0.07	0.00002	0.00005	0.00029
LPG - Cranes	2267002045	0.00	0.01	0.03	0.00001	0.00002	0.00011
LPG - Rough Terrain Forklifts	2267002057	0.00	0.01	0.05	0.00001	0.00004	0.00020
LPG - Rubber Tire Loaders	2267002060	0.01	0.02	0.12	0.00003	0.00010	0.00049
LPG - Tractors/Loaders/Backhoes	2267002066	0.00	0.00	0.01	0.00000	0.00001	0.00005
LPG - Skid Steer Loaders	2267002072	0.01	0.02	0.10	0.00002	0.00009	0.00040
LPG - Other Construction Equipment	2267002081	0.00	0.01	0.04	0.00001	0.00004	0.00016
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.00	0.00000	0.00000	0.00001
Dsl - Pavers	2270002003	0.05	0.53	0.23	0.00021	0.00238	0.00104
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.08	0.74	0.44	0.00038	0.00335	0.00197
Dsl - Scrapers	2270002018	0.02	0.30	0.11	0.00011	0.00136	0.00051
Dsl - Paving Equipment	2270002021	0.06	0.59	0.34	0.00025	0.00268	0.00152
Dsl - Surfacing Equipment	2270002024	0.07	0.99	0.49	0.00033	0.00446	0.00221
Dsl - Signal Boards/Light Plants	2270002027	0.02	0.13	0.08	0.00010	0.00057	0.00033
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Bore/Drill Rigs	2270002033	0.00	0.01	0.00	0.00000	0.00002	0.00001
Dsl - Excavators	2270002036	0.21	2.90	1.15	0.00093	0.01312	0.00518
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Cranes	2270002045	0.01	0.09	0.02	0.00003	0.00039	0.00010
Dsl - Graders	2270002048	0.18	1.83	0.72	0.00079	0.00826	0.00324
Dsl - Off-highway Trucks	2270002051	0.04	0.81	0.29	0.00020	0.00366	0.00133
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.01	0.01	0.00001	0.00005	0.00005
Dsl - Rubber Tire Loaders	2270002060	0.21	3.05	1.15	0.00097	0.01382	0.00520
Dsl - Tractors/Loaders/Backhoes	2270002066	1.01	3.96	4.42	0.00458	0.01793	0.01999
Dsl - Crawler Tractor/Dozers	2270002069	0.45	5.74	2.37	0.00204	0.02596	0.01071
Dsl - Skid Steer Loaders	2270002072	0.00	0.01	0.01	0.00001	0.00005	0.00005

Non-Road Mobile Source Emissions - Gillespie County, 2005

GILLESPIE COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - Off-Highway Tractors	2270002075	0.06	0.64	0.34	0.00029	0.00288	0.00154
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**4.48**	**22.68**	**47.27**	**0.01951**	**0.10236**	**0.20495**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.31	0.00	1.12	0.00111	0.00002	0.00403
2-Str Pumps	2260006010	0.92	0.02	3.74	0.00331	0.00006	0.01347
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00001
2-Str Hydro Power Units	2260006035	0.00	0.00	0.02	0.00002	0.00000	0.00008
4-Str Generator Sets	2265006005	7.48	2.42	214.00	0.02731	0.00800	0.78759
4-Str Pumps	2265006010	2.97	0.31	61.49	0.01068	0.00101	0.22631
4-Str Air Compressors	2265006015	1.04	0.36	24.84	0.00374	0.00120	0.09141
4-Str Welders	2265006025	1.07	0.27	60.36	0.00389	0.00089	0.22214
4-Str Pressure Washers	2265006030	4.69	0.67	128.54	0.01703	0.00220	0.47306
4-Str Hydro Power Units	2265006035	0.14	0.03	5.72	0.00049	0.00009	0.02106
LPG - Generator Sets	2267006005	0.17	0.83	2.46	0.00061	0.00297	0.00884
LPG - Pumps	2267006010	0.04	0.18	0.58	0.00014	0.00066	0.00208
LPG - Air Compressors	2267006015	0.04	0.21	0.70	0.00016	0.00077	0.00253
LPG - Welders	2267006025	0.07	0.27	1.27	0.00027	0.00099	0.00456
LPG - Pressure Washers	2267006030	0.00	0.00	0.02	0.00000	0.00001	0.00006
LPG - Hydro Power Units	2267006035	0.00	0.00	0.01	0.00000	0.00001	0.00004
CNG - Generator Sets	2268006005	0.00	0.26	0.77	0.00001	0.00094	0.00276
CNG - Pumps	2268006010	0.00	0.01	0.04	0.00000	0.00005	0.00014
CNG - Air Compressors	2268006015	0.00	0.02	0.06	0.00000	0.00006	0.00020
CNG - Gas Compressors	2268006020	0.00	0.22	2.97	0.00002	0.00080	0.01068
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	1.95	22.07	8.33	0.00703	0.07944	0.02999
Dsl - Pumps	2270006010	0.47	5.26	2.02	0.00170	0.01892	0.00727
Dsl - Air Compressors	2270006015	0.27	2.93	0.95	0.00096	0.01055	0.00343
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.35	0.84	1.24	0.00124	0.00303	0.00447
Dsl - Pressure Washers	2270006030	0.02	0.12	0.05	0.00006	0.00043	0.00020
Dsl - Hydro Power Units	2270006035	0.01	0.09	0.04	0.00004	0.00033	0.00015
TOTAL		**22.02**	**37.40**	**521.33**	**0.07982**	**0.13344**	**1.91656**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.00	0.00	0.01	0.00001	0.00000	0.00005
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Aerial Lifts	2265003010	0.05	0.01	2.20	0.00017	0.00004	0.00835
4-Str Forklifts	2265003020	0.10	0.11	2.28	0.00036	0.00036	0.00865
4-Str Sweepers/Scrubbers	2265003030	0.07	0.07	2.58	0.00028	0.00024	0.00977
4-Str Other General Industrial Eqp	2265003040	0.18	0.03	4.51	0.00066	0.00009	0.01709
4-Str Other Material Handling Eqp	2265003050	0.00	0.00	0.14	0.00001	0.00001	0.00053
4-Str AC\Refrigeration	2265003060	0.00	0.00	0.23	0.00001	0.00000	0.00064
4-Str Terminal Tractors	2265003070	0.01	0.02	0.34	0.00005	0.00005	0.00127
LPG - Aerial Lifts	2267003010	0.02	0.09	0.37	0.00009	0.00032	0.00139
LPG - Forklifts	2267003020	1.87	6.74	32.18	0.00694	0.02501	0.11939
LPG - Sweepers/Scrubbers	2267003030	0.01	0.05	0.27	0.00005	0.00019	0.00100
LPG - Other General Industrial Equipment	2267003040	0.00	0.02	0.08	0.00002	0.00006	0.00031
LPG - Other Material Handling Equipment	2267003050	0.00	0.00	0.02	0.00000	0.00002	0.00008
LPG - Terminal Tractors	2267003070	0.01	0.03	0.16	0.00003	0.00011	0.00061
CNG - Forklifts	2268003020	0.01	0.53	2.54	0.00003	0.00198	0.00942
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - AC\Refrigeration	2268003060	0.00	0.00	0.01	0.00000	0.00001	0.00003
CNG - Terminal Tractors	2268003070	0.00	0.00	0.01	0.00000	0.00001	0.00004
Dsl - Aerial Lifts	2270003010	0.03	0.09	0.10	0.00010	0.00034	0.00035
Dsl - Forklifts	2270003020	0.03	0.35	0.22	0.00012	0.00131	0.00083
Dsl - Sweepers/Scrubbers	2270003030	0.04	0.48	0.15	0.00015	0.00178	0.00054
Dsl - Other General Industrial Eqp	2270003040	0.05	0.55	0.17	0.00018	0.00205	0.00063
Dsl - Other Material Handling Eqp	2270003050	0.00	0.03	0.02	0.00002	0.00010	0.00006

Non-Road Mobile Source Emissions - Gillespie County, 2005

GILLESPIE COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	0.33	3.05	1.45	0.00090	0.00828	0.00394
Dsl - Terminal Tractors	2270003070	0.06	1.20	0.45	0.00024	0.00444	0.00166
TOTAL		**2.90**	**13.45**	**50.49**	**0.01042**	**0.04680**	**0.18664**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Railway Maintenance	2285004015	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Railway Maintenance	2285006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Line-haul Locomotive	2285002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.13	1.78	0.62	0.00046	0.00616	0.00214
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.52	8.82	2.85	0.00178	0.03045	0.00986
Dsl - Rubber Tire Loaders	2270002060	0.41	5.43	2.23	0.00140	0.01874	0.00771
Dsl - Tractors/Loaders/Backhoes	2270002066	0.23	1.03	0.96	0.00080	0.00355	0.00332
Dsl - Crawler Tractors/Dozers	2270002069	0.06	0.81	0.32	0.00020	0.00279	0.00109
TOTAL		**1.34**	**17.86**	**6.99**	**0.00464**	**0.06169**	**0.02413**

Landfill Equipment

Dsl - Pavers	2270002003	0.24	4.71	1.56	0.00098	0.01915	0.00636
Dsl - Scrapers	2270002018	0.16	2.80	0.91	0.00065	0.01139	0.00368
Dsl - Excavators	2270002036	0.01	0.18	0.05	0.00006	0.00073	0.00021
Dsl - Graders	2270002048	0.04	0.49	0.14	0.00015	0.00201	0.00055
Dsl - Off Highway Trucks	2270002051	0.05	0.72	0.19	0.00022	0.00294	0.00078
Dsl - Rubber Tire Loaders	2270002060	0.06	0.69	0.20	0.00023	0.00280	0.00082
Dsl - Crawler Tractors/Dozers	2270002069	0.26	3.19	1.06	0.00107	0.01295	0.00431
Dsl - Other Const. Equipment	2270002081	0.13	1.48	0.53	0.00053	0.00602	0.00216
TOTAL		**0.96**	**14.27**	**4.64**	**0.00389**	**0.05800**	**0.01888**

Recreational Boating

2-Str Outboard	2282005010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Personal Water Craft	2282005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Inboard/Sterndrive	2282010005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Inboard	2282020005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Outboards	2282020010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	40.84	0.10	39.05	0.12775	0.00031	0.12195
2-Str ATVs	2260001030	51.32	0.12	49.15	0.16052	0.00039	0.15347
2-Str Specialty Vehicles / Carts	2260001060	0.45	0.10	20.68	0.00146	0.00032	0.06459
4-Str Offroad Motorcycles	2265001010	1.15	0.14	17.28	0.00366	0.00040	0.05517
GILLESPIE COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Gillespie County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	11.02	1.34	164.59	0.03497	0.00384	0.52546
4-Str Golf Carts	2265001050	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Specialty Vehicles / Carts	2265001060	0.51	0.11	17.62	0.00161	0.00031	0.05624
LPG - Specialty Vehicles / Carts	2267001060	0.01	0.04	0.17	0.00003	0.00012	0.00052
Dsl - Specialty Vehicle Carts	2270001060	0.16	0.46	0.63	0.00050	0.00145	0.00196
TOTAL		**105.47**	**2.42**	**309.17**	**0.33050**	**0.00714**	**0.97937**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	0.34	0.00	0.84	0.00096	0.00001	0.00240
2-Str Chain Saws < 6 HP (Res)	2260004020	7.46	0.06	18.26	0.01563	0.00012	0.03827
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	11.27	0.09	29.36	0.03206	0.00027	0.08353
2-Str Leafblowers/Vacuums (Res)	2260004030	1.56	0.01	4.08	0.00443	0.00004	0.01161
4-Str Lawn Mowers (Res)	2265004010	6.03	0.43	79.92	0.01716	0.00123	0.22740
4-Str Rotary Tillers <6 HP (Res)	2265004015	1.47	0.10	18.28	0.00417	0.00028	0.05201
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.20	0.01	2.43	0.00058	0.00004	0.00692
4-Str Leafblowers/Vacuums (Res)	2265004030	0.08	0.01	0.99	0.00022	0.00002	0.00282
4-Str Rear Engine Riding Mower (Res)	2265004040	7.12	1.36	289.44	0.02026	0.00388	0.82355
4-Str Lawn & Garden Tractors (Res)	2265004055	5.65	1.59	297.32	0.01695	0.00420	0.87202
4-Str Other Lawn & Garden Equip. (Res)	2265004075	0.42	0.05	9.40	0.00125	0.00014	0.02757
TOTAL		**41.58**	**3.73**	**750.33**	**0.11367**	**0.01021**	**2.14812**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00002	0.00000	0.00007
2-Str Chain Saws < 6 HP (Com)	2260004021	2.92	0.03	9.39	0.01101	0.00013	0.03536
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.59	0.01	2.09	0.00300	0.00004	0.01069
2-Str Leafblowers/Vacuums (Com)	2260004031	0.88	0.01	3.15	0.00451	0.00007	0.01612
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.01	0.04	6.81	0.00003	0.00018	0.03557
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.02	0.00	0.32	0.00011	0.00001	0.00165
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.01	0.00	0.27	0.00007	0.00001	0.00140
4-Str Leafblowers/Vacuums (Com)	2265004031	0.29	0.11	14.44	0.00147	0.00051	0.07542
4-Str Rear Engine Riding Mower (Com)	2265004041	0.10	0.03	7.09	0.00049	0.00015	0.03705
4-Str Front Mowers (Com)	2265004046	0.11	0.03	5.40	0.00054	0.00014	0.02821
4-Str Shredders < 6 HP (Com)	2265004051	0.10	0.01	1.48	0.00051	0.00004	0.00771
4-Str Lawn & Garden Tractors (Com)	2265004056	0.02	0.01	1.72	0.00012	0.00004	0.00900
4-Str Chippers/Stump Grinders (Com)	2265004066	0.06	0.04	3.68	0.00032	0.00020	0.01923
4-Str Commercial Turf Equipment (Com)	2265004071	0.03	0.01	1.42	0.00014	0.00004	0.00742
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.12	0.02	2.72	0.00059	0.00008	0.01418
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.11	0.64	0.37	0.00056	0.00326	0.00192
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00002	0.00001
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.05	0.43	0.21	0.00026	0.00219	0.00105
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00001	0.00000
TOTAL		**5.43**	**1.42**	**60.58**	**0.02375**	**0.00710**	**0.30208**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
GILLESPIE COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

Non-Road Mobile Source Emissions - Gillespie County, 2005

4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00001	0.00000	0.00001
2-Str Chain Saws < 6 HP (Com)	2260004021	0.03	0.00	0.11	0.00011	0.00000	0.00043
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.94	0.01	3.49	0.00487	0.00008	0.01800
2-Str Leafblowers/Vacuums (Com)	2260004031	0.17	0.00	0.69	0.00086	0.00002	0.00357
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00093	0.00007	0.01462
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.18	0.02	2.77	0.00001	0.00000	0.00022
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.04	0.00025	0.00008	0.01870
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00026	0.00006	0.01196
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00169	0.00014	0.02989
4-Str Commercial Turf Equipment (Com)	2265004071	0.05	0.02	3.55	0.00004	0.00004	0.00097
4-Str Shredders > 6 HP	2265007010	0.05	0.01	2.27	0.00014	0.00002	0.00543
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00002	0.00013	0.00008
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.33	0.03	5.67	0.00006	0.00037	0.00021
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00001	0.00003	0.00002
Dsl - Commercial Turf Equipment (Com)	2270004071	0.01	0.01	0.18	0.00000	0.00002	0.00001
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00002	0.00012	0.00012
TOTAL		**1.76**	**0.10**	**18.78**	**0.00928**	**0.00117**	**0.10424**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.02	0.00	0.08	0.00008	0.00000	0.00026
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.12	0.00	0.45	0.00055	0.00001	0.00203
2-Str Leafblowers/Vacuums (Com)	2260004031	0.18	0.00	0.76	0.00082	0.00001	0.00341
4-Str Lawn Mowers (Com)	2265004011	0.03	0.00	0.42	0.00013	0.00001	0.00194
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.06	0.00002	0.00000	0.00026
4-Str Rear Engine Riding Mower (Com)	2265004041	0.11	0.04	7.97	0.00048	0.00015	0.03666
4-Str Front Mowers (Com)	2265004046	0.67	0.70	15.01	0.00298	0.00289	0.06907
4-Str Commercial Turf Equipment (Com)	2265004071	0.63	0.22	51.95	0.00283	0.00093	0.23905
Dsl - Front Mowers (Com)	2270004046	0.06	0.35	0.20	0.00029	0.00156	0.00092
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.03	0.17	0.10	0.00013	0.00078	0.00044
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.02	0.01	0.00001	0.00008	0.00003
TOTAL		**1.87**	**1.51**	**77.00**	**0.00831**	**0.00642**	**0.35407**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.01	0.00	0.03	0.00003	0.00000	0.00010
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.07	0.00	0.25	0.00034	0.00001	0.00121
2-Str Leafblowers/Vacuums (Com)	2260004031	0.01	0.00	0.03	0.00005	0.00000	0.00017
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.01	0.00	0.19	0.00006	0.00000	0.00094
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
GILLESPIE COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000

Non-Road Mobile Source Emissions - Gillespie County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.10	0.03	5.49	0.00050	0.00013	0.02678
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.02	0.01	0.00002	0.00010	0.00006
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.21**	**0.05**	**6.00**	**0.00099**	**0.00024**	**0.02926**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.40	0.00	1.28	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.11	0.00	0.40	0.00046	0.00001	0.00162
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.11	0.01	1.75	0.00049	0.00004	0.00753
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.04	0.01	2.76	0.00018	0.00005	0.01346
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.03	0.01	2.55	0.00014	0.00004	0.01037
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.69**	**0.04**	**8.73**	**0.00126**	**0.00014**	**0.03299**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.02	0.00000	0.00000	0.00005
4-Str Tractor - Hay	2265005015	0.00	0.00	0.10	0.00000	0.00000	0.00008
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.05	0.00001	0.00001	0.00044
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.02	0.00000	0.00000	0.00007
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Corn	2270005015	0.07	0.66	0.37	0.00020	0.00171	0.00095
Dsl - Tractor - Hay	2270005015	0.38	3.43	1.91	0.00030	0.00259	0.00144
Dsl - Tractor - Peanuts	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Small Grains	2270005015	0.18	1.64	0.91	0.00169	0.01468	0.00816
Dsl - Tractor - Sorghum	2270005015	0.08	0.71	0.39	0.00028	0.00246	0.00137
Dsl - Tractor - Cotton	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Corn	2270005020	0.05	0.56	0.20	0.00030	0.00309	0.00109
Dsl - Combine - Hay	2270005020	0.11	1.18	0.42	0.00063	0.00649	0.00229
Dsl - Combine - Peanuts	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Small Grains	2270005020	0.30	3.30	1.16	0.00175	0.01814	0.00639
Dsl - Combine - Sorghum	2270005020	0.06	0.60	0.21	0.00032	0.00330	0.00116
Dsl - Combine - Cotton	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Sprayers	2260005035	0.06	0.00	0.18	0.00028	0.00000	0.00076
4-Str Balers	2265005025	0.05	0.04	0.79	0.00021	0.00015	0.00347
4-Str Agricultural Mowers	2265005030	0.02	0.00	0.72	0.00007	0.00002	0.00315
4-Str Sprayers	2265005035	0.28	0.07	5.96	0.00118	0.00026	0.02620
4-Str Tillers > 6 HP	2265005040	0.57	0.07	14.85	0.00241	0.00026	0.06532
4-Str Swathers	2265005045	0.07	0.06	1.25	0.00030	0.00024	0.00549
4-Str Other Agriculture Equipment	2265005055	0.11	0.07	2.67	0.00044	0.00029	0.01174
4-Str Irrigation Sets	2265005060	0.09	0.09	2.19	0.00039	0.00036	0.00961
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.01	0.00000	0.00001	0.00002
LPG - Irrigation Sets	2267005060	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.01	0.00000	0.00000	0.00002
CNG - Irrigation Sets	2268005060	0.00	0.05	0.22	0.00000	0.00021	0.00095
Dsl - Balers	2270005025	0.00	0.02	0.02	0.00002	0.00010	0.00007
Dsl - Agricultural Mowers	2270005030	0.00	0.00	0.00	0.00000	0.00002	0.00002
GILLESPIE COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.06	0.36	0.20	0.00026	0.00156	0.00087

Non-Road Mobile Source Emissions - Gillespie County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Swathers	2270005045	0.04	0.35	0.19	0.00017	0.00151	0.00083
Dsl - Other Agriculture Equipment	2270005055	0.12	1.01	0.55	0.00053	0.00436	0.00238
Dsl - Irrigation Sets	2270005060	0.07	0.65	0.25	0.00032	0.00278	0.00109
TOTAL		**2.79**	**14.95**	**35.81**	**0.01208**	**0.06462**	**0.15549**
TOTAL NONROAD SOURCES		191.50	129.86	1,897.13	0.61812	0.49933	6.45677

Non-Road Mobile Source Emissions - Guadalupe County, 2005

GUADALUPE COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Construction Equipment							
2-Str Tampers/Rammers	2260002006	4.37	0.05	13.00	0.01825	0.00022	0.05447
2-Str Plate Compactors	2260002009	0.12	0.00	0.46	0.00052	0.00001	0.00193
2-Str Paving Equipment	2260002021	0.14	0.00	0.55	0.00058	0.00001	0.00229
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00002
2-Str Concrete/Industrial Saws	2260002039	8.93	0.11	31.86	0.03736	0.00048	0.13346
2-Str Crushing/Proc. Equipment	2260002054	0.02	0.00	0.10	0.00009	0.00000	0.00043
4-Str Pavers	2265002003	0.27	0.09	12.49	0.00109	0.00035	0.05351
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.10	0.00001	0.00000	0.00042
4-Str Plate Compactors	2265002009	1.19	0.12	22.80	0.00489	0.00047	0.09764
4-Str Rollers	2265002015	0.37	0.15	23.35	0.00153	0.00058	0.09998
4-Str Paving Equipment	2265002021	1.46	0.24	44.90	0.00591	0.00094	0.19227
4-Str Surfacing Equipment	2265002024	0.51	0.10	20.57	0.00209	0.00037	0.08811
4-Str Signal Boards/Light Plants	2265002027	0.04	0.00	1.04	0.00015	0.00002	0.00447
4-Str Trenchers	2265002030	1.01	0.28	38.07	0.00415	0.00109	0.16302
4-Str Bore/Drill Rigs	2265002033	0.67	0.10	10.96	0.00273	0.00039	0.04694
4-Str Concrete/Industrial Saws	2265002039	1.32	0.45	94.77	0.00543	0.00172	0.40587
4-Str Cement & Mortar Mixers	2265002042	1.61	0.22	38.15	0.00642	0.00083	0.16339
4-Str Cranes	2265002045	0.05	0.05	1.48	0.00021	0.00019	0.00635
4-Str Crushing/Proc. Equipment	2265002054	0.13	0.03	5.58	0.00054	0.00012	0.02390
4-Str Rough Terrain Forklift	2265002057	0.08	0.08	1.82	0.00031	0.00032	0.00780
4-Str Rubber Tire Loaders	2265002060	0.18	0.20	4.18	0.00072	0.00075	0.01789
4-Str Tractors/Loaders/Backhoes	2265002066	0.45	0.14	30.07	0.00186	0.00055	0.12880
4-Str Skid Steer Loaders	2265002072	0.35	0.22	12.83	0.00140	0.00084	0.05493
4-Str Dumpers/Tenders	2265002078	0.23	0.03	5.95	0.00092	0.00013	0.02547
4-Str Other Construction Equipment	2265002081	0.07	0.07	1.58	0.00028	0.00029	0.00677
LPG - Pavers	2267002003	0.02	0.06	0.29	0.00007	0.00026	0.00122
LPG - Rollers	2267002015	0.03	0.10	0.49	0.00011	0.00040	0.00206
LPG - Paving Equipment	2267002021	0.00	0.02	0.08	0.00002	0.00007	0.00032
LPG - Surfacing Equipment	2267002024	0.00	0.01	0.05	0.00001	0.00004	0.00021
LPG - Trenchers	2267002030	0.05	0.19	0.89	0.00022	0.00080	0.00374
LPG - Bore/Drill Rigs	2267002033	0.02	0.07	0.29	0.00008	0.00029	0.00122
LPG - Concrete/Industrial Saws	2267002039	0.04	0.15	0.85	0.00018	0.00064	0.00356
LPG - Cranes	2267002045	0.02	0.07	0.31	0.00008	0.00030	0.00131
LPG - Rough Terrain Forklifts	2267002057	0.03	0.12	0.57	0.00014	0.00052	0.00238
LPG - Rubber Tire Loaders	2267002060	0.08	0.30	1.41	0.00035	0.00124	0.00593
LPG - Tractors/Loaders/Backhoes	2267002066	0.01	0.03	0.15	0.00004	0.00013	0.00063
LPG - Skid Steer Loaders	2267002072	0.07	0.26	1.17	0.00030	0.00109	0.00488
LPG - Other Construction Equipment	2267002081	0.03	0.11	0.47	0.00012	0.00045	0.00197
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.02	0.00000	0.00002	0.00008
Dsl - Pavers	2270002003	0.27	3.21	1.31	0.00123	0.01454	0.00590
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.79	7.97	3.87	0.00356	0.03607	0.01750
Dsl - Scrapers	2270002018	0.08	0.98	0.38	0.00034	0.00445	0.00172
Dsl - Paving Equipment	2270002021	0.27	2.91	1.62	0.00124	0.01315	0.00734
Dsl - Surfacing Equipment	2270002024	0.71	8.99	4.49	0.00319	0.04066	0.02031
Dsl - Signal Boards/Light Plants	2270002027	0.28	1.63	0.96	0.00119	0.00682	0.00402
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00001	0.00001
Dsl - Bore/Drill Rigs	2270002033	0.00	0.02	0.01	0.00001	0.00011	0.00004
Dsl - Excavators	2270002036	1.81	25.89	9.91	0.00819	0.11714	0.04485
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00001	0.00001
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.01	0.00	0.00001	0.00006	0.00002
Dsl - Cranes	2270002045	0.03	0.40	0.10	0.00016	0.00179	0.00046
Dsl - Graders	2270002048	0.87	9.21	3.53	0.00394	0.04165	0.01598
Dsl - Off-highway Trucks	2270002051	0.09	1.75	0.65	0.00043	0.00792	0.00294
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.01	0.05	0.05	0.00005	0.00025	0.00025
Dsl - Rubber Tire Loaders	2270002060	1.59	21.35	8.11	0.00718	0.09657	0.03668
Dsl - Tractors/Loaders/Backhoes	2270002066	4.86	19.11	21.23	0.02200	0.08647	0.09607
Dsl - Crawler Tractor/Dozers	2270002069	2.21	27.37	11.18	0.01001	0.12380	0.05058
Dsl - Skid Steer Loaders	2270002072	0.01	0.05	0.05	0.00007	0.00021	0.00024

Non-Road Mobile Source Emissions - Guadalupe County, 2005

GUADALUPE COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - Off-Highway Tractors	2270002075	0.29	2.89	1.55	0.00133	0.01308	0.00701
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**38.19**	**138.05**	**492.73**	**0.16327**	**0.62169**	**2.12154**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.62	0.01	2.27	0.00223	0.00003	0.00816
2-Str Pumps	2260006010	1.85	0.03	7.57	0.00667	0.00013	0.02726
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00001
2-Str Hydro Power Units	2260006035	0.01	0.00	0.05	0.00003	0.00000	0.00017
4-Str Generator Sets	2265006005	15.14	4.90	432.97	0.05355	0.01619	1.59350
4-Str Pumps	2265006010	6.01	0.62	124.41	0.02150	0.00205	0.45787
4-Str Air Compressors	2265006015	2.11	0.74	50.25	0.00750	0.00243	0.18495
4-Str Welders	2265006025	2.16	0.55	122.12	0.00775	0.00180	0.44945
4-Str Pressure Washers	2265006030	9.50	1.35	260.06	0.03405	0.00446	0.95712
4-Str Hydro Power Units	2265006035	0.28	0.05	11.58	0.00099	0.00018	0.04262
LPG - Generator Sets	2267006005	0.34	1.67	4.97	0.00123	0.00602	0.01789
LPG - Pumps	2267006010	0.08	0.37	1.17	0.00028	0.00133	0.00421
LPG - Air Compressors	2267006015	0.09	0.43	1.42	0.00032	0.00156	0.00511
LPG - Welders	2267006025	0.15	0.55	2.56	0.00055	0.00199	0.00923
LPG - Pressure Washers	2267006030	0.00	0.01	0.03	0.00001	0.00003	0.00012
LPG - Hydro Power Units	2267006035	0.00	0.01	0.02	0.00001	0.00002	0.00008
CNG - Generator Sets	2268006005	0.01	0.53	1.55	0.00002	0.00190	0.00558
CNG - Pumps	2268006010	0.00	0.03	0.08	0.00000	0.00009	0.00028
CNG - Air Compressors	2268006015	0.00	0.03	0.11	0.00000	0.00013	0.00040
CNG - Gas Compressors	2268006020	0.01	0.45	6.00	0.00003	0.00162	0.02161
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	3.95	44.65	16.86	0.01423	0.16073	0.06068
Dsl - Pumps	2270006010	0.96	10.63	4.09	0.00345	0.03828	0.01471
Dsl - Air Compressors	2270006015	0.54	5.93	1.93	0.00195	0.02134	0.00693
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.70	1.70	2.51	0.00252	0.00614	0.00903
Dsl - Pressure Washers	2270006030	0.03	0.24	0.11	0.00012	0.00087	0.00040
Dsl - Hydro Power Units	2270006035	0.02	0.18	0.08	0.00008	0.00066	0.00030
TOTAL		**44.56**	**75.66**	**1,054.78**	**0.15906**	**0.26998**	**3.87769**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.03	0.00	0.15	0.00011	0.00000	0.00057
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.01	0.00001	0.00000	0.00005
4-Str Aerial Lifts	2265003010	0.57	0.14	27.23	0.00210	0.00048	0.10327
4-Str Forklifts	2265003020	1.19	1.31	28.22	0.00434	0.00448	0.10701
4-Str Sweepers/Scrubbers	2265003030	0.93	0.86	31.87	0.00338	0.00291	0.12085
4-Str Other General Industrial Eqp	2265003040	2.20	0.33	55.76	0.00808	0.00114	0.21148
4-Str Other Material Handling Eqp	2265003050	0.05	0.03	1.72	0.00018	0.00012	0.00652
4-Str AC\Refrigeration	2265003060	0.02	0.00	1.01	0.00005	0.00001	0.00280
4-Str Terminal Tractors	2265003070	0.17	0.19	4.15	0.00060	0.00064	0.01572
LPG - Aerial Lifts	2267003010	0.29	1.05	4.62	0.00106	0.00391	0.01716
LPG - Forklifts	2267003020	23.14	83.42	398.17	0.08583	0.30947	1.47705
LPG - Sweepers/Scrubbers	2267003030	0.18	0.64	3.34	0.00067	0.00237	0.01238
LPG - Other General Industrial Equipment	2267003040	0.06	0.21	1.02	0.00021	0.00076	0.00379
LPG - Other Material Handling Equipment	2267003050	0.02	0.06	0.25	0.00006	0.00021	0.00093
LPG - Terminal Tractors	2267003070	0.10	0.37	2.03	0.00039	0.00136	0.00751
CNG - Forklifts	2268003020	0.11	6.59	31.41	0.00040	0.02446	0.11652
CNG - Sweepers/Scrubbers	2268003030	0.00	0.01	0.04	0.00000	0.00003	0.00014
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.02	0.00000	0.00002	0.00009
CNG - AC\Refrigeration	2268003060	0.00	0.01	0.05	0.00000	0.00003	0.00014
CNG - Terminal Tractors	2268003070	0.00	0.03	0.14	0.00000	0.00010	0.00053
Dsl - Aerial Lifts	2270003010	0.33	1.13	1.18	0.00121	0.00419	0.00438
Dsl - Forklifts	2270003020	0.41	4.37	2.78	0.00153	0.01621	0.01031
Dsl - Sweepers/Scrubbers	2270003030	0.51	5.92	1.80	0.00190	0.02197	0.00668
Dsl - Other General Industrial Eqp	2270003040	0.60	6.84	2.11	0.00222	0.02537	0.00782
Dsl - Other Material Handling Eqp	2270003050	0.06	0.33	0.21	0.00022	0.00121	0.00078

Non-Road Mobile Source Emissions - Guadalupe County, 2005

GUADALUPE COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	1.44	13.29	6.31	0.00391	0.03610	0.01716
Dsl - Terminal Tractors	2270003070	0.79	14.82	5.53	0.00293	0.05499	0.02050
TOTAL		**33.18**	**141.96**	**611.13**	**0.12140**	**0.51255**	**2.27214**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.18	0.92	0.75	0.00060	0.00315	0.00257
4-Str Railway Maintenance	2285004015	0.04	0.01	2.15	0.00014	0.00004	0.00754
LPG - Railway Maintenance	2285006015	0.00	0.00	0.01	0.00000	0.00001	0.00003
Line-haul Locomotive	2285002006	20.43	518.60	79.76	0.05598	1.42083	0.21851
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**20.65**	**519.54**	**82.67**	**0.05672**	**1.42403**	**0.22865**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractors/Loaders/Backhoes	2270002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Landfill Equipment

Dsl - Pavers	2270002003	0.24	4.71	1.56	0.00098	0.01915	0.00636
Dsl - Scrapers	2270002018	0.16	2.80	0.91	0.00065	0.01139	0.00368
Dsl - Excavators	2270002036	0.01	0.18	0.05	0.00006	0.00073	0.00021
Dsl - Graders	2270002048	0.04	0.49	0.14	0.00015	0.00201	0.00055
Dsl - Off Highway Trucks	2270002051	0.05	0.72	0.19	0.00022	0.00294	0.00078
Dsl - Rubber Tire Loaders	2270002060	0.06	0.69	0.20	0.00023	0.00280	0.00082
Dsl - Crawler Tractors/Dozers	2270002069	0.26	3.19	1.06	0.00107	0.01295	0.00431
Dsl - Other Const. Equipment	2270002081	0.13	1.48	0.53	0.00053	0.00602	0.00216
TOTAL		**0.96**	**14.27**	**4.64**	**0.00389**	**0.05800**	**0.01888**

Recreational Boating

2-Str Outboard	2282005010	17.80	0.52	42.90	0.04045	0.00114	0.09411
2-Str Personal Water Craft	2282005015	4.01	0.10	9.49	0.00891	0.00021	0.02081
4-Str Inboard/Sterndrive	2282010005	1.59	0.78	18.69	0.00402	0.00157	0.04191
Dsl - Inboard	2282020005	0.05	1.31	0.21	0.00011	0.00288	0.00046
Dsl - Outboards	2282020010	0.00	0.00	0.00	0.00000	0.00001	0.00001
TOTAL		**23.46**	**2.72**	**71.29**	**0.05349**	**0.00582**	**0.15729**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	20.42	0.05	19.53	0.06373	0.00015	0.06097
2-Str ATVs	2260001030	25.66	0.06	24.57	0.08009	0.00019	0.07674
2-Str Specialty Vehicles / Carts	2260001060	0.22	0.05	10.34	0.00069	0.00016	0.03230
4-Str Offroad Motorcycles	2265001010	0.58	0.07	8.64	0.00177	0.00020	0.02759
GUADALUPE COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Guadalupe County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	5.51	0.67	82.30	0.01692	0.00192	0.26273
4-Str Golf Carts	2265001050	6.01	1.97	540.45	0.01855	0.00565	1.72538
4-Str Specialty Vehicles / Carts	2265001060	0.26	0.05	8.81	0.00079	0.00016	0.02812
LPG - Specialty Vehicles / Carts	2267001060	0.01	0.02	0.08	0.00002	0.00006	0.00026
Dsl - Specialty Vehicle Carts	2270001060	0.08	0.23	0.31	0.00025	0.00073	0.00098
TOTAL		**58.75**	**3.18**	**695.04**	**0.18281**	**0.00922**	**2.21506**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	1.24	0.01	3.11	0.00349	0.00002	0.13656
2-Str Chain Saws < 6 HP (Res)	2260004020	27.54	0.21	67.42	0.05757	0.00043	0.14134
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	41.61	0.35	108.41	0.11691	0.00099	0.30848
2-Str Leafblowers/Vacuums (Res)	2260004030	5.75	0.05	15.08	0.01582	0.00013	0.04289
4-Str Lawn Mowers (Res)	2265004010	22.27	1.59	295.15	0.06203	0.00453	0.83980
4-Str Rotary Tillers <6 HP (Res)	2265004015	5.42	0.37	67.51	0.01517	0.00104	0.19209
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.75	0.05	8.98	0.00211	0.00014	0.02555
4-Str Leafblowers/Vacuums (Res)	2265004030	0.29	0.02	3.66	0.00080	0.00006	0.01043
4-Str Rear Engine Riding Mower (Res)	2265004040	26.29	5.04	1,068.91	0.06854	0.01434	3.04140
4-Str Lawn & Garden Tractors (Res)	2265004055	15.96	4.50	840.21	0.04535	0.01185	2.46426
4-Str Other Lawn & Garden Equip. (Res)	2265004075	1.19	0.15	26.57	0.00338	0.00041	0.07792
TOTAL		**148.31**	**12.33**	**2,505.01**	**0.39116**	**0.03395**	**7.28070**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.02	0.00	0.06	0.00011	0.00000	0.00030
2-Str Chain Saws < 6 HP (Com)	2260004021	12.72	0.15	40.89	0.04789	0.00056	0.15391
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.56	0.04	9.11	0.01306	0.00019	0.04654
2-Str Leafblowers/Vacuums (Com)	2260004031	3.84	0.06	13.73	0.01961	0.00029	0.07017
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.02	0.17	29.64	0.00012	0.00079	0.15485
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.09	0.01	1.38	0.00047	0.00004	0.00720
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.06	0.01	1.17	0.00031	0.00003	0.00609
4-Str Leafblowers/Vacuums (Com)	2265004031	1.25	0.47	62.85	0.00634	0.00222	0.32831
4-Str Rear Engine Riding Mower (Com)	2265004041	0.42	0.14	30.88	0.00210	0.00066	0.16129
4-Str Front Mowers (Com)	2265004046	0.47	0.13	23.51	0.00233	0.00063	0.12281
4-Str Shredders < 6 HP (Com)	2265004051	0.43	0.04	6.42	0.00219	0.00018	0.03356
4-Str Lawn & Garden Tractors (Com)	2265004056	0.10	0.03	7.50	0.00051	0.00016	0.03917
4-Str Chippers/Stump Grinders (Com)	2265004066	0.27	0.19	16.02	0.00137	0.00088	0.08370
4-Str Commercial Turf Equipment (Com)	2265004071	0.12	0.03	6.19	0.00058	0.00016	0.03232
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.53	0.07	11.82	0.00251	0.00033	0.06174
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.48	2.78	1.63	0.00244	0.01418	0.00834
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.01	0.01	0.00001	0.00007	0.00004
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.22	1.86	0.89	0.00113	0.00951	0.00457
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.01	0.00	0.00000	0.00003	0.00002
TOTAL		**23.62**	**6.19**	**263.70**	**0.10310**	**0.03091**	**1.31494**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.14	0.00	0.54	0.00052	0.00001	0.00199
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.67	0.01	2.48	0.00332	0.00005	0.01230
2-Str Leafblowers/Vacuums (Com)	2260004031	0.33	0.01	1.37	0.00164	0.00003	0.00681
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.03	0.03	0.70	0.00012	0.00013	0.00300
4-Str Lawn Mowers (Com)	2265004011	0.06	0.01	1.23	0.00031	0.00003	0.00626
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.05	0.00002	0.00000	0.00025
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.26	0.07	15.95	0.00125	0.00034	0.08097
4-Str Front Mowers (Com)	2265004046	0.07	0.03	3.38	0.00035	0.00013	0.01717
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
GUADALUPE COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

4-Str Lawn & Garden Tractors (Com)	2265004056	0.01	0.00	1.05	0.00007	0.00002	0.00533
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.14	0.00002	0.00000	0.00070
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.05	0.00001	0.00000	0.00024
4-Str Shredders > 6 HP	2265007010	0.01	0.00	0.18	0.00002	0.00000	0.00058
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.03	0.17	0.10	0.00015	0.00084	0.00050
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.03	0.02	0.00002	0.00014	0.00008
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.01	0.00	0.00000	0.00004	0.00002
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.05	0.37	0.31	0.00016	0.00116	0.00098
TOTAL		**1.68**	**0.74**	**27.55**	**0.00797**	**0.00293**	**0.13716**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00002	0.00000	0.00006
2-Str Chain Saws < 6 HP (Com)	2260004021	0.11	0.00	0.44	0.00043	0.00001	0.00166
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	3.67	0.06	13.57	0.01891	0.00029	0.07000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.65	0.01	2.69	0.00334	0.00006	0.01388
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00361	0.00029	0.05687
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.71	0.06	10.79	0.00006	0.00000	0.00084
4-Str Rear Engine Riding Mower (Com)	2265004041	0.01	0.00	0.16	0.00095	0.00030	0.07273
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00100	0.00022	0.04649
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00655	0.00053	0.11624
4-Str Commercial Turf Equipment (Com)	2265004071	0.19	0.06	13.79	0.00014	0.00015	0.00377
4-Str Shredders > 6 HP	2265007010	0.20	0.05	8.82	0.00055	0.00009	0.02113
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00009	0.00052	0.00031
Dsl - Lawn & Garden Tractors (Com)	2270004056	1.29	0.11	22.05	0.00024	0.00143	0.00084
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00002	0.00011	0.00007
Dsl - Commercial Turf Equipment (Com)	2270004071	0.03	0.03	0.72	0.00001	0.00009	0.00004
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00008	0.00045	0.00046
TOTAL		**6.86**	**0.39**	**73.03**	**0.03601**	**0.00456**	**0.40539**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.08	0.00	0.25	0.00027	0.00000	0.00084
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.40	0.01	1.47	0.00179	0.00003	0.00663
2-Str Leafblowers/Vacuums (Com)	2260004031	0.60	0.01	2.48	0.00269	0.00005	0.01117
4-Str Lawn Mowers (Com)	2265004011	0.09	0.01	1.38	0.00041	0.00003	0.00636
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.01	0.00	0.19	0.00006	0.00000	0.00086
4-Str Rear Engine Riding Mower (Com)	2265004041	0.35	0.12	26.06	0.00155	0.00049	0.11993
4-Str Front Mowers (Com)	2265004046	2.20	2.28	49.11	0.00952	0.00944	0.22596
4-Str Commercial Turf Equipment (Com)	2265004071	2.07	0.74	169.95	0.00914	0.00304	0.78204
Dsl - Front Mowers (Com)	2270004046	0.21	1.13	0.67	0.00093	0.00511	0.00301
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.10	0.57	0.32	0.00043	0.00256	0.00143
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.01	0.06	0.02	0.00003	0.00026	0.00010
TOTAL		**6.11**	**4.92**	**251.91**	**0.02681**	**0.02101**	**1.15832**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.07	0.00	0.20	0.00035	0.00000	0.00098
2-Str Chain Saws < 6 HP (Com)	2260004021	3.96	0.05	12.72	0.01428	0.00017	0.04589
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.53	0.04	9.01	0.01102	0.00016	0.03922
2-Str Leafblowers/Vacuums (Com)	2260004031	1.88	0.03	6.73	0.00781	0.00011	0.02788
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.29	0.02	4.45	0.00141	0.00011	0.02172
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.03	0.00001	0.00000	0.00013
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.01	0.00	0.21	0.00005	0.00000	0.00105
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.58	0.18	44.08	0.00283	0.00087	0.21506
4-Str Front Mowers (Com)	2265004046	0.16	0.04	8.07	0.00077	0.00020	0.03937
GUADALUPE COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	0.09	0.03	6.97	0.00044	0.00014	0.03401

Non-Road Mobile Source Emissions - Guadalupe County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.10	0.06	6.07	0.00049	0.00031	0.02959
4-Str Commercial Turf Equipment (Com)	2265004071	1.47	0.39	79.91	0.00575	0.00153	0.31463
4-Str Other Lawn & Garden Equip. (Com)	2265004076	1.79	0.22	40.81	0.00868	0.00105	0.19886
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.83	0.22	42.28	0.00403	0.00106	0.20605
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.03	2.25	1.08	0.00119	0.01001	0.00481
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.27	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**14.07**	**3.52**	**262.62**	**0.05912**	**0.01574**	**1.17925**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.05	0.00	0.16	0.00019	0.00000	0.00060
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.17	0.01	2.57	0.00081	0.00006	0.01255
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.01	0.00000	0.00000	0.00003
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.22**	**0.01**	**2.73**	**0.00100**	**0.00007**	**0.01318**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.01	0.01	0.23	0.00002	0.00002	0.00059
4-Str Tractor - Hay	2265005015	0.01	0.01	0.21	0.00000	0.00000	0.00016
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.10	0.00002	0.00003	0.00090
4-Str Tractor - Sorghum	2265005015	0.01	0.01	0.24	0.00002	0.00002	0.00082
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Corn	2270005015	0.84	7.66	4.26	0.00227	0.01971	0.01096
Dsl - Tractor - Hay	2270005015	0.75	6.87	3.82	0.00060	0.00517	0.00288
Dsl - Tractor - Peanuts	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Small Grains	2270005015	0.37	3.35	1.86	0.00346	0.03003	0.01669
Dsl - Tractor - Sorghum	2270005015	0.86	7.88	4.38	0.00316	0.02741	0.01524
Dsl - Tractor - Cotton	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Corn	2270005020	0.60	6.49	2.29	0.00345	0.03565	0.01257
Dsl - Combine - Hay	2270005020	0.22	2.36	0.83	0.00126	0.01298	0.00457
Dsl - Combine - Peanuts	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Small Grains	2270005020	0.62	6.75	2.38	0.00359	0.03710	0.01307
Dsl - Combine - Sorghum	2270005020	0.61	6.68	2.35	0.00355	0.03668	0.01293
Dsl - Combine - Cotton	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Sprayers	2260005035	0.19	0.00	0.53	0.00082	0.00001	0.00230
4-Str Balers	2265005025	0.16	0.12	2.37	0.00059	0.00046	0.01044
4-Str Agricultural Mowers	2265005030	0.05	0.01	2.16	0.00021	0.00005	0.00948
4-Str Sprayers	2265005035	0.86	0.20	17.94	0.00347	0.00077	0.07890
4-Str Tillers > 6 HP	2265005040	1.73	0.20	44.71	0.00720	0.00080	0.19668
4-Str Swathers	2265005045	0.22	0.18	3.76	0.00084	0.00073	0.01654
4-Str Other Agriculture Equipment	2265005055	0.32	0.22	8.04	0.00128	0.00087	0.03535
4-Str Irrigation Sets	2265005060	0.28	0.27	6.58	0.00117	0.00109	0.02895
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.02	0.00000	0.00002	0.00006
LPG - Irrigation Sets	2267005060	0.00	0.00	0.01	0.00000	0.00001	0.00004
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.02	0.00000	0.00001	0.00007
CNG - Irrigation Sets	2268005060	0.00	0.15	0.66	0.00001	0.00065	0.00286
Dsl - Balers	2270005025	0.01	0.07	0.05	0.00005	0.00029	0.00020
Dsl - Agricultural Mowers	2270005030	0.00	0.01	0.01	0.00001	0.00006	0.00005
GUADALUPE COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.18	1.09	0.61	0.00077	0.00470	0.00261

Non-Road Mobile Source Emissions - Guadalupe County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Swathers	2270005045	0.12	1.06	0.58	0.00052	0.00455	0.00249
Dsl - Other Agriculture Equipment	2270005055	0.37	3.05	1.66	0.00158	0.01313	0.00715
Dsl - Irrigation Sets	2270005060	0.22	1.95	0.76	0.00096	0.00837	0.00327
TOTAL		**9.60**	**56.65**	**113.40**	**0.04089**	**0.24139**	**0.48883**
TOTAL NONROAD SOURCES		430.20	980.14	6,512.25	1.40671	3.25183	22.86904

Non-Road Mobile Source Emissions - Karnes County, 2005

KARNES COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Construction Equipment							
2-Str Tampers/Rammers	2260002006	0.13	0.00	0.39	0.00054	0.00001	0.00162
2-Str Plate Compactors	2260002009	0.00	0.00	0.01	0.00002	0.00000	0.00006
2-Str Paving Equipment	2260002021	0.00	0.00	0.02	0.00002	0.00000	0.00007
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Concrete/Industrial Saws	2260002039	0.27	0.00	0.95	0.00111	0.00001	0.00396
2-Str Crushing/Proc. Equipment	2260002054	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Pavers	2265002003	0.01	0.00	0.37	0.00003	0.00001	0.00159
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Plate Compactors	2265002009	0.04	0.00	0.68	0.00015	0.00001	0.00290
4-Str Rollers	2265002015	0.01	0.00	0.69	0.00005	0.00002	0.00297
4-Str Paving Equipment	2265002021	0.04	0.01	1.33	0.00018	0.00003	0.00571
4-Str Surfacing Equipment	2265002024	0.02	0.00	0.61	0.00006	0.00001	0.00262
4-Str Signal Boards/Light Plants	2265002027	0.00	0.00	0.03	0.00000	0.00000	0.00013
4-Str Trenchers	2265002030	0.03	0.01	1.13	0.00012	0.00003	0.00484
4-Str Bore/Drill Rigs	2265002033	0.02	0.00	0.33	0.00008	0.00001	0.00139
4-Str Concrete/Industrial Saws	2265002039	0.04	0.01	2.81	0.00016	0.00005	0.01205
4-Str Cement & Mortar Mixers	2265002042	0.05	0.01	1.13	0.00019	0.00002	0.00485
4-Str Cranes	2265002045	0.00	0.00	0.04	0.00001	0.00001	0.00019
4-Str Crushing/Proc. Equipment	2265002054	0.00	0.00	0.17	0.00002	0.00000	0.00071
4-Str Rough Terrain Forklift	2265002057	0.00	0.00	0.05	0.00001	0.00001	0.00023
4-Str Rubber Tire Loaders	2265002060	0.01	0.01	0.12	0.00002	0.00002	0.00053
4-Str Tractors/Loaders/Backhoes	2265002066	0.01	0.00	0.89	0.00006	0.00002	0.00383
4-Str Skid Steer Loaders	2265002072	0.01	0.01	0.38	0.00004	0.00002	0.00163
4-Str Dumpers/Tenders	2265002078	0.01	0.00	0.18	0.00003	0.00000	0.00076
4-Str Other Construction Equipment	2265002081	0.00	0.00	0.05	0.00001	0.00001	0.00020
LPG - Pavers	2267002003	0.00	0.00	0.01	0.00000	0.00001	0.00004
LPG - Rollers	2267002015	0.00	0.00	0.01	0.00000	0.00001	0.00006
LPG - Paving Equipment	2267002021	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Surfacing Equipment	2267002024	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Trenchers	2267002030	0.00	0.01	0.03	0.00001	0.00002	0.00011
LPG - Bore/Drill Rigs	2267002033	0.00	0.00	0.01	0.00000	0.00001	0.00004
LPG - Concrete/Industrial Saws	2267002039	0.00	0.00	0.03	0.00001	0.00002	0.00011
LPG - Cranes	2267002045	0.00	0.00	0.01	0.00000	0.00001	0.00004
LPG - Rough Terrain Forklifts	2267002057	0.00	0.00	0.02	0.00000	0.00002	0.00007
LPG - Rubber Tire Loaders	2267002060	0.00	0.01	0.04	0.00001	0.00004	0.00018
LPG - Tractors/Loaders/Backhoes	2267002066	0.00	0.00	0.00	0.00000	0.00000	0.00002
LPG - Skid Steer Loaders	2267002072	0.00	0.01	0.03	0.00001	0.00003	0.00015
LPG - Other Construction Equipment	2267002081	0.00	0.00	0.01	0.00000	0.00001	0.00006
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Pavers	2270002003	0.02	0.24	0.11	0.00010	0.00110	0.00051
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.04	0.36	0.22	0.00019	0.00161	0.00101
Dsl - Scrapers	2270002018	0.01	0.12	0.05	0.00004	0.00054	0.00021
Dsl - Paving Equipment	2270002021	0.04	0.41	0.23	0.00018	0.00184	0.00106
Dsl - Surfacing Equipment	2270002024	0.01	0.17	0.09	0.00006	0.00078	0.00039
Dsl - Signal Boards/Light Plants	2270002027	0.01	0.05	0.03	0.00004	0.00020	0.00012
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Bore/Drill Rigs	2270002033	0.00	0.00	0.00	0.00000	0.00002	0.00001
Dsl - Excavators	2270002036	0.10	1.32	0.53	0.00045	0.00597	0.00242
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Cranes	2270002045	0.01	0.06	0.02	0.00002	0.00028	0.00007
Dsl - Graders	2270002048	0.10	0.99	0.41	0.00045	0.00446	0.00183
Dsl - Off-highway Trucks	2270002051	0.03	0.57	0.20	0.00014	0.00257	0.00090
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.01	0.01	0.00001	0.00004	0.00004
Dsl - Rubber Tire Loaders	2270002060	0.09	1.18	0.47	0.00039	0.00536	0.00211
Dsl - Tractors/Loaders/Backhoes	2270002066	0.51	2.02	2.25	0.00232	0.00914	0.01017
Dsl - Crawler Tractor/Dozers	2270002069	0.20	2.35	1.00	0.00089	0.01065	0.00450
Dsl - Skid Steer Loaders	2270002072	0.00	0.01	0.01	0.00001	0.00003	0.00004

Non-Road Mobile Source Emissions - Karnes County, 2005

KARNES COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - Off-Highway Tractors	2270002075	0.05	0.46	0.25	0.00021	0.00208	0.00111
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**1.93**	**10.45**	**18.45**	**0.00843**	**0.04720**	**0.08026**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.09	0.00	0.31	0.00031	0.00000	0.00113
2-Str Pumps	2260006010	0.26	0.00	1.04	0.00092	0.00002	0.00376
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Hydro Power Units	2260006035	0.00	0.00	0.01	0.00000	0.00000	0.00002
4-Str Generator Sets	2265006005	2.09	0.68	59.72	0.00739	0.00223	0.21979
4-Str Pumps	2265006010	0.83	0.09	17.16	0.00297	0.00028	0.06316
4-Str Air Compressors	2265006015	0.29	0.10	6.93	0.00103	0.00034	0.02551
4-Str Welders	2265006025	0.30	0.08	16.84	0.00107	0.00025	0.06199
4-Str Pressure Washers	2265006030	1.31	0.19	35.87	0.00470	0.00061	0.13202
4-Str Hydro Power Units	2265006035	0.04	0.01	1.60	0.00014	0.00002	0.00588
LPG - Generator Sets	2267006005	0.05	0.23	0.69	0.00017	0.00083	0.00247
LPG - Pumps	2267006010	0.01	0.05	0.16	0.00004	0.00018	0.00058
LPG - Air Compressors	2267006015	0.01	0.06	0.20	0.00004	0.00021	0.00070
LPG - Welders	2267006025	0.02	0.08	0.35	0.00008	0.00028	0.00127
LPG - Pressure Washers	2267006030	0.00	0.00	0.00	0.00000	0.00000	0.00002
LPG - Hydro Power Units	2267006035	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Generator Sets	2268006005	0.00	0.07	0.21	0.00000	0.00026	0.00077
CNG - Pumps	2268006010	0.00	0.00	0.01	0.00000	0.00001	0.00004
CNG - Air Compressors	2268006015	0.00	0.00	0.02	0.00000	0.00002	0.00006
CNG - Gas Compressors	2268006020	0.00	0.06	0.83	0.00000	0.00022	0.00298
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	0.55	6.16	2.32	0.00196	0.02217	0.00837
Dsl - Pumps	2270006010	0.13	1.47	0.56	0.00048	0.00528	0.00203
Dsl - Air Compressors	2270006015	0.07	0.82	0.27	0.00027	0.00294	0.00096
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.10	0.24	0.35	0.00035	0.00085	0.00125
Dsl - Pressure Washers	2270006030	0.00	0.03	0.02	0.00002	0.00012	0.00005
Dsl - Hydro Power Units	2270006035	0.00	0.03	0.01	0.00001	0.00009	0.00004
TOTAL		**6.15**	**10.44**	**145.49**	**0.02194**	**0.03724**	**0.53485**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.00	0.00	0.00	0.00000	0.00000	0.00002
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Aerial Lifts	2265003010	0.02	0.00	0.74	0.00006	0.00001	0.00282
4-Str Forklifts	2265003020	0.03	0.04	0.77	0.00012	0.00012	0.00292
4-Str Sweepers/Scrubbers	2265003030	0.03	0.02	0.87	0.00009	0.00008	0.00330
4-Str Other General Industrial Eqp	2265003040	0.06	0.01	1.52	0.00022	0.00003	0.00578
4-Str Other Material Handling Eqp	2265003050	0.00	0.00	0.05	0.00000	0.00000	0.00018
4-Str AC\Refrigeration	2265003060	0.00	0.00	0.16	0.00001	0.00000	0.00045
4-Str Terminal Tractors	2265003070	0.00	0.01	0.11	0.00002	0.00002	0.00043
LPG - Aerial Lifts	2267003010	0.01	0.03	0.13	0.00003	0.00011	0.00047
LPG - Forklifts	2267003020	0.63	2.28	10.88	0.00234	0.00845	0.04035
LPG - Sweepers/Scrubbers	2267003030	0.00	0.02	0.09	0.00002	0.00006	0.00034
LPG - Other General Industrial Equipment	2267003040	0.00	0.01	0.03	0.00001	0.00002	0.00010
LPG - Other Material Handling Equipment	2267003050	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Terminal Tractors	2267003070	0.00	0.01	0.06	0.00001	0.00004	0.00021
CNG - Forklifts	2268003020	0.00	0.18	0.86	0.00001	0.00067	0.00318
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - AC\Refrigeration	2268003060	0.00	0.00	0.01	0.00000	0.00000	0.00002
CNG - Terminal Tractors	2268003070	0.00	0.00	0.00	0.00000	0.00000	0.00001
Dsl - Aerial Lifts	2270003010	0.01	0.03	0.03	0.00003	0.00011	0.00012
Dsl - Forklifts	2270003020	0.01	0.12	0.08	0.00004	0.00044	0.00028
Dsl - Sweepers/Scrubbers	2270003030	0.01	0.16	0.05	0.00005	0.00060	0.00018
Dsl - Other General Industrial Eqp	2270003040	0.02	0.19	0.06	0.00006	0.00069	0.00021
Dsl - Other Material Handling Eqp	2270003050	0.00	0.01	0.01	0.00001	0.00003	0.00002

Non-Road Mobile Source Emissions - Karnes County, 2005

KARNES COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	0.23	2.16	1.03	0.00063	0.00587	0.00279
Dsl - Terminal Tractors	2270003070	0.02	0.40	0.15	0.00008	0.00150	0.00056
TOTAL		**1.10**	**5.68**	**17.69**	**0.00385**	**0.01889**	**0.06479**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Railway Maintenance	2285004015	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Railway Maintenance	2285006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Line-haul Locomotive	2285002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractors/Loaders/Backhoes	2270002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Landfill Equipment

Dsl - Pavers	2270002003	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Const. Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Boating

2-Str Outboard	2282005010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Personal Water Craft	2282005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Inboard/Sterndrive	2282010005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Inboard	2282020005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Outboards	2282020010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str ATVs	2260001030	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Specialty Vehicles / Carts	2260001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Offroad Motorcycles	2265001010	0.00	0.00	0.00	0.00000	0.00000	0.00000
KARNES COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Karnes County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Golf Carts	2265001050	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Specialty Vehicles / Carts	2265001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Specialty Vehicles / Carts	2267001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Specialty Vehicle Carts	2270001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	0.18	0.00	0.44	0.00049	0.00000	0.13656
2-Str Chain Saws < 6 HP (Res)	2260004020	3.90	0.03	9.54	0.00815	0.00006	0.02000
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	5.89	0.05	15.34	0.01655	0.00014	0.04366
2-Str Leafblowers/Vacuums (Res)	2260004030	0.81	0.01	2.13	0.00224	0.00002	0.00607
4-Str Lawn Mowers (Res)	2265004010	3.15	0.23	41.78	0.00878	0.00064	0.11886
4-Str Rotary Tillers <6 HP (Res)	2265004015	0.77	0.05	9.56	0.00215	0.00015	0.02719
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.11	0.01	1.27	0.00030	0.00002	0.00362
4-Str Leafblowers/Vacuums (Res)	2265004030	0.04	0.00	0.52	0.00011	0.00001	0.00148
4-Str Rear Engine Riding Mower (Res)	2265004040	3.72	0.71	151.29	0.00970	0.00203	0.43048
4-Str Lawn & Garden Tractors (Res)	2265004055	3.03	0.85	159.39	0.00860	0.00225	0.46749
4-Str Other Lawn & Garden Equip. (Res)	2265004075	0.23	0.03	5.04	0.00064	0.00008	0.01478
TOTAL		**21.82**	**1.97**	**396.31**	**0.05771**	**0.00540**	**1.27018**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
KARNES COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

Non-Road Mobile Source Emissions - Karnes County, 2005

4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00001	0.00000	0.00002
2-Str Chain Saws < 6 HP (Com)	2260004021	0.05	0.00	0.17	0.00017	0.00000	0.00066
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	1.47	0.02	5.43	0.00757	0.00012	0.02800
2-Str Leafblowers/Vacuums (Com)	2260004031	0.26	0.00	1.08	0.00134	0.00002	0.00555
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00145	0.00012	0.02275
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.28	0.02	4.31	0.00002	0.00000	0.00034
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.06	0.00038	0.00012	0.02909
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00040	0.00009	0.01860
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00262	0.00021	0.04650
4-Str Commercial Turf Equipment (Com)	2265004071	0.07	0.03	5.52	0.00006	0.00006	0.00151
4-Str Shredders > 6 HP	2265007010	0.08	0.02	3.53	0.00022	0.00004	0.00845
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00004	0.00021	0.00012
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.52	0.04	8.82	0.00010	0.00057	0.00033
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00001	0.00005	0.00003
Dsl - Commercial Turf Equipment (Com)	2270004071	0.01	0.01	0.29	0.00000	0.00004	0.00002
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00003	0.00018	0.00018
TOTAL		**2.74**	**0.15**	**29.21**	**0.01441**	**0.00182**	**0.16216**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.02	0.00	0.06	0.00006	0.00000	0.00019
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.09	0.00	0.34	0.00042	0.00001	0.00154
2-Str Leafblowers/Vacuums (Com)	2260004031	0.14	0.00	0.58	0.00063	0.00001	0.00260
4-Str Lawn Mowers (Com)	2265004011	0.02	0.00	0.32	0.00010	0.00001	0.00148
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.04	0.00001	0.00000	0.00020
4-Str Rear Engine Riding Mower (Com)	2265004041	0.08	0.03	6.07	0.00036	0.00011	0.02793
4-Str Front Mowers (Com)	2265004046	0.51	0.53	11.44	0.00222	0.00220	0.05263
4-Str Commercial Turf Equipment (Com)	2265004071	0.48	0.17	39.58	0.00213	0.00071	0.18213
Dsl - Front Mowers (Com)	2270004046	0.05	0.26	0.16	0.00022	0.00119	0.00070
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.02	0.13	0.07	0.00010	0.00060	0.00033
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.01	0.01	0.00001	0.00006	0.00002
TOTAL		**1.42**	**1.15**	**58.67**	**0.00624**	**0.00489**	**0.26977**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
KARNES COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000

Non-Road Mobile Source Emissions - Karnes County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.13	0.00001	0.00001	0.00034
4-Str Tractor - Hay	2265005015	0.00	0.00	0.16	0.00000	0.00000	0.00012
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.04	0.00001	0.00001	0.00035
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.04	0.00000	0.00000	0.00013
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.05	0.00000	0.00001	0.00018
Dsl - Tractor - Corn	2270005015	0.48	4.38	2.44	0.00130	0.01128	0.00627
Dsl - Tractor - Hay	2270005015	0.57	5.26	2.92	0.00046	0.00396	0.00220
Dsl - Tractor - Peanuts	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Small Grains	2270005015	0.14	1.28	0.71	0.00133	0.01151	0.00640
Dsl - Tractor - Sorghum	2270005015	0.14	1.28	0.71	0.00051	0.00447	0.00248
Dsl - Tractor - Cotton	2270005015	0.17	1.59	0.89	0.00069	0.00599	0.00333
Dsl - Combine - Corn	2270005020	0.34	3.71	1.31	0.00197	0.02040	0.00719
Dsl - Combine - Hay	2270005020	0.17	1.81	0.64	0.00096	0.00994	0.00350
Dsl - Combine - Peanuts	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Small Grains	2270005020	0.24	2.59	0.91	0.00138	0.01422	0.00501
Dsl - Combine - Sorghum	2270005020	0.10	1.09	0.38	0.00058	0.00598	0.00211
Dsl - Combine - Cotton	2270005020	0.12	1.35	0.48	0.00072	0.00742	0.00261
2-Str Sprayers	2260005035	0.10	0.00	0.28	0.00042	0.00000	0.00118
4-Str Balers	2265005025	0.08	0.06	1.22	0.00030	0.00024	0.00538
4-Str Agricultural Mowers	2265005030	0.03	0.01	1.11	0.00011	0.00002	0.00489
4-Str Sprayers	2265005035	0.44	0.10	9.25	0.00179	0.00040	0.04069
4-Str Tillers > 6 HP	2265005040	0.89	0.10	23.05	0.00371	0.00041	0.10142
4-Str Swathers	2265005045	0.11	0.10	1.94	0.00043	0.00038	0.00853
4-Str Other Agriculture Equipment	2265005055	0.16	0.11	4.14	0.00066	0.00045	0.01823
4-Str Irrigation Sets	2265005060	0.14	0.14	3.39	0.00060	0.00056	0.01493
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Irrigation Sets	2267005060	0.00	0.00	0.01	0.00000	0.00000	0.00002
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.01	0.00000	0.00001	0.00003
CNG - Irrigation Sets	2268005060	0.00	0.08	0.34	0.00001	0.00033	0.00147
Dsl - Balers	2270005025	0.01	0.03	0.02	0.00003	0.00015	0.00011
Dsl - Agricultural Mowers	2270005030	0.00	0.01	0.01	0.00000	0.00003	0.00002
KARNES COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.09	0.56	0.31	0.00040	0.00243	0.00135

Non-Road Mobile Source Emissions - Karnes County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Swathers	2270005045	0.06	0.55	0.30	0.00027	0.00235	0.00128
Dsl - Other Agriculture Equipment	2270005055	0.19	1.57	0.86	0.00082	0.00677	0.00369
Dsl - Irrigation Sets	2270005060	0.12	1.00	0.39	0.00049	0.00432	0.00169
TOTAL		**4.92**	**28.79**	**58.45**	**0.01998**	**0.11405**	**0.24718**
TOTAL NONROAD SOURCES		40.08	58.63	724.27	0.13256	0.22949	2.62919

Non-Road Mobile Source Emissions - Kendall County, 2005

KENDALL COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Construction Equipment							
2-Str Tampers/Rammers	2260002006	1.67	0.02	4.98	0.00700	0.00008	0.02085
2-Str Plate Compactors	2260002009	0.05	0.00	0.18	0.00020	0.00000	0.00074
2-Str Paving Equipment	2260002021	0.05	0.00	0.21	0.00022	0.00000	0.00088
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00001
2-Str Concrete/Industrial Saws	2260002039	3.42	0.04	12.20	0.01432	0.00018	0.05109
2-Str Crushing/Proc. Equipment	2260002054	0.01	0.00	0.04	0.00003	0.00000	0.00017
4-Str Pavers	2265002003	0.10	0.03	4.78	0.00042	0.00013	0.02048
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.04	0.00000	0.00000	0.00016
4-Str Plate Compactors	2265002009	0.45	0.05	8.73	0.00188	0.00018	0.03738
4-Str Rollers	2265002015	0.14	0.06	8.94	0.00059	0.00022	0.03827
4-Str Paving Equipment	2265002021	0.56	0.09	17.19	0.00230	0.00036	0.07360
4-Str Surfacing Equipment	2265002024	0.20	0.04	7.88	0.00081	0.00014	0.03373
4-Str Signal Boards/Light Plants	2265002027	0.01	0.00	0.40	0.00006	0.00001	0.00171
4-Str Trenchers	2265002030	0.39	0.11	14.57	0.00160	0.00042	0.06240
4-Str Bore/Drill Rigs	2265002033	0.26	0.04	4.20	0.00106	0.00015	0.01797
4-Str Concrete/Industrial Saws	2265002039	0.51	0.17	36.28	0.00210	0.00066	0.15536
4-Str Cement & Mortar Mixers	2265002042	0.62	0.08	14.60	0.00252	0.00032	0.06254
4-Str Cranes	2265002045	0.02	0.02	0.57	0.00008	0.00007	0.00243
4-Str Crushing/Proc. Equipment	2265002054	0.05	0.01	2.14	0.00021	0.00005	0.00915
4-Str Rough Terrain Forklift	2265002057	0.03	0.03	0.70	0.00012	0.00012	0.00299
4-Str Rubber Tire Loaders	2265002060	0.07	0.07	1.60	0.00028	0.00029	0.00685
4-Str Tractors/Loaders/Backhoes	2265002066	0.17	0.05	11.51	0.00072	0.00021	0.04930
4-Str Skid Steer Loaders	2265002072	0.13	0.08	4.91	0.00055	0.00032	0.02103
4-Str Dumpers/Tenders	2265002078	0.09	0.01	2.28	0.00036	0.00005	0.00975
4-Str Other Construction Equipment	2265002081	0.03	0.03	0.60	0.00011	0.00011	0.00259
LPG - Pavers	2267002003	0.01	0.02	0.11	0.00003	0.00010	0.00047
LPG - Rollers	2267002015	0.01	0.04	0.19	0.00004	0.00015	0.00079
LPG - Paving Equipment	2267002021	0.00	0.01	0.03	0.00001	0.00003	0.00012
LPG - Surfacing Equipment	2267002024	0.00	0.00	0.02	0.00000	0.00002	0.00008
LPG - Trenchers	2267002030	0.02	0.07	0.34	0.00008	0.00031	0.00143
LPG - Bore/Drill Rigs	2267002033	0.01	0.03	0.11	0.00003	0.00011	0.00047
LPG - Concrete/Industrial Saws	2267002039	0.02	0.06	0.33	0.00007	0.00024	0.00136
LPG - Cranes	2267002045	0.01	0.03	0.12	0.00003	0.00011	0.00050
LPG - Rough Terrain Forklifts	2267002057	0.01	0.05	0.22	0.00005	0.00020	0.00091
LPG - Rubber Tire Loaders	2267002060	0.03	0.11	0.54	0.00013	0.00048	0.00227
LPG - Tractors/Loaders/Backhoes	2267002066	0.00	0.01	0.06	0.00001	0.00005	0.00024
LPG - Skid Steer Loaders	2267002072	0.03	0.10	0.45	0.00011	0.00042	0.00187
LPG - Other Construction Equipment	2267002081	0.01	0.04	0.18	0.00005	0.00017	0.00075
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.01	0.00000	0.00001	0.00003
Dsl - Pavers	2270002003	0.08	0.95	0.37	0.00036	0.00431	0.00169
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.21	2.23	1.02	0.00096	0.01009	0.00463
Dsl - Scrapers	2270002018	0.03	0.39	0.14	0.00014	0.00175	0.00065
Dsl - Paving Equipment	2270002021	0.07	0.75	0.43	0.00032	0.00339	0.00195
Dsl - Surfacing Equipment	2270002024	0.17	2.18	1.08	0.00077	0.00985	0.00488
Dsl - Signal Boards/Light Plants	2270002027	0.11	0.62	0.37	0.00045	0.00261	0.00154
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Bore/Drill Rigs	2270002033	0.00	0.01	0.00	0.00000	0.00003	0.00001
Dsl - Excavators	2270002036	0.62	8.97	3.46	0.00280	0.04058	0.01564
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.00	0.00	0.00000	0.00002	0.00001
Dsl - Cranes	2270002045	0.01	0.12	0.03	0.00005	0.00052	0.00013
Dsl - Graders	2270002048	0.24	2.46	0.97	0.00107	0.01114	0.00440
Dsl - Off-highway Trucks	2270002051	0.07	1.30	0.47	0.00031	0.00589	0.00211
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.02	0.02	0.00001	0.00007	0.00007
Dsl - Rubber Tire Loaders	2270002060	0.45	6.08	2.28	0.00202	0.02750	0.01030
Dsl - Tractors/Loaders/Backhoes	2270002066	1.56	6.08	6.80	0.00707	0.02749	0.03075
Dsl - Crawler Tractor/Dozers	2270002069	0.77	9.59	3.90	0.00348	0.04337	0.01765
Dsl - Skid Steer Loaders	2270002072	0.00	0.01	0.02	0.00002	0.00006	0.00007

Non-Road Mobile Source Emissions - Kendall County, 2005

KENDALL COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Off-Highway Tractors	2270002075	0.09	0.84	0.45	0.00039	0.00382	0.00205
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**13.67**	**44.22**	**184.00**	**0.05844**	**0.19898**	**0.79125**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.34	0.00	1.25	0.00124	0.00002	0.00450
2-Str Pumps	2260006010	1.02	0.02	4.18	0.00370	0.00007	0.01504
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00001
2-Str Hydro Power Units	2260006035	0.00	0.00	0.03	0.00002	0.00000	0.00009
4-Str Generator Sets	2265006005	8.35	2.70	238.88	0.03048	0.00893	0.87917
4-Str Pumps	2265006010	3.32	0.34	68.64	0.01193	0.00113	0.25262
4-Str Air Compressors	2265006015	1.16	0.41	27.73	0.00418	0.00134	0.10204
4-Str Welders	2265006025	1.19	0.30	67.38	0.00434	0.00100	0.24797
4-Str Pressure Washers	2265006030	5.24	0.74	143.48	0.01901	0.00246	0.52807
4-Str Hydro Power Units	2265006035	0.15	0.03	6.39	0.00055	0.00010	0.02351
LPG - Generator Sets	2267006005	0.19	0.92	2.74	0.00068	0.00332	0.00987
LPG - Pumps	2267006010	0.04	0.20	0.65	0.00015	0.00074	0.00232
LPG - Air Compressors	2267006015	0.05	0.24	0.78	0.00018	0.00086	0.00282
LPG - Welders	2267006025	0.08	0.31	1.41	0.00030	0.00110	0.00509
LPG - Pressure Washers	2267006030	0.00	0.00	0.02	0.00000	0.00002	0.00007
LPG - Hydro Power Units	2267006035	0.00	0.00	0.01	0.00000	0.00001	0.00005
CNG - Generator Sets	2268006005	0.00	0.29	0.85	0.00001	0.00105	0.00308
CNG - Pumps	2268006010	0.00	0.01	0.04	0.00000	0.00005	0.00016
CNG - Air Compressors	2268006015	0.00	0.02	0.06	0.00000	0.00007	0.00022
CNG - Gas Compressors	2268006020	0.00	0.25	3.31	0.00002	0.00089	0.01192
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	2.18	24.63	9.30	0.00785	0.08868	0.03348
Dsl - Pumps	2270006010	0.53	5.87	2.25	0.00190	0.02112	0.00812
Dsl - Air Compressors	2270006015	0.30	3.27	1.06	0.00107	0.01177	0.00382
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.39	0.94	1.38	0.00139	0.00339	0.00498
Dsl - Pressure Washers	2270006030	0.02	0.13	0.06	0.00006	0.00048	0.00022
Dsl - Hydro Power Units	2270006035	0.01	0.10	0.05	0.00004	0.00036	0.00017
TOTAL		**24.59**	**41.75**	**581.95**	**0.08910**	**0.14895**	**2.13941**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.00	0.00	0.02	0.00002	0.00000	0.00008
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Aerial Lifts	2265003010	0.08	0.02	3.88	0.00031	0.00007	0.01472
4-Str Forklifts	2265003020	0.17	0.19	4.02	0.00063	0.00064	0.01525
4-Str Sweepers/Scrubbers	2265003030	0.13	0.12	4.54	0.00049	0.00042	0.01723
4-Str Other General Industrial Eqp	2265003040	0.31	0.05	7.95	0.00116	0.00016	0.03014
4-Str Other Material Handling Eqp	2265003050	0.01	0.00	0.24	0.00003	0.00002	0.00093
4-Str AC\Refrigeration	2265003060	0.00	0.00	0.27	0.00001	0.00000	0.00075
4-Str Terminal Tractors	2265003070	0.02	0.03	0.59	0.00009	0.00009	0.00224
LPG - Aerial Lifts	2267003010	0.04	0.15	0.66	0.00015	0.00056	0.00245
LPG - Forklifts	2267003020	3.30	11.89	56.75	0.01223	0.04411	0.21053
LPG - Sweepers/Scrubbers	2267003030	0.03	0.09	0.48	0.00010	0.00034	0.00176
LPG - Other General Industrial Equipment	2267003040	0.01	0.03	0.15	0.00003	0.00011	0.00054
LPG - Other Material Handling Equipment	2267003050	0.00	0.01	0.04	0.00001	0.00003	0.00013
LPG - Terminal Tractors	2267003070	0.01	0.05	0.29	0.00006	0.00019	0.00107
CNG - Forklifts	2268003020	0.02	0.94	4.48	0.00006	0.00349	0.01661
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.01	0.00000	0.00000	0.00002
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - AC\Refrigeration	2268003060	0.00	0.00	0.01	0.00000	0.00001	0.00004
CNG - Terminal Tractors	2268003070	0.00	0.00	0.02	0.00000	0.00001	0.00008
Dsl - Aerial Lifts	2270003010	0.05	0.16	0.17	0.00017	0.00060	0.00062
Dsl - Forklifts	2270003020	0.06	0.62	0.40	0.00022	0.00231	0.00147
Dsl - Sweepers/Scrubbers	2270003030	0.07	0.84	0.26	0.00027	0.00313	0.00095
Dsl - Other General Industrial Eqp	2270003040	0.09	0.97	0.30	0.00032	0.00362	0.00111
Dsl - Other Material Handling Eqp	2270003050	0.01	0.05	0.03	0.00003	0.00017	0.00011

Non-Road Mobile Source Emissions - Kendall County, 2005

KENDALL COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	0.39	3.57	1.69	0.00105	0.00969	0.00461
Dsl - Terminal Tractors	2270003070	0.11	2.11	0.79	0.00042	0.00784	0.00292
TOTAL		**4.91**	**21.91**	**88.04**	**0.01783**	**0.07761**	**0.32639**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Railway Maintenance	2285004015	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Railway Maintenance	2285006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Line-haul Locomotive	2285002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractors/Loaders/Backhoes	2270002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Landfill Equipment

Dsl - Pavers	2270002003	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Const. Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Boating

2-Str Outboard	2282005010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Personal Water Craft	2282005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Inboard/Sterndrive	2282010005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Inboard	2282020005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Outboards	2282020010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	122.52	0.29	117.15	0.38325	0.00092	0.36584
2-Str ATVs	2260001030	153.96	0.37	147.44	0.48156	0.00116	0.46041
2-Str Specialty Vehicles / Carts	2260001060	1.35	0.31	62.05	0.00438	0.00095	0.19377
4-Str Offroad Motorcycles	2265001010	3.46	0.42	51.85	0.01098	0.00120	0.16552
KENDALL COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Kendall County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	33.07	4.01	493.78	0.10491	0.01151	1.57639
4-Str Golf Carts	2265001050	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Specialty Vehicles / Carts	2265001060	1.53	0.33	52.85	0.00482	0.00094	0.16872
LPG - Specialty Vehicles / Carts	2267001060	0.03	0.12	0.50	0.00010	0.00037	0.00157
Dsl - Specialty Vehicle Carts	2270001060	0.48	1.39	1.89	0.00149	0.00435	0.00589
TOTAL		**316.41**	**7.25**	**927.52**	**0.99150**	**0.02142**	**2.93811**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	0.34	0.00	0.85	0.00096	0.00001	0.13656
2-Str Chain Saws < 6 HP (Res)	2260004020	7.54	0.06	18.45	0.01576	0.00012	0.03868
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	11.39	0.09	29.67	0.03200	0.00027	0.08443
2-Str Leafblowers/Vacuums (Res)	2260004030	1.57	0.01	4.13	0.00433	0.00004	0.01174
4-Str Lawn Mowers (Res)	2265004010	6.09	0.44	80.78	0.01698	0.00124	0.22985
4-Str Rotary Tillers <6 HP (Res)	2265004015	1.48	0.10	18.48	0.00415	0.00029	0.05258
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.21	0.01	2.46	0.00058	0.00004	0.00699
4-Str Leafblowers/Vacuums (Res)	2265004030	0.08	0.01	1.00	0.00022	0.00002	0.00285
4-Str Rear Engine Riding Mower (Res)	2265004040	7.20	1.38	292.56	0.01876	0.00392	0.83244
4-Str Lawn & Garden Tractors (Res)	2265004055	4.95	1.40	260.54	0.01486	0.00368	0.76413
4-Str Other Lawn & Garden Equip. (Res)	2265004075	0.37	0.05	8.24	0.00110	0.00013	0.02416
TOTAL		**41.22**	**3.54**	**717.17**	**0.10968**	**0.00974**	**2.18442**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.02	0.00	0.07	0.00012	0.00000	0.00034
2-Str Chain Saws < 6 HP (Com)	2260004021	14.27	0.17	45.86	0.05375	0.00062	0.17263
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.87	0.04	10.22	0.01466	0.00022	0.05220
2-Str Leafblowers/Vacuums (Com)	2260004031	4.31	0.06	15.40	0.02202	0.00032	0.07870
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.03	0.19	33.25	0.00014	0.00089	0.17369
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.10	0.01	1.55	0.00053	0.00004	0.00808
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.07	0.01	1.31	0.00035	0.00003	0.00684
4-Str Leafblowers/Vacuums (Com)	2265004031	1.40	0.53	70.49	0.00715	0.00248	0.36824
4-Str Rear Engine Riding Mower (Com)	2265004041	0.47	0.16	34.63	0.00238	0.00074	0.18091
4-Str Front Mowers (Com)	2265004046	0.53	0.15	26.37	0.00266	0.00071	0.13775
4-Str Shredders < 6 HP (Com)	2265004051	0.49	0.04	7.21	0.00247	0.00020	0.03764
4-Str Lawn & Garden Tractors (Com)	2265004056	0.11	0.04	8.41	0.00057	0.00018	0.04393
4-Str Chippers/Stump Grinders (Com)	2265004066	0.31	0.21	17.97	0.00156	0.00099	0.09388
4-Str Commercial Turf Equipment (Com)	2265004071	0.13	0.04	6.94	0.00066	0.00018	0.03625
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.59	0.08	13.26	0.00290	0.00037	0.06925
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.53	3.11	1.83	0.00273	0.01591	0.00935
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.02	0.01	0.00001	0.00008	0.00005
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.25	2.09	1.00	0.00127	0.01067	0.00513
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00001	0.00001
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.01	0.00	0.00000	0.00003	0.00002
TOTAL		**26.49**	**6.95**	**295.78**	**0.11594**	**0.03467**	**1.47487**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
KENDALL COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

Non-Road Mobile Source Emissions - Kendall County, 2005

4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00001	0.00000	0.00002
2-Str Chain Saws < 6 HP (Com)	2260004021	0.04	0.00	0.16	0.00016	0.00000	0.00062
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	1.36	0.02	5.04	0.00703	0.00011	0.02600
2-Str Leafblowers/Vacuums (Com)	2260004031	0.24	0.00	1.00	0.00124	0.00002	0.00516
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00135	0.00011	0.02112
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.26	0.02	4.01	0.00002	0.00000	0.00031
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.06	0.00036	0.00011	0.02701
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00038	0.00008	0.01727
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00244	0.00020	0.04318
4-Str Commercial Turf Equipment (Com)	2265004071	0.07	0.02	5.12	0.00005	0.00006	0.00140
4-Str Shredders > 6 HP	2265007010	0.07	0.02	3.28	0.00021	0.00003	0.00785
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00004	0.00019	0.00012
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.48	0.04	8.19	0.00009	0.00053	0.00031
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00001	0.00004	0.00003
Dsl - Commercial Turf Equipment (Com)	2270004071	0.01	0.01	0.27	0.00000	0.00003	0.00002
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00003	0.00017	0.00017
TOTAL		**2.55**	**0.14**	**27.12**	**0.01341**	**0.00169**	**0.15057**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.30	0.00	0.96	0.00114	0.00001	0.00367
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.06	0.00	0.20	0.00028	0.00000	0.00098
2-Str Leafblowers/Vacuums (Com)	2260004031	0.02	0.00	0.06	0.00009	0.00000	0.00032
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.02	0.00	0.32	0.00010	0.00001	0.00157
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.26	0.00002	0.00001	0.00128
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
KENDALL COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	0.02	0.01	1.33	0.00009	0.00003	0.00648

Non-Road Mobile Source Emissions - Kendall County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.53	0.33	31.42	0.00260	0.00161	0.15330
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.94**	**0.34**	**34.57**	**0.00431**	**0.00167**	**0.16760**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Hay	2265005015	0.00	0.00	0.05	0.00000	0.00000	0.00003
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00003
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Corn	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Hay	2270005015	0.17	1.54	0.86	0.00013	0.00116	0.00065
Dsl - Tractor - Peanuts	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Small Grains	2270005015	0.01	0.11	0.06	0.00012	0.00100	0.00056
Dsl - Tractor - Sorghum	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Cotton	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Corn	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Hay	2270005020	0.05	0.53	0.19	0.00028	0.00292	0.00103
Dsl - Combine - Peanuts	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Small Grains	2270005020	0.02	0.23	0.08	0.00012	0.00124	0.00044
Dsl - Combine - Sorghum	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Cotton	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Sprayers	2260005035	0.02	0.00	0.05	0.00009	0.00000	0.00024
4-Str Balers	2265005025	0.02	0.01	0.24	0.00007	0.00005	0.00107
4-Str Agricultural Mowers	2265005030	0.01	0.00	0.22	0.00002	0.00000	0.00097
4-Str Sprayers	2265005035	0.09	0.02	1.84	0.00036	0.00008	0.00808
4-Str Tillers > 6 HP	2265005040	0.18	0.02	4.58	0.00074	0.00008	0.02014
4-Str Swathers	2265005045	0.02	0.02	0.39	0.00009	0.00007	0.00169
4-Str Other Agriculture Equipment	2265005055	0.03	0.02	0.82	0.00014	0.00009	0.00362
4-Str Irrigation Sets	2265005060	0.03	0.03	0.67	0.00012	0.00011	0.00296
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Irrigation Sets	2267005060	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Irrigation Sets	2268005060	0.00	0.02	0.07	0.00000	0.00007	0.00029
Dsl - Balers	2270005025	0.00	0.01	0.00	0.00001	0.00003	0.00002
Dsl - Agricultural Mowers	2270005030	0.00	0.00	0.00	0.00000	0.00001	0.00000
KENDALL COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.02	0.11	0.06	0.00008	0.00048	0.00027

Non-Road Mobile Source Emissions - Kendall County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Swathers	2270005045	0.01	0.11	0.06	0.00005	0.00047	0.00025
Dsl - Other Agriculture Equipment	2270005055	0.04	0.31	0.17	0.00016	0.00135	0.00073
Dsl - Irrigation Sets	2270005060	0.02	0.20	0.08	0.00010	0.00086	0.00033
TOTAL		**0.73**	**3.29**	**10.50**	**0.00268**	**0.01007**	**0.04344**
TOTAL NONROAD SOURCES		431.50	129.40	2,866.64	1.40289	0.50479	10.21607

Non-Road Mobile Source Emissions - Kerr County, 2005

KERR COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Construction Equipment							
2-Str Tampers/Rammers	2260002006	0.70	0.01	2.08	0.00292	0.00004	0.00870
2-Str Plate Compactors	2260002006	0.02	0.00	0.07	0.00008	0.00000	0.00031
2-Str Paving Equipment	2260002021	0.02	0.00	0.09	0.00009	0.00000	0.00037
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Concrete/Industrial Saws	2260002039	1.43	0.02	5.09	0.00597	0.00008	0.02131
2-Str Crushing/Proc. Equipment	2260002054	0.00	0.00	0.02	0.00001	0.00000	0.00007
4-Str Pavers	2265002003	0.04	0.01	2.00	0.00018	0.00006	0.00855
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.02	0.00000	0.00000	0.00007
4-Str Plate Compactors	2265002009	0.19	0.02	3.64	0.00078	0.00007	0.01559
4-Str Rollers	2265002015	0.06	0.02	3.73	0.00025	0.00009	0.01597
4-Str Paving Equipment	2265002021	0.23	0.04	7.17	0.00096	0.00015	0.03071
4-Str Surfacing Equipment	2265002024	0.08	0.02	3.29	0.00034	0.00006	0.01407
4-Str Signal Boards/Light Plants	2265002027	0.01	0.00	0.17	0.00002	0.00000	0.00071
4-Str Trenchers	2265002030	0.16	0.05	6.08	0.00067	0.00017	0.02603
4-Str Bore/Drill Rigs	2265002033	0.11	0.02	1.75	0.00044	0.00006	0.00750
4-Str Concrete/Industrial Saws	2265002039	0.21	0.07	15.14	0.00088	0.00028	0.06482
4-Str Cement & Mortar Mixers	2265002042	0.26	0.03	6.09	0.00105	0.00013	0.02609
4-Str Cranes	2265002045	0.01	0.01	0.24	0.00004	0.00003	0.00101
4-Str Crushing/Proc. Equipment	2265002054	0.02	0.00	0.89	0.00009	0.00002	0.00382
4-Str Rough Terrain Forklift	2265002057	0.01	0.01	0.29	0.00005	0.00005	0.00125
4-Str Rubber Tire Loaders	2265002060	0.03	0.03	0.67	0.00012	0.00012	0.00286
4-Str Tractors/Loaders/Backhoes	2265002066	0.07	0.02	4.80	0.00030	0.00009	0.02057
4-Str Skid Steer Loaders	2265002072	0.06	0.03	2.05	0.00023	0.00013	0.00877
4-Str Dumpers/Tenders	2265002078	0.04	0.01	0.95	0.00015	0.00002	0.00407
4-Str Other Construction Equipment	2265002081	0.01	0.01	0.25	0.00005	0.00005	0.00108
LPG - Pavers	2267002003	0.00	0.01	0.05	0.00001	0.00004	0.00019
LPG - Rollers	2267002015	0.00	0.02	0.08	0.00002	0.00006	0.00033
LPG - Paving Equipment	2267002021	0.00	0.00	0.01	0.00000	0.00001	0.00005
LPG - Surfacing Equipment	2267002024	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Trenchers	2267002030	0.01	0.03	0.14	0.00004	0.00013	0.00060
LPG - Bore/Drill Rigs	2267002033	0.00	0.01	0.05	0.00001	0.00005	0.00020
LPG - Concrete/Industrial Saws	2267002039	0.01	0.02	0.14	0.00003	0.00010	0.00057
LPG - Cranes	2267002045	0.00	0.01	0.05	0.00001	0.00005	0.00021
LPG - Rough Terrain Forklifts	2267002057	0.01	0.02	0.09	0.00002	0.00008	0.00038
LPG - Rubber Tire Loaders	2267002060	0.01	0.05	0.23	0.00006	0.00020	0.00095
LPG - Tractors/Loaders/Backhoes	2267002066	0.00	0.00	0.02	0.00001	0.00002	0.00010
LPG - Skid Steer Loaders	2267002072	0.01	0.04	0.19	0.00005	0.00017	0.00078
LPG - Other Construction Equipment	2267002081	0.00	0.02	0.07	0.00002	0.00007	0.00031
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.00	0.00000	0.00000	0.00001
Dsl - Pavers	2270002003	0.12	1.34	0.59	0.00054	0.00605	0.00267
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.28	2.57	1.47	0.00128	0.01162	0.00665
Dsl - Scrapers	2270002018	0.05	0.61	0.23	0.00022	0.00275	0.00104
Dsl - Paving Equipment	2270002021	0.14	1.47	0.80	0.00062	0.00665	0.00362
Dsl - Surfacing Equipment	2270002024	0.31	4.08	2.05	0.00142	0.01846	0.00927
Dsl - Signal Boards/Light Plants	2270002027	0.05	0.26	0.15	0.00019	0.00109	0.00064
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00001	0.00001
Dsl - Bore/Drill Rigs	2270002033	0.00	0.01	0.00	0.00000	0.00005	0.00002
Dsl - Excavators	2270002036	0.47	6.64	2.63	0.00211	0.03006	0.01189
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.01	0.00	0.00000	0.00003	0.00001
Dsl - Cranes	2270002045	0.02	0.18	0.05	0.00007	0.00081	0.00021
Dsl - Graders	2270002048	0.47	5.07	1.88	0.00211	0.02294	0.00852
Dsl - Off-highway Trucks	2270002051	0.07	1.22	0.45	0.00030	0.00553	0.00205
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.02	0.02	0.00002	0.00011	0.00011
Dsl - Rubber Tire Loaders	2270002060	0.70	9.62	3.60	0.00314	0.04354	0.01629
Dsl - Tractors/Loaders/Backhoes	2270002066	2.04	8.01	8.86	0.00923	0.03623	0.04010
Dsl - Crawler Tractor/Dozers	2270002069	1.13	14.37	5.95	0.00512	0.06502	0.02691
Dsl - Skid Steer Loaders	2270002072	0.01	0.02	0.02	0.00003	0.00010	0.00011

Non-Road Mobile Source Emissions - Kerr County, 2005

KERR COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Dsl - Off-Highway Tractors	2270002075	0.13	1.32	0.71	0.00060	0.00596	0.00320
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**9.81**	**57.51**	**97.15**	**0.04295**	**0.25973**	**0.42233**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.26	0.00	0.96	0.00095	0.00001	0.00347
2-Str Pumps	2260006010	0.79	0.01	3.22	0.00285	0.00005	0.01159
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Hydro Power Units	2260006035	0.00	0.00	0.02	0.00001	0.00000	0.00007
4-Str Generator Sets	2265006005	6.44	2.08	184.14	0.02350	0.00689	0.67770
4-Str Pumps	2265006010	2.56	0.26	52.91	0.00919	0.00087	0.19473
4-Str Air Compressors	2265006015	0.90	0.31	21.37	0.00322	0.00103	0.07866
4-Str Welders	2265006025	0.92	0.23	51.94	0.00334	0.00077	0.19115
4-Str Pressure Washers	2265006030	4.04	0.57	110.60	0.01465	0.00189	0.40705
4-Str Hydro Power Units	2265006035	0.12	0.02	4.92	0.00042	0.00008	0.01812
LPG - Generator Sets	2267006005	0.14	0.71	2.11	0.00052	0.00256	0.00761
LPG - Pumps	2267006010	0.03	0.16	0.50	0.00012	0.00057	0.00179
LPG - Air Compressors	2267006015	0.04	0.18	0.60	0.00014	0.00066	0.00217
LPG - Welders	2267006025	0.06	0.24	1.09	0.00023	0.00085	0.00392
LPG - Pressure Washers	2267006030	0.00	0.00	0.01	0.00000	0.00001	0.00005
LPG - Hydro Power Units	2267006035	0.00	0.00	0.01	0.00000	0.00001	0.00004
CNG - Generator Sets	2268006005	0.00	0.22	0.66	0.00001	0.00081	0.00237
CNG - Pumps	2268006010	0.00	0.01	0.03	0.00000	0.00004	0.00012
CNG - Air Compressors	2268006015	0.00	0.01	0.05	0.00000	0.00005	0.00017
CNG - Gas Compressors	2268006020	0.00	0.19	2.55	0.00001	0.00069	0.00919
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	1.68	18.99	7.17	0.00605	0.06836	0.02581
Dsl - Pumps	2270006010	0.41	4.52	1.74	0.00147	0.01628	0.00626
Dsl - Air Compressors	2270006015	0.23	2.52	0.82	0.00083	0.00907	0.00295
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.30	0.72	1.07	0.00107	0.00261	0.00384
Dsl - Pressure Washers	2270006030	0.01	0.10	0.05	0.00005	0.00037	0.00017
Dsl - Hydro Power Units	2270006035	0.01	0.08	0.04	0.00003	0.00028	0.00013
TOTAL		**18.95**	**32.18**	**448.58**	**0.06868**	**0.11482**	**1.64913**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.00	0.00	0.02	0.00002	0.00000	0.00008
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Aerial Lifts	2265003010	0.08	0.02	3.83	0.00030	0.00007	0.01454
4-Str Forklifts	2265003020	0.17	0.19	3.97	0.00062	0.00063	0.01506
4-Str Sweepers/Scrubbers	2265003030	0.13	0.12	4.49	0.00048	0.00041	0.01701
4-Str Other General Industrial Eqp	2265003040	0.31	0.05	7.85	0.00114	0.00016	0.02977
4-Str Other Material Handling Eqp	2265003050	0.01	0.00	0.24	0.00003	0.00002	0.00092
4-Str AC\Refrigeration	2265003060	0.01	0.00	0.48	0.00003	0.00001	0.00133
4-Str Terminal Tractors	2265003070	0.02	0.03	0.58	0.00009	0.00009	0.00221
LPG - Aerial Lifts	2267003010	0.04	0.15	0.65	0.00015	0.00055	0.00241
LPG - Forklifts	2267003020	3.26	11.74	56.05	0.01208	0.04356	0.20792
LPG - Sweepers/Scrubbers	2267003030	0.03	0.09	0.47	0.00009	0.00033	0.00174
LPG - Other General Industrial Equipment	2267003040	0.01	0.03	0.14	0.00003	0.00011	0.00053
LPG - Other Material Handling Equipment	2267003050	0.00	0.01	0.04	0.00001	0.00003	0.00013
LPG - Terminal Tractors	2267003070	0.01	0.05	0.29	0.00005	0.00019	0.00106
CNG - Forklifts	2268003020	0.02	0.93	4.42	0.00006	0.00344	0.01640
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.01	0.00000	0.00000	0.00002
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - AC\Refrigeration	2268003060	0.00	0.00	0.02	0.00000	0.00001	0.00006
CNG - Terminal Tractors	2268003070	0.00	0.00	0.02	0.00000	0.00001	0.00008
Dsl - Aerial Lifts	2270003010	0.05	0.16	0.17	0.00017	0.00059	0.00062
Dsl - Forklifts	2270003020	0.06	0.62	0.39	0.00022	0.00228	0.00145
Dsl - Sweepers/Scrubbers	2270003030	0.07	0.83	0.25	0.00027	0.00309	0.00094
Dsl - Other General Industrial Eqp	2270003040	0.08	0.96	0.30	0.00031	0.00357	0.00110
Dsl - Other Material Handling Eqp	2270003050	0.01	0.05	0.03	0.00003	0.00017	0.00011

Non-Road Mobile Source Emissions - Kerr County, 2005

KERR COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	0.68	6.31	3.00	0.00186	0.01716	0.00815
Dsl - Terminal Tractors	2270003070	0.11	2.09	0.78	0.00041	0.00774	0.00289
TOTAL		**5.16**	**24.43**	**88.49**	**0.01844**	**0.08424**	**0.32656**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Railway Maintenance	2285004015	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Railway Maintenance	2285006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Line-haul Locomotive	2285002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.00	0.05	0.02	0.00001	0.00019	0.00008
Dsl - Excavators	2270002036	0.01	0.20	0.07	0.00005	0.00068	0.00024
Dsl - Graders	2270002048	0.00	0.01	0.00	0.00000	0.00004	0.00001
Dsl - Off Highway Trucks	2270002051	0.08	1.31	0.43	0.00026	0.00454	0.00147
Dsl - Rubber Tire Loaders	2270002060	0.08	1.09	0.45	0.00028	0.00375	0.00154
Dsl - Tractors/Loaders/Backhoes	2270002066	0.01	0.05	0.04	0.00004	0.00016	0.00015
Dsl - Crawler Tractors/Dozers	2270002069	0.01	0.11	0.04	0.00003	0.00039	0.00015
TOTAL		**0.19**	**2.82**	**1.05**	**0.00067**	**0.00974**	**0.00364**

Landfill Equipment

Dsl - Pavers	2270002003	0.24	4.71	1.56	0.00098	0.01915	0.00636
Dsl - Scrapers	2270002018	0.16	2.80	0.91	0.00065	0.01139	0.00368
Dsl - Excavators	2270002036	0.01	0.18	0.05	0.00006	0.00073	0.00021
Dsl - Graders	2270002048	0.04	0.49	0.14	0.00015	0.00201	0.00055
Dsl - Off Highway Trucks	2270002051	0.05	0.72	0.19	0.00022	0.00294	0.00078
Dsl - Rubber Tire Loaders	2270002060	0.06	0.69	0.20	0.00023	0.00280	0.00082
Dsl - Crawler Tractors/Dozers	2270002069	0.26	3.19	1.06	0.00107	0.01295	0.00431
Dsl - Other Const. Equipment	2270002081	0.13	1.48	0.53	0.00053	0.00602	0.00216
TOTAL		**0.96**	**14.27**	**4.64**	**0.00389**	**0.05800**	**0.01888**

Recreational Boating

2-Str Outboard	2282005010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Personal Water Craft	2282005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Inboard/Sterndrive	2282010005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Inboard	2282020005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Outboards	2282020010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	285.88	0.69	273.36	0.89426	0.00215	0.85362
2-Str ATVs	2260001030	359.25	0.87	344.03	1.12363	0.00272	1.07430
2-Str Specialty Vehicles / Carts	2260001060	3.14	0.71	144.79	0.01022	0.00223	0.45213
4-Str Offroad Motorcycles	2265001010	8.08	0.98	120.98	0.02562	0.00281	0.38621
KERR COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Kerr County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	77.16	9.36	1,152.16	0.24479	0.02686	3.67823
4-Str Golf Carts	2265001050	1.50	0.49	135.11	0.00470	0.00141	0.43135
4-Str Specialty Vehicles / Carts	2265001060	3.58	0.77	123.31	0.01125	0.00220	0.39368
LPG - Specialty Vehicles / Carts	2267001060	0.08	0.28	1.17	0.00024	0.00087	0.00366
Dsl - Specialty Vehicle Carts	2270001060	1.11	3.25	4.40	0.00348	0.01016	0.01375
TOTAL		**739.78**	**17.40**	**2,299.32**	**2.31819**	**0.05139**	**7.28693**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	0.70	0.00	1.76	0.00200	0.00001	0.00501
2-Str Chain Saws < 6 HP (Res)	2260004020	15.59	0.12	38.17	0.03268	0.00025	0.08001
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	23.55	0.20	61.37	0.06701	0.00056	0.17462
2-Str Leafblowers/Vacuums (Res)	2260004030	3.25	0.03	8.53	0.00926	0.00008	0.02428
4-Str Lawn Mowers (Res)	2265004010	12.60	0.90	167.07	0.03587	0.00257	0.47538
4-Str Rotary Tillers <6 HP (Res)	2265004015	3.07	0.21	38.22	0.00872	0.00059	0.10873
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.43	0.03	5.08	0.00121	0.00008	0.01446
4-Str Leafblowers/Vacuums (Res)	2265004030	0.16	0.01	2.07	0.00047	0.00003	0.00590
4-Str Rear Engine Riding Mower (Res)	2265004040	14.88	2.85	605.07	0.04235	0.00812	1.72162
4-Str Lawn & Garden Tractors (Res)	2265004055	10.25	2.89	539.89	0.03078	0.00762	1.58345
4-Str Other Lawn & Garden Equip. (Res)	2265004075	0.77	0.10	17.07	0.00227	0.00026	0.05007
TOTAL		**85.26**	**7.34**	**1,484.30**	**0.23263**	**0.02016**	**4.24353**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.02	0.00	0.05	0.00009	0.00000	0.00026
2-Str Chain Saws < 6 HP (Com)	2260004021	10.66	0.12	34.26	0.04015	0.00047	0.12895
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.14	0.03	7.63	0.01095	0.00016	0.03899
2-Str Leafblowers/Vacuums (Com)	2260004031	3.22	0.05	11.51	0.01645	0.00024	0.05879
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.02	0.14	24.84	0.00010	0.00066	0.12974
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.08	0.01	1.16	0.00040	0.00003	0.00604
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.05	0.00	0.98	0.00026	0.00002	0.00511
4-Str Leafblowers/Vacuums (Com)	2265004031	1.05	0.40	52.66	0.00534	0.00186	0.27507
4-Str Rear Engine Riding Mower (Com)	2265004041	0.35	0.12	25.87	0.00178	0.00055	0.13514
4-Str Front Mowers (Com)	2265004046	0.40	0.11	19.70	0.00198	0.00053	0.10290
4-Str Shredders < 6 HP (Com)	2265004051	0.36	0.03	5.38	0.00184	0.00015	0.02812
4-Str Lawn & Garden Tractors (Com)	2265004056	0.08	0.03	6.28	0.00043	0.00013	0.03281
4-Str Chippers/Stump Grinders (Com)	2265004066	0.23	0.16	13.43	0.00116	0.00074	0.07013
4-Str Commercial Turf Equipment (Com)	2265004071	0.10	0.03	5.18	0.00049	0.00013	0.02708
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.44	0.06	9.90	0.00216	0.00027	0.05173
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.40	2.33	1.37	0.00204	0.01188	0.00698
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.01	0.01	0.00001	0.00006	0.00004
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.19	1.56	0.75	0.00095	0.00797	0.00383
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00002	0.00001
TOTAL		**19.79**	**5.19**	**220.94**	**0.08660**	**0.02590**	**1.10171**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
KERR COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

Non-Road Mobile Source Emissions - Kerr County, 2005

4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00001	0.00000	0.00003
2-Str Chain Saws < 6 HP (Com)	2260004021	0.06	0.00	0.22	0.00022	0.00000	0.00085
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	1.89	0.03	6.98	0.00974	0.00015	0.03600
2-Str Leafblowers/Vacuums (Com)	2260004031	0.33	0.01	1.38	0.00172	0.00003	0.00714
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00186	0.00015	0.02925
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.36	0.03	5.55	0.00003	0.00000	0.00043
4-Str Rear Engine Riding Mower (Com)	2265004041	0.01	0.00	0.08	0.00049	0.00016	0.03740
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00052	0.00012	0.02391
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00338	0.00027	0.05978
4-Str Commercial Turf Equipment (Com)	2265004071	0.10	0.03	7.09	0.00007	0.00008	0.00194
4-Str Shredders > 6 HP	2265007010	0.10	0.02	4.53	0.00029	0.00005	0.01087
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00005	0.00027	0.00016
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.66	0.06	11.34	0.00012	0.00074	0.00043
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00001	0.00006	0.00004
Dsl - Commercial Turf Equipment (Com)	2270004071	0.01	0.02	0.37	0.00001	0.00005	0.00002
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00004	0.00023	0.00024
TOTAL		**3.53**	**0.20**	**37.56**	**0.01857**	**0.00235**	**0.20849**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.20	0.00	0.61	0.00065	0.00001	0.00204
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.97	0.02	3.59	0.00436	0.00007	0.01614
2-Str Leafblowers/Vacuums (Com)	2260004031	1.46	0.03	6.04	0.00656	0.00011	0.02719
4-Str Lawn Mowers (Com)	2265004011	0.22	0.02	3.37	0.00100	0.00008	0.01549
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.03	0.00	0.46	0.00014	0.00001	0.00210
4-Str Rear Engine Riding Mower (Com)	2265004041	0.86	0.29	63.47	0.00383	0.00119	0.29206
4-Str Front Mowers (Com)	2265004046	5.35	5.56	119.59	0.02372	0.02299	0.55027
4-Str Commercial Turf Equipment (Com)	2265004071	5.04	1.79	413.87	0.02254	0.00741	1.90443
Dsl - Front Mowers (Com)	2270004046	0.50	2.76	1.63	0.00227	0.01244	0.00734
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.23	1.38	0.77	0.00104	0.00623	0.00347
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.01	0.14	0.05	0.00006	0.00062	0.00024
TOTAL		**14.87**	**11.99**	**613.45**	**0.06617**	**0.05116**	**2.82078**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.33	0.00	1.07	0.00127	0.00001	0.00409
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.21	0.00	0.73	0.00101	0.00001	0.00357
2-Str Leafblowers/Vacuums (Com)	2260004031	0.05	0.00	0.19	0.00019	0.00000	0.00067
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.01	0.00	0.14	0.00004	0.00000	0.00057
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
KERR COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	0.04	0.01	3.06	0.00016	0.00005	0.01254

Non-Road Mobile Source Emissions - Kerr County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.50	0.31	29.66	0.00246	0.00152	0.14471
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.16	0.46	0.59	0.00060	0.00177	0.00226
TOTAL		**1.29**	**0.79**	**35.44**	**0.00573**	**0.00338**	**0.16842**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.05	0.00	0.18	0.00025	0.00000	0.00090
4-Str Lawn Mowers (Com)	2265004011	0.04	0.00	0.54	0.00012	0.00001	0.00188
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.09**	**0.00**	**0.72**	**0.00037**	**0.00001**	**0.00278**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Hay	2265005015	0.00	0.00	0.05	0.00000	0.00000	0.00003
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00001
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Corn	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Hay	2270005015	0.17	1.53	0.85	0.00013	0.00115	0.00064
Dsl - Tractor - Peanuts	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Small Grains	2270005015	0.00	0.02	0.01	0.00002	0.00017	0.00009
Dsl - Tractor - Sorghum	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Cotton	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Corn	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Hay	2270005020	0.05	0.53	0.19	0.00028	0.00289	0.00102
Dsl - Combine - Peanuts	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Small Grains	2270005020	0.00	0.04	0.01	0.00002	0.00021	0.00007
Dsl - Combine - Sorghum	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Cotton	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Sprayers	2260005035	0.02	0.00	0.06	0.00009	0.00000	0.00024
4-Str Balers	2265005025	0.02	0.01	0.25	0.00007	0.00005	0.00110
4-Str Agricultural Mowers	2265005030	0.01	0.00	0.23	0.00002	0.00000	0.00100
4-Str Sprayers	2265005035	0.09	0.02	1.89	0.00038	0.00008	0.00833
4-Str Tillers > 6 HP	2265005040	0.18	0.02	4.72	0.00077	0.00008	0.02077
4-Str Swathers	2265005045	0.02	0.02	0.40	0.00010	0.00008	0.00175
4-Str Other Agriculture Equipment	2265005055	0.03	0.02	0.85	0.00014	0.00009	0.00373
4-Str Irrigation Sets	2265005060	0.03	0.03	0.69	0.00013	0.00011	0.00306
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Irrigation Sets	2267005060	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Irrigation Sets	2268005060	0.00	0.02	0.07	0.00000	0.00007	0.00030
Dsl - Balers	2270005025	0.00	0.01	0.01	0.00001	0.00003	0.00002
Dsl - Agricultural Mowers	2270005030	0.00	0.00	0.00	0.00000	0.00001	0.00001
KERR COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.02	0.12	0.06	0.00008	0.00050	0.00028

Non-Road Mobile Source Emissions - Kerr County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Swathers	2270005045	0.01	0.11	0.06	0.00006	0.00048	0.00026
Dsl - Other Agriculture Equipment	2270005055	0.04	0.32	0.18	0.00017	0.00139	0.00076
Dsl - Irrigation Sets	2270005060	0.02	0.21	0.08	0.00010	0.00088	0.00035
TOTAL		**0.72**	**3.02**	**10.66**	**0.00255**	**0.00827**	**0.04383**
TOTAL NONROAD SOURCES		900.40	177.14	5,342.32	2.86545	0.68913	18.29700

Non-Road Mobile Source Emissions - Medina County, 2005

MEDINA COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Construction Equipment							
2-Str Tampers/Rammers	2260002006	0.25	0.00	0.76	0.00107	0.00001	0.00318
2-Str Plate Compactors	2260002009	0.01	0.00	0.03	0.00003	0.00000	0.00011
2-Str Paving Equipment	2260002021	0.01	0.00	0.03	0.00003	0.00000	0.00013
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Concrete/Industrial Saws	2260002039	0.52	0.01	1.86	0.00218	0.00003	0.00778
2-Str Crushing/Proc. Equipment	2260002054	0.00	0.00	0.01	0.00001	0.00000	0.00003
4-Str Pavers	2265002003	0.02	0.01	0.73	0.00006	0.00002	0.00312
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.01	0.00000	0.00000	0.00002
4-Str Plate Compactors	2265002009	0.07	0.01	1.33	0.00029	0.00003	0.00569
4-Str Rollers	2265002015	0.02	0.01	1.36	0.00009	0.00003	0.00583
4-Str Paving Equipment	2265002021	0.09	0.01	2.62	0.00035	0.00005	0.01121
4-Str Surfacing Equipment	2265002024	0.03	0.01	1.20	0.00012	0.00002	0.00514
4-Str Signal Boards/Light Plants	2265002027	0.00	0.00	0.06	0.00001	0.00000	0.00026
4-Str Trenchers	2265002030	0.06	0.02	2.22	0.00024	0.00006	0.00951
4-Str Bore/Drill Rigs	2265002033	0.04	0.01	0.64	0.00016	0.00002	0.00274
4-Str Concrete/Industrial Saws	2265002039	0.08	0.03	5.53	0.00032	0.00010	0.02367
4-Str Cement & Mortar Mixers	2265002042	0.09	0.01	2.22	0.00038	0.00005	0.00953
4-Str Cranes	2265002045	0.00	0.00	0.09	0.00001	0.00001	0.00037
4-Str Crushing/Proc. Equipment	2265002054	0.01	0.00	0.33	0.00003	0.00001	0.00139
4-Str Rough Terrain Forklift	2265002057	0.00	0.00	0.11	0.00002	0.00002	0.00046
4-Str Rubber Tire Loaders	2265002060	0.01	0.01	0.24	0.00004	0.00004	0.00104
4-Str Tractors/Loaders/Backhoes	2265002066	0.03	0.01	1.75	0.00011	0.00003	0.00751
4-Str Skid Steer Loaders	2265002072	0.02	0.01	0.75	0.00008	0.00005	0.00320
4-Str Dumpers/Tenders	2265002078	0.01	0.00	0.35	0.00005	0.00001	0.00149
4-Str Other Construction Equipment	2265002081	0.00	0.00	0.09	0.00002	0.00002	0.00039
LPG - Pavers	2267002003	0.00	0.00	0.02	0.00000	0.00002	0.00007
LPG - Rollers	2267002015	0.00	0.01	0.03	0.00001	0.00002	0.00012
LPG - Paving Equipment	2267002021	0.00	0.00	0.00	0.00000	0.00000	0.00002
LPG - Surfacing Equipment	2267002024	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Trenchers	2267002030	0.00	0.01	0.05	0.00001	0.00005	0.00022
LPG - Bore/Drill Rigs	2267002033	0.00	0.00	0.02	0.00000	0.00002	0.00007
LPG - Concrete/Industrial Saws	2267002039	0.00	0.01	0.05	0.00001	0.00004	0.00021
LPG - Cranes	2267002045	0.00	0.00	0.02	0.00000	0.00002	0.00008
LPG - Rough Terrain Forklifts	2267002057	0.00	0.01	0.03	0.00001	0.00003	0.00014
LPG - Rubber Tire Loaders	2267002060	0.00	0.02	0.08	0.00002	0.00007	0.00035
LPG - Tractors/Loaders/Backhoes	2267002066	0.00	0.00	0.01	0.00000	0.00001	0.00004
LPG - Skid Steer Loaders	2267002072	0.00	0.02	0.07	0.00002	0.00006	0.00028
LPG - Other Construction Equipment	2267002081	0.00	0.01	0.03	0.00001	0.00003	0.00011
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Pavers	2270002003	0.07	0.77	0.34	0.00030	0.00347	0.00156
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.13	1.13	0.67	0.00059	0.00512	0.00303
Dsl - Scrapers	2270002018	0.03	0.42	0.16	0.00014	0.00189	0.00071
Dsl - Paving Equipment	2270002021	0.10	1.08	0.62	0.00047	0.00488	0.00282
Dsl - Surfacing Equipment	2270002024	0.06	0.86	0.43	0.00029	0.00391	0.00194
Dsl - Signal Boards/Light Plants	2270002027	0.02	0.09	0.06	0.00007	0.00040	0.00023
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00001	0.00001
Dsl - Bore/Drill Rigs	2270002033	0.00	0.01	0.00	0.00000	0.00005	0.00002
Dsl - Excavators	2270002036	0.33	4.61	1.84	0.00151	0.02084	0.00831
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.01	0.00	0.00000	0.00003	0.00001
Dsl - Cranes	2270002045	0.01	0.17	0.04	0.00007	0.00075	0.00019
Dsl - Graders	2270002048	0.28	2.86	1.16	0.00128	0.01293	0.00524
Dsl - Off-highway Trucks	2270002051	0.09	1.78	0.63	0.00043	0.00804	0.00284
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.02	0.02	0.00002	0.00010	0.00010
Dsl - Rubber Tire Loaders	2270002060	0.30	4.17	1.60	0.00135	0.01887	0.00726
Dsl - Tractors/Loaders/Backhoes	2270002066	1.57	6.18	6.90	0.00710	0.02798	0.03120
Dsl - Crawler Tractor/Dozers	2270002069	0.66	8.10	3.38	0.00298	0.03664	0.01531
Dsl - Skid Steer Loaders	2270002072	0.01	0.02	0.02	0.00003	0.00009	0.00010

Non-Road Mobile Source Emissions - Medina County, 2005

MEDINA COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - Off-Highway Tractors	2270002075	0.12	1.22	0.65	0.00056	0.00552	0.00296
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**5.20**	**33.74**	**43.24**	**0.02302**	**0.15249**	**0.18937**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.14	0.00	0.52	0.00052	0.00001	0.00188
2-Str Pumps	2260006010	0.43	0.01	1.74	0.00154	0.00003	0.00627
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Hydro Power Units	2260006035	0.00	0.00	0.01	0.00001	0.00000	0.00004
4-Str Generator Sets	2265006005	3.48	1.13	99.53	0.01270	0.00372	0.36632
4-Str Pumps	2265006010	1.38	0.14	28.60	0.00497	0.00047	0.10526
4-Str Air Compressors	2265006015	0.48	0.17	11.55	0.00174	0.00056	0.04252
4-Str Welders	2265006025	0.50	0.13	28.07	0.00181	0.00041	0.10332
4-Str Pressure Washers	2265006030	2.18	0.31	59.78	0.00792	0.00102	0.22003
4-Str Hydro Power Units	2265006035	0.06	0.01	2.66	0.00023	0.00004	0.00980
LPG - Generator Sets	2267006005	0.08	0.38	1.14	0.00028	0.00138	0.00411
LPG - Pumps	2267006010	0.02	0.09	0.27	0.00006	0.00031	0.00097
LPG - Air Compressors	2267006015	0.02	0.10	0.33	0.00007	0.00036	0.00117
LPG - Welders	2267006025	0.03	0.13	0.59	0.00013	0.00046	0.00212
LPG - Pressure Washers	2267006030	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Hydro Power Units	2267006035	0.00	0.00	0.01	0.00000	0.00001	0.00002
CNG - Generator Sets	2268006005	0.00	0.12	0.36	0.00001	0.00044	0.00128
CNG - Pumps	2268006010	0.00	0.01	0.02	0.00000	0.00002	0.00007
CNG - Air Compressors	2268006015	0.00	0.01	0.03	0.00000	0.00003	0.00009
CNG - Gas Compressors	2268006020	0.00	0.10	1.38	0.00001	0.00037	0.00497
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	0.91	10.26	3.87	0.00327	0.03695	0.01395
Dsl - Pumps	2270006010	0.22	2.44	0.94	0.00079	0.00880	0.00338
Dsl - Air Compressors	2270006015	0.12	1.36	0.44	0.00045	0.00491	0.00159
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.16	0.39	0.58	0.00058	0.00141	0.00208
Dsl - Pressure Washers	2270006030	0.01	0.06	0.03	0.00003	0.00020	0.00009
Dsl - Hydro Power Units	2270006035	0.00	0.04	0.02	0.00002	0.00015	0.00007
TOTAL		**10.24**	**17.39**	**242.48**	**0.03713**	**0.06206**	**0.89142**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.00	0.00	0.01	0.00001	0.00000	0.00005
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Aerial Lifts	2265003010	0.05	0.01	2.37	0.00019	0.00004	0.00899
4-Str Forklifts	2265003020	0.10	0.11	2.46	0.00038	0.00039	0.00932
4-Str Sweepers/Scrubbers	2265003030	0.08	0.07	2.78	0.00030	0.00025	0.01053
4-Str Other General Industrial Eqp	2265003040	0.19	0.03	4.86	0.00071	0.00010	0.01842
4-Str Other Material Handling Eqp	2265003050	0.00	0.00	0.15	0.00002	0.00001	0.00057
4-Str AC\Refrigeration	2265003060	0.01	0.00	0.43	0.00002	0.00000	0.00121
4-Str Terminal Tractors	2265003070	0.01	0.02	0.36	0.00005	0.00006	0.00137
LPG - Aerial Lifts	2267003010	0.02	0.09	0.40	0.00009	0.00034	0.00149
LPG - Forklifts	2267003020	2.02	7.27	34.68	0.00748	0.02695	0.12865
LPG - Sweepers/Scrubbers	2267003030	0.02	0.06	0.29	0.00006	0.00021	0.00108
LPG - Other General Industrial Equipment	2267003040	0.00	0.02	0.09	0.00002	0.00007	0.00033
LPG - Other Material Handling Equipment	2267003050	0.00	0.00	0.02	0.00000	0.00002	0.00008
LPG - Terminal Tractors	2267003070	0.01	0.03	0.18	0.00003	0.00012	0.00065
CNG - Forklifts	2268003020	0.01	0.57	2.74	0.00003	0.00213	0.01015
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - AC\Refrigeration	2268003060	0.00	0.00	0.02	0.00000	0.00001	0.00006
CNG - Terminal Tractors	2268003070	0.00	0.00	0.01	0.00000	0.00001	0.00005
Dsl - Aerial Lifts	2270003010	0.03	0.10	0.10	0.00011	0.00037	0.00038
Dsl - Forklifts	2270003020	0.04	0.38	0.24	0.00013	0.00141	0.00090
Dsl - Sweepers/Scrubbers	2270003030	0.04	0.52	0.16	0.00017	0.00191	0.00058
Dsl - Other General Industrial Eqp	2270003040	0.05	0.60	0.18	0.00019	0.00221	0.00068
Dsl - Other Material Handling Eqp	2270003050	0.01	0.03	0.02	0.00002	0.00011	0.00007

Non-Road Mobile Source Emissions - Medina County, 2005

MEDINA COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	0.62	5.74	2.73	0.00169	0.01559	0.00741
Dsl - Terminal Tractors	2270003070	0.07	1.29	0.48	0.00026	0.00479	0.00179
TOTAL		**3.39**	**16.95**	**55.77**	**0.01196**	**0.05710**	**0.20482**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.08	0.43	0.35	0.00029	0.00149	0.00122
4-Str Railway Maintenance	2285004015	0.02	0.01	1.02	0.00007	0.00002	0.00356
LPG - Railway Maintenance	2285006015	0.00	0.00	0.00	0.00000	0.00000	0.00001
Line-haul Locomotive	2285002006	27.33	693.70	106.68	0.07488	1.90054	0.29229
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**27.43**	**694.14**	**108.06**	**0.07523**	**1.90205**	**0.29708**

Mining Equipment

4 - Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.02	0.27	0.11	0.00006	0.00093	0.00038
Dsl - Excavators	2270002036	0.14	1.87	0.65	0.00048	0.00647	0.00225
Dsl - Graders	2270002048	0.00	0.06	0.02	0.00002	0.00022	0.00007
Dsl - Off Highway Trucks	2270002051	0.76	13.02	4.21	0.00263	0.04498	0.01456
Dsl - Rubber Tire Loaders	2270002060	0.79	10.57	4.35	0.00273	0.03649	0.01502
Dsl - Tractors/Loaders/Backhoes	2270002066	0.11	0.48	0.45	0.00037	0.00165	0.00154
Dsl - Crawler Tractors/Dozers	2270002069	0.09	1.22	0.48	0.00030	0.00420	0.00164
TOTAL		**1.91**	**27.49**	**10.27**	**0.00658**	**0.09492**	**0.03546**

Landfill Equipment

Dsl - Pavers	2270002003	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Const. Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Boating

2-Str Outboard	2282005010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Personal Water Craft	2282005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Inboard/Sterndrive	2282010005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Inboard	2282020005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Outboards	2282020010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	40.84	0.10	39.05	0.12775	0.00031	0.12195
2-Str ATVs	2260001030	51.32	0.12	49.15	0.16052	0.00039	0.15347
2-Str Specialty Vehicles / Carts	2260001060	0.45	0.10	20.68	0.00146	0.00032	0.06459
4-Str Offroad Motorcycles	2265001010	1.15	0.14	17.28	0.00366	0.00040	0.05517
MEDINA COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Medina County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	11.02	1.34	164.59	0.03497	0.00384	0.52546
4-Str Golf Carts	2265001050	1.50	0.49	135.11	0.00470	0.00141	0.43135
4-Str Specialty Vehicles / Carts	2265001060	0.51	0.11	17.62	0.00161	0.00031	0.05624
LPG - Specialty Vehicles / Carts	2267001060	0.01	0.04	0.17	0.00003	0.00012	0.00052
Dsl - Specialty Vehicle Carts	2270001060	0.16	0.46	0.63	0.00050	0.00145	0.00196
TOTAL		**106.97**	**2.91**	**444.28**	**0.33520**	**0.00855**	**1.41071**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	0.51	0.00	1.27	0.00144	0.00001	0.00363
2-Str Chain Saws < 6 HP (Res)	2260004020	11.27	0.08	27.60	0.02363	0.00018	0.05785
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	17.03	0.14	44.37	0.04845	0.00040	0.12626
2-Str Leafblowers/Vacuums (Res)	2260004030	2.35	0.02	6.17	0.00670	0.00005	0.01756
4-Str Lawn Mowers (Res)	2265004010	9.11	0.65	120.80	0.02593	0.00186	0.34373
4-Str Rotary Tillers <6 HP (Res)	2265004015	2.22	0.15	27.63	0.00631	0.00043	0.07862
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.31	0.02	3.68	0.00087	0.00006	0.01046
4-Str Leafblowers/Vacuums (Res)	2265004030	0.12	0.01	1.50	0.00034	0.00002	0.00427
4-Str Rear Engine Riding Mower (Res)	2265004040	10.76	2.06	437.51	0.03062	0.00587	1.24485
4-Str Lawn & Garden Tractors (Res)	2265004055	7.89	2.22	415.25	0.02368	0.00586	1.21788
4-Str Other Lawn & Garden Equip. (Res)	2265004075	0.59	0.08	13.13	0.00175	0.00020	0.03851
TOTAL		**62.16**	**5.44**	**1,098.91**	**0.16973**	**0.01494**	**3.14360**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.02	0.00	0.05	0.00001	0.00000	0.00004
2-Str Chain Saws < 6 HP (Com)	2260004021	10.66	0.12	34.26	0.00648	0.00008	0.02080
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.14	0.03	7.63	0.00177	0.00003	0.00629
2-Str Leafblowers/Vacuums (Com)	2260004031	3.22	0.05	11.51	0.00265	0.00004	0.00948
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.02	0.14	24.84	0.00002	0.00011	0.02093
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.08	0.01	1.16	0.00006	0.00001	0.00097
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.05	0.00	0.98	0.00004	0.00000	0.00082
4-Str Leafblowers/Vacuums (Com)	2265004031	1.05	0.40	52.66	0.00086	0.00030	0.04437
4-Str Rear Engine Riding Mower (Com)	2265004041	0.35	0.12	25.87	0.00029	0.00009	0.02180
4-Str Front Mowers (Com)	2265004046	0.40	0.11	19.70	0.00032	0.00008	0.01660
4-Str Shredders < 6 HP (Com)	2265004051	0.36	0.03	5.38	0.00030	0.00002	0.00453
4-Str Lawn & Garden Tractors (Com)	2265004056	0.08	0.03	6.28	0.00007	0.00002	0.00529
4-Str Chippers/Stump Grinders (Com)	2265004066	0.23	0.16	13.43	0.00019	0.00012	0.01131
4-Str Commercial Turf Equipment (Com)	2265004071	0.10	0.03	5.18	0.00008	0.00002	0.00437
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.44	0.06	9.90	0.00035	0.00004	0.00834
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.40	2.33	1.37	0.00033	0.00192	0.00113
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.01	0.01	0.00000	0.00001	0.00001
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.19	1.56	0.75	0.00015	0.00129	0.00062
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**19.79**	**5.19**	**220.94**	**0.01397**	**0.00418**	**0.17770**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
MEDINA COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

Non-Road Mobile Source Emissions - Medina County, 2005

4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00001	0.00000	0.00003
2-Str Chain Saws < 6 HP (Com)	2260004021	0.07	0.00	0.25	0.00022	0.00000	0.00085
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.10	0.03	7.76	0.00974	0.00015	0.03600
2-Str Leafblowers/Vacuums (Com)	2260004031	0.37	0.01	1.54	0.00172	0.00003	0.00714
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00186	0.00015	0.02925
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.40	0.03	6.16	0.00003	0.00000	0.00043
4-Str Rear Engine Riding Mower (Com)	2265004041	0.01	0.00	0.09	0.00049	0.00016	0.03740
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00052	0.00012	0.02391
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00338	0.00027	0.05978
4-Str Commercial Turf Equipment (Com)	2265004071	0.11	0.04	7.88	0.00007	0.00008	0.00194
4-Str Shredders > 6 HP	2265007010	0.11	0.03	5.04	0.00029	0.00005	0.01087
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00005	0.00027	0.00016
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.74	0.06	12.60	0.00012	0.00074	0.00043
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00001	0.00006	0.00004
Dsl - Commercial Turf Equipment (Com)	2270004071	0.02	0.02	0.41	0.00001	0.00005	0.00002
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00004	0.00023	0.00024
TOTAL		**3.92**	**0.22**	**41.73**	**0.01857**	**0.00235**	**0.20849**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.04	0.00	0.12	0.00013	0.00000	0.00041
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.19	0.00	0.72	0.00087	0.00001	0.00323
2-Str Leafblowers/Vacuums (Com)	2260004031	0.29	0.01	1.21	0.00131	0.00002	0.00544
4-Str Lawn Mowers (Com)	2265004011	0.05	0.00	0.67	0.00020	0.00002	0.00310
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.01	0.00	0.09	0.00003	0.00000	0.00042
4-Str Rear Engine Riding Mower (Com)	2265004041	0.17	0.06	12.71	0.00077	0.00024	0.05848
4-Str Front Mowers (Com)	2265004046	1.07	1.11	23.95	0.00475	0.00460	0.11019
4-Str Commercial Turf Equipment (Com)	2265004071	1.01	0.36	82.87	0.00451	0.00148	0.38134
Dsl - Front Mowers (Com)	2270004046	0.10	0.55	0.33	0.00045	0.00249	0.00147
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.05	0.28	0.15	0.00021	0.00125	0.00070
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.03	0.01	0.00001	0.00012	0.00005
TOTAL		**2.98**	**2.40**	**122.84**	**0.01325**	**0.01024**	**0.56483**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.06	0.00	0.18	0.00031	0.00000	0.00088
2-Str Chain Saws < 6 HP (Com)	2260004021	3.10	0.04	9.98	0.01192	0.00014	0.03827
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	1.85	0.03	6.60	0.00906	0.00013	0.03221
2-Str Leafblowers/Vacuums (Com)	2260004031	0.13	0.00	0.46	0.00063	0.00001	0.00226
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.31	0.02	4.70	0.00148	0.00012	0.02282
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.28	0.00002	0.00001	0.00137
4-Str Front Mowers (Com)	2265004046	0.20	0.05	10.04	0.00098	0.00025	0.04900
MEDINA COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	0.15	0.05	11.12	0.00071	0.00022	0.05425

Non-Road Mobile Source Emissions - Medina County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.96	0.61	57.57	0.00477	0.00295	0.28084
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.02	0.00	0.83	0.00008	0.00002	0.00403
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.06	0.37	0.22	0.00032	0.00182	0.00108
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.10	0.82	0.39	0.00047	0.00398	0.00191
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**6.95**	**1.99**	**102.37**	**0.03076**	**0.00965**	**0.48892**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.01	0.00000	0.00000	0.00005
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.01**	**0.00000**	**0.00000**	**0.00005**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.01	0.01	0.34	0.00002	0.00002	0.00087
4-Str Tractor - Hay	2265005015	0.00	0.00	0.15	0.00000	0.00000	0.00011
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.14	0.00003	0.00004	0.00126
4-Str Tractor - Sorghum	2265005015	0.01	0.01	0.22	0.00002	0.00002	0.00074
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.15	0.00001	0.00002	0.00055
Dsl - Tractor - Corn	2270005015	1.23	11.29	6.28	0.00335	0.02906	0.01615
Dsl - Tractor - Hay	2270005015	0.52	4.79	2.66	0.00042	0.00361	0.00201
Dsl - Tractor - Peanuts	2270005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractor - Small Grains	2270005015	0.51	4.68	2.60	0.00484	0.04204	0.02337
Dsl - Tractor - Sorghum	2270005015	0.78	7.13	3.96	0.00285	0.02479	0.01378
Dsl - Tractor - Cotton	2270005015	0.53	4.87	2.71	0.00211	0.01829	0.01017
Dsl - Combine - Corn	2270005020	0.88	9.56	3.37	0.00508	0.05255	0.01852
Dsl - Combine - Hay	2270005020	0.15	1.65	0.58	0.00088	0.00906	0.00319
Dsl - Combine - Peanuts	2270005020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Combine - Small Grains	2270005020	0.87	9.45	3.33	0.00502	0.05194	0.01830
Dsl - Combine - Sorghum	2270005020	0.55	6.04	2.13	0.00321	0.03318	0.01169
Dsl - Combine - Cotton	2270005020	0.38	4.13	1.45	0.00219	0.02267	0.00799
2-Str Sprayers	2260005035	0.24	0.00	0.65	0.00101	0.00001	0.00280
4-Str Balers	2265005025	0.19	0.14	2.90	0.00079	0.00056	0.01276
4-Str Agricultural Mowers	2265005030	0.06	0.01	2.63	0.00026	0.00006	0.01158
4-Str Sprayers	2265005035	1.05	0.24	21.91	0.00435	0.00095	0.09640
4-Str Tillers > 6 HP	2265005040	2.11	0.25	54.62	0.00887	0.00097	0.24030
4-Str Swathers	2265005045	0.27	0.23	4.59	0.00110	0.00089	0.02021
4-Str Other Agriculture Equipment	2265005055	0.39	0.27	9.82	0.00162	0.00107	0.04319
4-Str Irrigation Sets	2265005060	0.34	0.34	8.04	0.00145	0.00133	0.03537
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.02	0.00001	0.00002	0.00008
LPG - Irrigation Sets	2267005060	0.00	0.00	0.01	0.00000	0.00001	0.00005
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.02	0.00000	0.00002	0.00008
CNG - Irrigation Sets	2268005060	0.00	0.18	0.81	0.00001	0.00079	0.00349
Dsl - Balers	2270005025	0.02	0.08	0.06	0.00007	0.00035	0.00025
Dsl - Agricultural Mowers	2270005030	0.00	0.02	0.01	0.00001	0.00007	0.00006
MEDINA COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
Dsl - Sprayers	2270005035	0.22	1.34	0.74	0.00094	0.00575	0.00319

Non-Road Mobile Source Emissions - Medina County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00001	0.00001
Dsl - Swathers	2270005045	0.15	1.29	0.71	0.00064	0.00556	0.00304
Dsl - Other Agriculture Equipment	2270005055	0.45	3.73	2.03	0.00193	0.01605	0.00874
Dsl - Irrigation Sets	2270005060	0.27	2.38	0.93	0.00117	0.01023	0.00399
TOTAL		**12.21**	**74.14**	**140.59**	**0.05429**	**0.33199**	**0.61431**
TOTAL NONROAD SOURCES		263.15	881.99	2,631.50	0.78967	2.65052	8.22676

Non-Road Mobile Source Emissions - Wilson County, 2005

WILSON COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Construction Equipment							
2-Str Tampers/Rammers	2260002006	0.24	0.00	0.72	0.00102	0.00001	0.00303
2-Str Plate Compactors	2260002009	0.01	0.00	0.03	0.00003	0.00000	0.00011
2-Str Paving Equipment	2260002021	0.01	0.00	0.03	0.00003	0.00000	0.00013
2-Str Signal Boards/Light Plants	2260002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Concrete/Industrial Saws	2260002039	0.50	0.01	1.77	0.00208	0.00003	0.00743
2-Str Crushing/Proc. Equipment	2260002054	0.00	0.00	0.01	0.00000	0.00000	0.00002
4-Str Pavers	2265002003	0.01	0.01	0.70	0.00006	0.00002	0.00298
4-Str Tampers/Rammers	2265002006	0.00	0.00	0.01	0.00000	0.00000	0.00002
4-Str Plate Compactors	2265002009	0.07	0.01	1.27	0.00027	0.00003	0.00543
4-Str Rollers	2265002015	0.02	0.01	1.30	0.00008	0.00003	0.00556
4-Str Paving Equipment	2265002021	0.08	0.01	2.50	0.00033	0.00005	0.01070
4-Str Surfacing Equipment	2265002024	0.03	0.01	1.14	0.00012	0.00002	0.00490
4-Str Signal Boards/Light Plants	2265002027	0.00	0.00	0.06	0.00001	0.00000	0.00025
4-Str Trenchers	2265002030	0.06	0.02	2.12	0.00023	0.00006	0.00907
4-Str Bore/Drill Rigs	2265002033	0.04	0.01	0.61	0.00015	0.00002	0.00261
4-Str Concrete/Industrial Saws	2265002039	0.07	0.02	5.27	0.00030	0.00010	0.02258
4-Str Cement & Mortar Mixers	2265002042	0.09	0.01	2.12	0.00036	0.00005	0.00909
4-Str Cranes	2265002045	0.00	0.00	0.08	0.00001	0.00001	0.00035
4-Str Crushing/Proc. Equipment	2265002054	0.01	0.00	0.31	0.00003	0.00001	0.00133
4-Str Rough Terrain Forklift	2265002057	0.00	0.00	0.10	0.00002	0.00002	0.00043
4-Str Rubber Tire Loaders	2265002060	0.01	0.01	0.23	0.00004	0.00004	0.00100
4-Str Tractors/Loaders/Backhoes	2265002066	0.03	0.01	1.67	0.00010	0.00003	0.00717
4-Str Skid Steer Loaders	2265002072	0.02	0.01	0.71	0.00008	0.00005	0.00306
4-Str Dumpers/Tenders	2265002078	0.01	0.00	0.33	0.00005	0.00001	0.00142
4-Str Other Construction Equipment	2265002081	0.00	0.00	0.09	0.00002	0.00002	0.00038
LPG - Pavers	2267002003	0.00	0.00	0.02	0.00000	0.00001	0.00007
LPG - Rollers	2267002015	0.00	0.01	0.03	0.00001	0.00002	0.00011
LPG - Paving Equipment	2267002021	0.00	0.00	0.00	0.00000	0.00000	0.00002
LPG - Surfacing Equipment	2267002024	0.00	0.00	0.00	0.00000	0.00000	0.00001
LPG - Trenchers	2267002030	0.00	0.01	0.05	0.00001	0.00004	0.00021
LPG - Bore/Drill Rigs	2267002033	0.00	0.00	0.02	0.00000	0.00002	0.00007
LPG - Concrete/Industrial Saws	2267002039	0.00	0.01	0.05	0.00001	0.00004	0.00020
LPG - Cranes	2267002045	0.00	0.00	0.02	0.00000	0.00002	0.00007
LPG - Rough Terrain Forklifts	2267002057	0.00	0.01	0.03	0.00001	0.00003	0.00013
LPG - Rubber Tire Loaders	2267002060	0.00	0.02	0.08	0.00002	0.00007	0.00033
LPG - Tractors/Loaders/Backhoes	2267002066	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Skid Steer Loaders	2267002072	0.00	0.01	0.06	0.00002	0.00006	0.00027
LPG - Other Construction Equipment	2267002081	0.00	0.01	0.03	0.00001	0.00003	0.00011
CNG - Other Construction Equipment	2268002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Pavers	2270002003	0.06	0.69	0.31	0.00027	0.00312	0.00141
Dsl - Tampers/Rammers	2270002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Plate Compactors	2270002009	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rollers	2270002015	0.13	1.09	0.65	0.00057	0.00494	0.00292
Dsl - Scrapers	2270002018	0.02	0.25	0.10	0.00009	0.00114	0.00046
Dsl - Paving Equipment	2270002021	0.09	0.99	0.56	0.00042	0.00446	0.00256
Dsl - Surfacing Equipment	2270002024	0.07	0.92	0.46	0.00031	0.00415	0.00207
Dsl - Signal Boards/Light Plants	2270002027	0.02	0.09	0.05	0.00007	0.00038	0.00022
Dsl - Trenchers	2270002030	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Bore/Drill Rigs	2270002033	0.00	0.01	0.00	0.00000	0.00004	0.00001
Dsl - Excavators	2270002036	0.24	3.16	1.27	0.00107	0.01431	0.00575
Dsl - Concrete/Industrial Saws	2270002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cement & Mortar Mixers	2270002042	0.00	0.00	0.00	0.00000	0.00002	0.00001
Dsl - Cranes	2270002045	0.01	0.15	0.04	0.00006	0.00067	0.00017
Dsl - Graders	2270002048	0.24	2.41	0.98	0.00109	0.01088	0.00443
Dsl - Off-highway Trucks	2270002051	0.01	0.18	0.07	0.00005	0.00082	0.00032
Dsl - Crushing/Proc. Equipment	2270002054	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.02	0.02	0.00002	0.00009	0.00009
Dsl - Rubber Tire Loaders	2270002060	0.20	2.68	1.05	0.00091	0.01211	0.00474
Dsl - Tractors/Loaders/Backhoes	2270002066	0.98	3.94	4.33	0.00442	0.01780	0.01957
Dsl - Crawler Tractor/Dozers	2270002069	0.37	4.49	1.85	0.00166	0.02033	0.00839
Dsl - Skid Steer Loaders	2270002072	0.01	0.02	0.02	0.00002	0.00008	0.00009

Non-Road Mobile Source Emissions - Wilson County, 2005

WILSON COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - Off-Highway Tractors	2270002075	0.11	1.08	0.58	0.00050	0.00491	0.00263
Dsl - Dumpers/Tenders	2270002078	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Construction Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**3.89**	**22.41**	**35.92**	**0.01707**	**0.10121**	**0.15653**

Light Commercial Equipment

2-Str Generator Sets	2260006005	0.14	0.00	0.49	0.00049	0.00001	0.00178
2-Str Pumps	2260006010	0.40	0.01	1.65	0.00146	0.00003	0.00595
2-Str Air Compressors	2260006015	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Hydro Power Units	2260006035	0.00	0.00	0.01	0.00001	0.00000	0.00004
4-Str Generator Sets	2265006005	3.31	1.07	94.56	0.01170	0.00354	0.34801
4-Str Pumps	2265006010	1.31	0.14	27.17	0.00470	0.00045	0.10000
4-Str Air Compressors	2265006015	0.46	0.16	10.97	0.00164	0.00053	0.04039
4-Str Welders	2265006025	0.47	0.12	26.67	0.00169	0.00039	0.09816
4-Str Pressure Washers	2265006030	2.07	0.29	56.79	0.00744	0.00097	0.20903
4-Str Hydro Power Units	2265006035	0.06	0.01	2.53	0.00022	0.00004	0.00931
LPG - Generator Sets	2267006005	0.07	0.37	1.09	0.00027	0.00131	0.00391
LPG - Pumps	2267006010	0.02	0.08	0.26	0.00006	0.00029	0.00092
LPG - Air Compressors	2267006015	0.02	0.09	0.31	0.00007	0.00034	0.00112
LPG - Welders	2267006025	0.03	0.12	0.56	0.00012	0.00044	0.00202
LPG - Pressure Washers	2267006030	0.00	0.00	0.01	0.00000	0.00001	0.00003
LPG - Hydro Power Units	2267006035	0.00	0.00	0.01	0.00000	0.00001	0.00002
CNG - Generator Sets	2268006005	0.00	0.12	0.34	0.00001	0.00041	0.00122
CNG - Pumps	2268006010	0.00	0.01	0.02	0.00000	0.00002	0.00006
CNG - Air Compressors	2268006015	0.00	0.01	0.02	0.00000	0.00003	0.00009
CNG - Gas Compressors	2268006020	0.00	0.10	1.31	0.00001	0.00035	0.00472
CNG - Hydro Power Units	2268006035	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Generator Sets	2270006005	0.86	9.75	3.68	0.00311	0.03510	0.01325
Dsl - Pumps	2270006010	0.21	2.32	0.89	0.00075	0.00836	0.00321
Dsl - Air Compressors	2270006015	0.12	1.29	0.42	0.00043	0.00466	0.00151
Dsl - Gas Compressors	2270006020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Welders	2270006025	0.15	0.37	0.55	0.00055	0.00134	0.00197
Dsl - Pressure Washers	2270006030	0.01	0.05	0.02	0.00003	0.00019	0.00009
Dsl - Hydro Power Units	2270006035	0.00	0.04	0.02	0.00002	0.00014	0.00007
TOTAL		**9.73**	**16.52**	**230.35**	**0.03474**	**0.05896**	**0.84685**

Industrial Equipment

2-Str Sweepers/Scrubbers	2260003030	0.00	0.00	0.01	0.00001	0.00000	0.00003
2-Str Other General Industrial Eqp	2260003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Aerial Lifts	2265003010	0.03	0.01	1.49	0.00011	0.00003	0.00564
4-Str Forklifts	2265003020	0.06	0.07	1.54	0.00024	0.00024	0.00585
4-Str Sweepers/Scrubbers	2265003030	0.05	0.05	1.74	0.00018	0.00016	0.00660
4-Str Other General Industrial Eqp	2265003040	0.12	0.02	3.05	0.00044	0.00006	0.01155
4-Str Other Material Handling Eqp	2265003050	0.00	0.00	0.09	0.00001	0.00001	0.00036
4-Str AC\Refrigeration	2265003060	0.01	0.00	0.37	0.00002	0.00000	0.00102
4-Str Terminal Tractors	2265003070	0.01	0.01	0.23	0.00003	0.00003	0.00086
LPG - Aerial Lifts	2267003010	0.02	0.06	0.25	0.00006	0.00021	0.00094
LPG - Forklifts	2267003020	1.26	4.56	21.75	0.00469	0.01691	0.08070
LPG - Sweepers/Scrubbers	2267003030	0.01	0.03	0.18	0.00004	0.00013	0.00068
LPG - Other General Industrial Equipment	2267003040	0.00	0.01	0.06	0.00001	0.00004	0.00021
LPG - Other Material Handling Equipment	2267003050	0.00	0.00	0.01	0.00000	0.00001	0.00005
LPG - Terminal Tractors	2267003070	0.01	0.02	0.11	0.00002	0.00007	0.00041
CNG - Forklifts	2268003020	0.01	0.36	1.72	0.00002	0.00134	0.00637
CNG - Sweepers/Scrubbers	2268003030	0.00	0.00	0.00	0.00000	0.00000	0.00001
CNG - Other General Industrial Equipment	2268003040	0.00	0.00	0.00	0.00000	0.00000	0.00000
CNG - AC\Refrigeration	2268003060	0.00	0.00	0.02	0.00000	0.00001	0.00005
CNG - Terminal Tractors	2268003070	0.00	0.00	0.01	0.00000	0.00001	0.00003
Dsl - Aerial Lifts	2270003010	0.02	0.06	0.06	0.00007	0.00023	0.00024
Dsl - Forklifts	2270003020	0.02	0.24	0.15	0.00008	0.00089	0.00056
Dsl - Sweepers/Scrubbers	2270003030	0.03	0.32	0.10	0.00010	0.00120	0.00037
Dsl - Other General Industrial Eqp	2270003040	0.03	0.37	0.12	0.00012	0.00139	0.00043
Dsl - Other Material Handling Eqp	2270003050	0.00	0.02	0.01	0.00001	0.00007	0.00004

Non-Road Mobile Source Emissions - Wilson County, 2005

WILSON COUNTY NON-ROAD MOBILE SOURCES	SCC Codes	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Dsl - AC\Refrigertion	2270003060	0.52	4.84	2.30	0.00142	0.01316	0.00625
Dsl - Terminal Tractors	2270003070	0.04	0.81	0.30	0.00016	0.00300	0.00112
TOTAL		**2.26**	**11.88**	**35.67**	**0.00786**	**0.03920**	**0.13036**

Railroad Equipment

Dsl - Railway Maintenance	2285002015	0.07	0.36	0.29	0.00023	0.00122	0.00100
4-Str Railway Maintenance	2285004015	0.02	0.00	0.83	0.00005	0.00001	0.00292
LPG - Railway Maintenance	2285006015	0.00	0.00	0.00	0.00000	0.00000	0.00001
Line-haul Locomotive	2285002006	0.00	0.00	0.00	0.00000	0.00000	0.00000
Switch Locomotive	2285002010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.08**	**0.36**	**1.13**	**0.00029**	**0.00124**	**0.00393**

Mining Equipment

4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Signal Boards/Light Plants	2270002027	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Cranes	2270002045	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rough Terrain Forklifts	2270002057	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractor/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off-Highway Tractors	2270002075	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Sprayers	2270005035	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Quarry Equipment

Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Tractors/Loaders/Backhoes	2270002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Landfill Equipment

Dsl - Pavers	2270002003	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Scrapers	2270002018	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Excavators	2270002036	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Graders	2270002048	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Off Highway Trucks	2270002051	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Rubber Tire Loaders	2270002060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Crawler Tractors/Dozers	2270002069	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Const. Equipment	2270002081	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Boating

2-Str Outboard	2282005010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Personal Water Craft	2282005015	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Inboard/Sterndrive	2282010005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Inboard	2282020005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Outboards	2282020010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Recreational Equipment

2-Str Offroad Motorcycles	2260001010	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str ATVs	2260001030	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Specialty Vehicles / Carts	2260001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Offroad Motorcycles	2265001010	0.00	0.00	0.00	0.00000	0.00000	0.00000
WILSON COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO

Non-Road Mobile Source Emissions - Wilson County, 2005

NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str ATVs	2265001030	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Golf Carts	2265001050	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Specialty Vehicles / Carts	2265001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Specialty Vehicles / Carts	2267001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Specialty Vehicle Carts	2270001060	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Residential Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Res)	2260004015	0.43	0.00	1.08	0.00121	0.00001	0.13656
2-Str Chain Saws < 6 HP (Res)	2260004020	9.55	0.07	23.37	0.01995	0.00015	0.04899
2-Str Trimmers/Edgers/Brush Cutter (Res)	2260004025	14.42	0.12	37.57	0.04052	0.00034	0.10691
2-Str Leafblowers/Vacuums (Res)	2260004030	1.99	0.02	5.22	0.00548	0.00005	0.01487
4-Str Lawn Mowers (Res)	2265004010	7.72	0.55	102.29	0.02150	0.00157	0.29106
4-Str Rotary Tillers <6 HP (Res)	2265004015	1.88	0.13	23.40	0.00526	0.00036	0.06658
4-Str Trimmers/Edgers/Brush Cutters (Res)	2265004025	0.26	0.02	3.11	0.00073	0.00005	0.00886
4-Str Leafblowers/Vacuums (Res)	2265004030	0.10	0.01	1.27	0.00028	0.00002	0.00361
4-Str Rear Engine Riding Mower (Res)	2265004040	9.11	1.75	370.47	0.02376	0.00497	1.05410
4-Str Lawn & Garden Tractors (Res)	2265004055	5.89	1.66	310.38	0.01675	0.00438	0.91032
4-Str Other Lawn & Garden Equip. (Res)	2265004075	0.44	0.06	9.81	0.00125	0.00015	0.02878
TOTAL		**51.79**	**4.38**	**887.98**	**0.13668**	**0.01205**	**2.67063**

Commercial Lawn & Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00001	0.00000	0.00003
2-Str Chain Saws < 6 HP (Com)	2260004021	1.38	0.02	4.42	0.00518	0.00006	0.01664
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.28	0.00	0.98	0.00141	0.00002	0.00503
2-Str Leafblowers/Vacuums (Com)	2260004031	0.42	0.01	1.48	0.00212	0.00003	0.00759
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.02	3.20	0.00001	0.00009	0.01674
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.01	0.00	0.15	0.00005	0.00000	0.00078
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.01	0.00	0.13	0.00003	0.00000	0.00066
4-Str Leafblowers/Vacuums (Com)	2265004031	0.14	0.05	6.79	0.00069	0.00024	0.03549
4-Str Rear Engine Riding Mower (Com)	2265004041	0.05	0.02	3.34	0.00023	0.00007	0.01744
4-Str Front Mowers (Com)	2265004046	0.05	0.01	2.54	0.00025	0.00007	0.01328
4-Str Shredders < 6 HP (Com)	2265004051	0.05	0.00	0.69	0.00024	0.00002	0.00363
4-Str Lawn & Garden Tractors (Com)	2265004056	0.01	0.00	0.81	0.00005	0.00002	0.00423
4-Str Chippers/Stump Grinders (Com)	2265004066	0.03	0.02	1.73	0.00015	0.00010	0.00905
4-Str Commercial Turf Equipment (Com)	2265004071	0.01	0.00	0.67	0.00006	0.00002	0.00349
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.06	0.01	1.28	0.00027	0.00004	0.00667
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.05	0.30	0.18	0.00026	0.00153	0.00090
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.02	0.20	0.10	0.00012	0.00103	0.00049
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**2.55**	**0.67**	**28.51**	**0.01115**	**0.00334**	**0.14216**

University/Colleges Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Commercial Turf Equipment (Com)	2260004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tractors/Loaders/Backhoe	2265002066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders < 6 HP (Com)	2265004051	0.00	0.00	0.00	0.00000	0.00000	0.00000
WILSON COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		

4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Tillers > 6 HP	2265005040	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG - Chippers/Stump Grinders (Com)	2267004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Public Schools Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.01	0.00001	0.00000	0.00004
2-Str Chain Saws < 6 HP (Com)	2260004021	0.08	0.00	0.31	0.00031	0.00001	0.00118
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.62	0.04	9.69	0.01351	0.00021	0.05000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.46	0.01	1.92	0.00239	0.00004	0.00991
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00258	0.00021	0.04062
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.51	0.04	7.70	0.00004	0.00000	0.00060
4-Str Rear Engine Riding Mower (Com)	2265004041	0.01	0.00	0.11	0.00068	0.00022	0.05195
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00072	0.00016	0.03321
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00468	0.00038	0.08303
4-Str Commercial Turf Equipment (Com)	2265004071	0.13	0.05	9.85	0.00010	0.00011	0.00270
4-Str Shredders > 6 HP	2265007010	0.14	0.03	6.30	0.00040	0.00007	0.01509
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00007	0.00037	0.00022
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.92	0.08	15.75	0.00017	0.00102	0.00060
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.00	0.00	0.00002	0.00008	0.00005
Dsl - Commercial Turf Equipment (Com)	2270004071	0.02	0.02	0.51	0.00001	0.00006	0.00003
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00005	0.00032	0.00033
TOTAL		**4.90**	**0.28**	**52.16**	**0.02572**	**0.00326**	**0.28957**

Golf Courses Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.02	0.00	0.06	0.00006	0.00000	0.00020
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.10	0.00	0.35	0.00043	0.00001	0.00159
2-Str Leafblowers/Vacuums (Com)	2260004031	0.14	0.00	0.60	0.00065	0.00001	0.00268
4-Str Lawn Mowers (Com)	2265004011	0.02	0.00	0.33	0.00010	0.00001	0.00153
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.05	0.00001	0.00000	0.00021
4-Str Rear Engine Riding Mower (Com)	2265004041	0.08	0.03	6.26	0.00037	0.00012	0.02880
4-Str Front Mowers (Com)	2265004046	0.53	0.55	11.79	0.00229	0.00227	0.05427
4-Str Commercial Turf Equipment (Com)	2265004071	0.50	0.18	40.82	0.00219	0.00073	0.18783
Dsl - Front Mowers (Com)	2270004046	0.05	0.27	0.16	0.00022	0.00123	0.00072
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.02	0.14	0.08	0.00010	0.00061	0.00034
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.01	0.01	0.00001	0.00006	0.00002
TOTAL		**1.47**	**1.18**	**60.50**	**0.00644**	**0.00505**	**0.27820**

Government Lawn and Garden Equipment

2-Str Rotary Tillers <6 HP (Com)	2260004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Chain Saws < 6 HP (Com)	2260004021	1.51	0.02	4.87	0.00580	0.00007	0.01862
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	2.10	0.03	7.49	0.01027	0.00015	0.03656
2-Str Leafblowers/Vacuums (Com)	2260004031	0.17	0.00	0.62	0.00085	0.00001	0.00305
4-Str Concrete/Industrial Saws	2265002039	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.93	0.07	14.19	0.00383	0.00030	0.05908
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.03	0.00	0.41	0.00013	0.00001	0.00199
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Leafblowers/Vacuums (Com)	2265004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.32	0.10	23.92	0.00154	0.00047	0.11669
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
WILSON COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes	tons/year			tons/day (Mon. - Fri.)		
4-Str Lawn & Garden Tractors (Com)	2265004056	0.08	0.02	5.75	0.00036	0.00011	0.02805

Non-Road Mobile Source Emissions - Wilson County, 2005

4-Str Chippers/Stump Grinders (Com)	2265004066	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Commercial Turf Equipment (Com)	2265004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Water Pumps	2265006010	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Front Mowers (Com)	2270004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.00	0.01	0.00	0.00000	0.00003	0.00001
Dsl - Commercial Turf Equipment (Com)	2270004071	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**5.14**	**0.25**	**57.26**	**0.02278**	**0.00116**	**0.26406**

Other Commercial Companies Lawn and Garden Equipment

2-Str Chain Saws < 6 HP (Com)	2260004021	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Trimmers/Edgers/Brush Cutter (Com)	2260004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
2-Str Leafblowers/Vacuums (Com)	2260004031	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn Mowers (Com)	2265004011	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rotary Tillers <6 HP (Com)	2265004016	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Rear Engine Riding Mower (Com)	2265004041	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Front Mowers (Com)	2265004046	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Shredders > 6 HP	2265007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Other Lawn & Garden Equipment (Com)	2270004076	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dsl - Shredders > 6 HP	2270007010	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL		**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**

Agricultural Equipment

4-Str Tractor - Corn	2265005015	0.00	0.00	0.12	0.00001	0.00001	0.00030
4-Str Tractor - Hay	2265005015	0.01	0.01	0.23	0.00000	0.00000	0.00017
4-Str Tractor - Peanuts	2265005015	0.00	0.00	0.03	0.00000	0.00000	0.00017
4-Str Tractor - Small Grains	2265005015	0.00	0.00	0.06	0.00001	0.00001	0.00050
4-Str Tractor - Sorghum	2265005015	0.00	0.00	0.08	0.00001	0.00001	0.00028
4-Str Tractor - Cotton	2265005015	0.00	0.00	0.03	0.00000	0.00000	0.00009
Dsl - Tractor - Corn	2270005015	0.42	3.85	2.14	0.00114	0.00991	0.00551
Dsl - Tractor - Hay	2270005015	0.81	7.38	4.10	0.00064	0.00556	0.00309
Dsl - Tractor - Peanuts	2270005015	0.11	1.00	0.56	0.00063	0.00550	0.00306
Dsl - Tractor - Small Grains	2270005015	0.20	1.84	1.02	0.00190	0.01652	0.00918
Dsl - Tractor - Sorghum	2270005015	0.29	2.66	1.48	0.00106	0.00924	0.00514
Dsl - Tractor - Cotton	2270005015	0.09	0.84	0.47	0.00036	0.00316	0.00176
Dsl - Combine - Corn	2270005020	0.30	3.26	1.15	0.00173	0.01793	0.00632
Dsl - Combine - Hay	2270005020	0.23	2.54	0.89	0.00135	0.01395	0.00491
Dsl - Combine - Peanuts	2270005020	0.18	1.91	0.67	0.00153	0.01577	0.00556
Dsl - Combine - Small Grains	2270005020	0.34	3.71	1.31	0.00197	0.02040	0.00719
Dsl - Combine - Sorghum	2270005020	0.21	2.25	0.79	0.00120	0.01237	0.00436
Dsl - Combine - Cotton	2270005020	0.07	0.71	0.25	0.00135	0.01395	0.00491
2-Str Sprayers	2260005035	0.14	0.00	0.39	0.00061	0.00001	0.00170
4-Str Balers	2265005025	0.12	0.09	1.76	0.00044	0.00034	0.00773
4-Str Agricultural Mowers	2265005030	0.04	0.01	1.60	0.00016	0.00003	0.00702
4-Str Sprayers	2265005035	0.63	0.15	13.28	0.00257	0.00057	0.05842
4-Str Tillers > 6 HP	2265005040	1.28	0.15	33.10	0.00533	0.00059	0.14562
4-Str Swathers	2265005045	0.16	0.14	2.78	0.00062	0.00054	0.01225
4-Str Other Agriculture Equipment	2265005055	0.23	0.16	5.95	0.00095	0.00065	0.02617
4-Str Irrigation Sets	2265005060	0.21	0.20	4.87	0.00086	0.00080	0.02143
LPG - Other Agriculture Equipment	2267005055	0.00	0.00	0.01	0.00000	0.00001	0.00005
LPG - Irrigation Sets	2267005060	0.00	0.00	0.01	0.00000	0.00001	0.00003
CNG - Other Agriculture Equipment	2268005055	0.00	0.00	0.01	0.00000	0.00001	0.00005
CNG - Irrigation Sets	2268005060	0.00	0.11	0.49	0.00001	0.00048	0.00211
Dsl - Balers	2270005025	0.01	0.05	0.04	0.00004	0.00021	0.00015
Dsl - Agricultural Mowers	2270005030	0.00	0.01	0.01	0.00001	0.00004	0.00004
WILSON COUNTY	SCC	VOC	NOx	CO	VOC	NOx	CO
NON-ROAD MOBILE SOURCES	Codes		tons/year			tons/day (Mon. - Fri.)	
Dsl - Sprayers	2270005035	0.13	0.81	0.45	0.00057	0.00348	0.00193

Non-Road Mobile Source Emissions - Wilson County, 2005

Dsl - Tillers > 6 HP	2270005040	0.00	0.00	0.00	0.00000	0.00001	0.00000
Dsl - Swathers	2270005045	0.09	0.78	0.43	0.00039	0.00337	0.00184
Dsl - Other Agriculture Equipment	2270005055	0.27	2.26	1.23	0.00117	0.00972	0.00530
Dsl - Irrigation Sets	2270005060	0.17	1.44	0.56	0.00071	0.00620	0.00242
TOTAL		**6.75**	**38.34**	**82.34**	**0.02935**	**0.17136**	**0.35674**
TOTAL NONROAD SOURCES		88.57	96.27	1,471.83	0.29208	0.39682	5.13902

CHAPTER 3 - AIRPORT AND MILITARY EMISSIONS

This section of 2005 emission inventory documents information on emissions of ozone precursor pollutants from US military bases, former military bases, commercial airports, and private airports in the AACOG region. The data for military bases are compiled from annual reports on emissions due to activities that release pollutants. AACOG has obtained these reports by contacting the members of environmental departments on the military bases. When such reports were not available, other source of information, such as surveys and federal data, were used. In some cases, when information was unknown or not supplied, previous years' information were used or emissions were calculated by using Environmental Protection Agency (EPA) approved methods including the EPA NONROAD 2004 model[1] and the EPA AP-42, Fifth Edition, Volume 1 document.[2]

Camp Stanley, which is a located northwest of San Antonio, is engaged in activities associated with supply, maintenance, test and storage of weapons and munitions. AACOG Staff contacted the post for emissions data. The staff was informed that the Camp does not maintain any emissions inventory, as it is not required by Texas Administrative Code to do so. Therefore, no emissions are reported for this facility in this emission inventory.

Commercial and private airports data was obtained through surveys, FAA/FPA Terminal Area Forecast (TAF) software,[3] Airport IQ Data Center,[4] www.FltPlan.com,[5] and other data sources. Emissions were calculated using the Emission & Dispersion Modeling System (EDMS) model version 4.21,[6] the EPA NONROAD 2004 model,[7] the EPA AP-42, Fifth Edition, Volume 1,[8] MOBILE6 model,[9] and other approved EPA methodologies.

Brooks City-Base

Introduction

Brooks City-Base (formerly Brooks Air Force Base), Texas is located in southeast Bexar County and is approximately 10 miles from downtown San Antonio. On July 22, 2002, the City of San Antonio assumed control of the newly named Brooks City-Base. The creation of the city-base was the first of its kind in which the Air Force remained as a tenant but forfeited the responsibility of managing the overall base infrastructure.

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[1] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm
[2] Environmental Protection Agency. AP42 Fifth Edition, Volume 1. Available online: http://www.epa.gov/ttn/chief/ap42/
[3] Federal Aviation Administration, 2005. Terminal Area Forecast Reports. Washington, DC. Available online: http://www.faa.gov/data_statistics/aviation/taf_reports/
[4] GCR & Associates, Inc., 2005. Airport IQ Data Center. Available online: http://www.airportiq.com/
[5] Fltplan.com. Available online: http://www.fltplan.com/AwMainPageSelect.exe?a=1
[6] The Federal Aviation Administration, Sept. 30, 2004. "Emissions & Dispersion Modeling System", available online: http://www.aee.faa.gov/emissions/edms/EDMShome.htm
[7] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm
[8] Environmental Protection Agency. AP42 Fifth Edition, Volume 1. Available online: http://www.epa.gov/ttn/chief/ap42/
[9] U.S. Environmental Protection Agency, August 2003. User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model. Available online: http://www.epa.gov/otaq/m6.htm

Property leased by the United States Air Force (USAF) at Brooks City-Base is used as the home of the 311 Human Systems Wing which is the USAF agent for human-centered research, development, acquisition, education, and operational support at both the individual and Total Force levels. Other partners located at Brooks City-Base are the Air Force Medical Support Agency, the Human Effectiveness Directorate of the Air Force Research Laboratory, and the Air Force Center for Environmental Excellence.[10]

Methodology for Area Source Emissions

Area Sources are stationary sources of emissions that are generated by such activities as fuel storage, surface coating, and boilers and furnaces (Table 3-1). Area source emissions data were obtained from the 2005 Air Emissions Inventory produced by URS Corporation for the 311 Human Systems Wing.[11] The URS Corporation used the EPA AP-42, Compilation of the Air Pollutants Emission Factors publication for calculating emissions. The URS also used instructions in a publication entitled "Air Emissions Inventory Guidance Document for Stationary Sources at Air Force Installations"[12] for several emission estimations. The ten source categories identified at the base are as followings:

- External Combustion
- Fuel Dispensing
- Fuel Storage
- Fume Hoods
- Miscellaneous Chemical Usage
- Ozone Depleting Compounds (ODC)
- Pathological Waste Incinerator
- Stationary Internal Combustion (Standby Generators)
- Groundwater and soil remediation
- Woodworking

On-road Source Emissions

On-road or mobile sources include motor vehicles that are licensed to operate on roadways of the Brooks base. To calculate mobile source emissions, first the 2005 emission factors for various speeds were generated, using the EPA MOBILE6 model[13] with local meteorological conditions. After reviewing the Base roadway map, a trip length of 1.2 miles and speed of 35 mile/hour were determined as the averages for the base. The traffic counts at Brooks gates for 1998, the most recent year of record, were used to estimate the total vehicle miles traveled (VMT) on the base. The average emission factors from MOBILE6 for all vehicles were applied to this VMT to generate total emissions attributed to vehicles on the base. The West gate was assumed closed for this analysis and the results are provided in Table 3-2.

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[10] Kamalpour, Hamid, 311th Human Systems Wing, personal conversation.

[11] URS Corporation, Sept. 2006. Air Emissions Inventory for 2005 Operations at the 311th Human Systems Wing Brooks City Base. Austin, Texas.

[12] Robert J. O'Brien and Mark D. Wade, revised Dec. 2003. Wade Air Emissions Inventory Guidance. Document for Stationary Sources at Air Force Installations. Karta Technologies, Inc. San Antonio, Texas. Air Force Institute for Environment, Safety and Occupational Health Risk Analysis Risk Analysis Directorate Environmental Analysis Division. Available online: http://airforcemedicine.afms.mil/idc/groups/public/documents/afms/ctb_001794.pdf

[13] U.S. Environmental Protection Agency, August 2003. User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model. Available online: http://www.epa.gov/otaq/m6.htm

Table 3-1. 2005 Annual Tonnage of Criteria Pollutants by Source Category at Brooks

Source	VOC	NOx	CO
External Combustion	0.14	2.42	1.83
Fuel Dispensing	3.69	0.00	0.00
Fuel Storage	2.39	0.00	0.00
Fume Hoods	1.47	0.00	0.00
Miscellaneous Chemical Use	0.34	0.00	0.00
Ozone Depleting Compounds	0.00	0.00	0.00
Pathological Waste Incinerator	0.00	0.02	0.02
Stationary Internal Combustion	0.13	1.54	0.33
Groundwater and soil remediation	0.00	0.00	0.00
Woodworking	0.00	0.00	0.00
Total	8.16	3.98	2.18

Table 3-2. 2005 Annual and Daily Mobile Source Emissions for Brooks

Roadway	Traffic Volume Daily	Length (mi)	Emissions (tons/year)			Emissions (ton/day)		
			VOC	NOx	CO	VOC	NOx	CO
HSW Gate	1,500	1.2	0.98	1.57	10.62	0.00268	0.00430	0.02910
Main Gate	5,250	1.2	3.41	5.50	37.18	0.00934	0.01507	0.10186
Total	6,750	NA	4.39	7.07	47.81	0.01203	0.01937	0.13099

Sample Calculation

Equation (1)

Annual vehicle emissions:

AE = Σ (TC_A x EF x LENG x DAYS) / 453.59 grams/lbs / 2,000 lbs/ton

Where,

AE = Annual vehicle emissions

TC_A = Traffic Count at gate A (from Table 3-2)

EF = Ozone season emission factor for vehicle grams/mile (from Mobile6 for 35 mph at 1.352 g/mile for VOC and 2.176 g/mile for NOx)

LENG = Average miles driven by each vehicle (1.2 miles)

DAYS = Days per year (365)

Annual vehicle emissions:

VRE_A = [(1,500 x 1.352 g/mi x 1.2 x 365) + (5,250 x 1. 352 g/mi x 1.2 x 365)] / 453.59 g/lbs / 2,000 lbs/ton
= 4.39 tons VOC/yr

Results

Table 3-3 lists total emissions by source at Brooks City-Base. Daily emissions were quantified by dividing the tons/year emissions by 261 days/year for area and 365 days/year for mobile, achieving a Monday – Friday daily emissions total.

Table 3-3. 2005 Brooks City-Base Total Emissions by Source

Source Category	Emissions (tons/year)			Emissions (tons/day)		
	VOC	NOx	CO	VOC	NOx	CO
Mobile	4.39	7.07	47.81	0.01203	0.01937	0.13099
Area (Stationary Sources)	8.16	3.98	2.18	0.03126	0.01525	0.00835
Total Emissions	12.55	11.05	49.99	0.04329	0.03462	0.13934

Camp Bullis

"Camp Bullis is located 18 miles northwest of downtown San Antonio and consists of 27,880 acres of training facilities, temporary barracks, firing ranges, and maneuvering areas. Camp Bullis provides field training, weapon firing, and assault landing strips for active US Army and US Air Force units, joint Army and Air Force exercises, Army, Navy and Marine Corps Reserve units, and the Texas National Guard units."[14]

Methodology

All data, methodologies, and emission estimates provided in this section were prepared by Dickson Consulting Group, LLC in the draft 2003 Emissions Inventory for Camp Bullis[15] (the final version is not yet available). Since the 2004 and 2005 emission inventories at the time of preparing this report had not been produced, the draft 2003 EI was used, as it was the closest to the 2005 inventory.

Methodology for Area Source Emissions

Methodologies for estimating emissions from area source categories are discussed in this section and calculation samples for each category are included. The area source categories covered in the Dickson EI for Camp Bullis are:

- Boilers and Furnaces
- Degreasing Operations
- Fuel Storage and Dispensing
- Generators
- Woodworking and Fabrication

Boilers and Furnaces

Camp Bullis previously relied on kerosene for heating purposes. Currently, propane is the primary fuel used for heating. Propane is cleaner burning and can be stored in small tanks next to the building it services. In 2003 the camp consumed 153,450 gallons of propane. Emissions from boilers and furnaces were calculated by multiplying the total gallons of propane by an appropriate emissions factor.[16]

[14] Dickson Consulting Group, LLC., 2003. 2003 Emissions Inventory for U.S. Army – Camp Bullis, Texas. TCEQ Account Number BG-0771-O, p. 5.
[15] Dickson Consulting Group, LLC., 2003. 2003 Emissions Inventory for U.S. Army – Camp Bullis, Texas. TCEQ Account Number BG-0771-O.
[16] Environmental Protection Agency. AP42 Fifth Edition, Volume 1. Available online: http://www.epa.gov/ttn/chief/ap42/

Sample Calculation
Equation (1)
Annual boilers and furnaces emissions:

AE = FUEL x EF / 2,000 lbs/ton

Where,

AE = Annual boilers and furnaces emissions
FUEL = Amount of fuel used (153,450 gal)
EF = Emission Factor (0.5 lbs/1,000 gal)

Annual boilers and furnaces VOC emissions:

AE = 153,450 gal × 0.5 lbs / 1,000 lbs / 2,000 lbs/ton
= 0.03836 tons VOC/yr

Daily rates were calculated using summer time fuel usage for July, August, and September (10,300 gallons) to account for typical ozone season day.[17]

Degreasing Operations
VOCs are the main pollutants produced by degreasing operations. Camp Bullis had only three cold cleaner degreasing facilities in 2003. The solvent in use at the time, "BrakeThru," is a low volatility solvent. The facilities are located in the Motor Pool with 30-gallon capacity basins. No records were kept on amounts of solvent used during the year, so VOC emissions were based on the solvent loss rate, VOC content, and density. On-site personnel estimated that no more than 5 gallons of solvent was lost between the changing of solvent every 3-4 years; thus, Dickson used a loss rate of 5 gallons-per-unit in calculating emissions.

Sample Calculation
Equation (2)
Annual degreasing emissions:

AE = FUEL x NUM x PER x EF / 2,000 lbs/ton

Where,

AE = Annual degreasing emissions, tons VOC/yr
FUEL = Amount of fuel used (153,450 gal)
PER = VOC content of the solvent (100%)
NUM = Number of units (3)
EF = Emission Factor (0.5 lbs/1,000 gal)

Annual degreasing emissions:

AE = 5 gal/yr × 1.00 x 3 x 7.91 lbs/gal / 2,000 lbs/ton
= 0.05933 tons VOC/yr

The daily rates were determined by dividing the annual rate by 250 days of operation per year.

[17] Dickson Consulting Group, LLC., 2003. 2003 Emissions Inventory for U.S. Army – Camp Bullis, Texas. TCEQ Account Number BG-0771-O, p. 32.

Fuel Storage and Dispensing Operations

Fuel storage and dispensing is another source of VOC emissions on the base. Camp Bullis gasoline and diesel facilities service military vehicles and equipment that operated on the base. Two underground 10,000-gallon tanks service all vehicles and equipment, and one 500-gallon aboveground diesel tank services the emergency power generator. Emissions for fuel tank working and standing losses, fuel tank filling and spilling losses, and fuel rank loading losses were estimated using the tank fuel throughputs and the EPA Tanks 4.09 emission calculation program.[18] Annual emissions were divided by 365 to determine ozone season daily emissions.

Power Generators

Camp Bullis had 11 fixed-site generators that were used for an emergency power source for critical activities (hospitals/clinics) or combat training operations in 2003. In addition to emergency situations, the generators were also operated periodically for testing. The testing schedule was part of a fixed maintenance schedule. Emissions were calculated based on hours of operation (52 hours per year and 12 hours per summer season), power ratings, and emission factors from AP-42.[19]

Sample Calculation

Equation (3)

Annual generators emissions:

AE = POWER x HOURS x EF / 453.59 g/lbs / 2,000 lbs/ton

Where,

AE = Annual generators emissions, tons VOC/yr
POWER = kW for each generator
HOURS = Number of hours per year (52)
EF = Emission Factor

Annual emissions for a 100 kW generator:

AE = 100 kW x 52 hr/yr × 4.06 g/kW-hr / 453.59 g/lbs / 2,000 lbs/ton
= 0.02327 tons CO/yr

Results

The total estimated emissions of criteria pollutants from activities at Camp Bullis for calendar year 2003 are presented in Table 3-4. The estimated daily emissions are based on typical ozone season day.

[18] U.S. Environmental Protection Agency, Oct 3, 2005. TANKS Emission Estimation Software. Available online: http://www.epa.gov/ttn/chief/software/tanks/index.html

[19] Environmental Protection Agency. AP42 Fifth Edition, Volume 1. Available online: http://www.epa.gov/ttn/chief/ap42/

Table 3-4. Total Emissions by Source Category for Camp Bullis in 2003[20]

Source Category	Emissions (tons/year)			Emissions (ton/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Boilers and Furnaces	0.04	1.07	0.15	0.00000	0.00000	0.00000
Degreasing Operations	0.06	0.00	0.00	0.00024	0.00000	0.00000
Fuel Storage / Dispensing	0.08	0.00	0.00	0.00021	0.00000	0.00000
Generators	0.05	0.67	0.14	0.00006	0.00072	0.00005
TOTAL	0.23	1.74	0.29	0.00051	0.00072	0.00005

Canyon Lake Recreation Center

Introduction

Canyon Lake Recreational Center (CLRC) is located in Comal County, Texas, southeast of Canyon Lake near the spillway. The center is approximately 30 miles northeast of downtown San Antonio and 10 miles northwest of New Braunfels. The center does not house any troops, but provides recreational facilities to local organizations and military personnel and their families. Two military recreation areas are located in Jacobs Creek Park on the north shore of Canyon Lake and are operated independently from the U.S. Army Corps of Engineer parks. Both offer overnight accommodations, camping, day use facilities, pavilions, a marina and boat rentals.

Methodology

The input data required to complete the 2005 EI were obtained from the Public Affairs Office at Fort Sam Houston for 2004, the closest year available to 2005. The data included:

- Two Chainsaws with a 3.5 horsepower 2-cycle engine type that operated 0.5 hour from 8am – 5pm, Monday through Fri.
- 1 Lawnmower with a 4.1 horsepower 4-cycle engine that operated 1 hour from 8am – 5pm, Monday through Fri.
- 1 electric welding machine
- 1 diesel tractor with a 50 horsepower engine that operated 1.5 hours, Monday through Fri. and 0.5 hour (Sat. – Sun.) from 8am to 5pm

Electric equipment, such as the welder, is assumed to have no on-site emissions caused by operation. Annual and daily emissions are provided in the Table 3-5. For each type of equipment the VOC, NOx, and CO emissions were calculated.

Sample Calculation

Equation (1)

Annual emissions for each type of non-road equipment:

$$AE_A = (EP_A \times HRS_A \times HP_A \times LF \times EF_A) / 453.59 \text{ g/lbs} / 2{,}000 \text{ lbs/ton}$$

Where,

[20] Dickson Consulting Group, LLC., 2003. 2003 Emissions Inventory for U.S. Army – Camp Bullis, Texas, TCEQ Account Number BG-0771-O (Section 4: Table 3 & Table 4)

AE_A	= Annual emissions for each type of equipment A (tons/yr)
EP_A	= Equipment population of type A (based on survey)
HRS_A	= Annual hours of use for equipment A (based on survey)
HP_A	= Average rated horsepower for equipment type A (based on survey)
LF_A	= Typical load factor for equipment type A (NONROAD Model)
EF_A	= Average emissions of pollutant per unit of use for equipment type A, g/hp-hr (NONROAD Model)

A final step in the calculation is to determine weekday versus weekend emissions. The NONROAD 2004 model default values for residential Lawn and Garden equipment was used to calculated the weekly adjustment factor.

Results

The total estimated emissions of criteria pollutants from activities at CLRC for calendar year 2005 are presented in Table 3-5. The estimated daily emissions are based on typical ozone season day.

Table 3-5. 2005 Total Emissions for Equipment at Canyon Lake Recreational Center

Source Category	Emissions (tons/year)			Emissions (ton/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Chainsaws	0.08	0.00	0.27	0.00019	0.00000	0.00060
Lawnmower	0.03	0.00	0.51	0.00007	0.00001	0.00115
Welding Machine	n/a	n/a	n/a	n/a	n/a	n/a
Tractor	0.02	0.07	0.07	0.00003	0.00014	0.00013
Total	0.13	0.08	0.85	0.00029	0.00015	0.00189

Fort Sam Houston

The US Army Fort Sam Houston (Ft. Sam) is a 3,265-acre military reservation located in Bexar County, Texas 3 miles northeast of downtown San Antonio. "The primary mission at Ft. Sam Houston is medical training and a support post housing Headquarters U.S. 5th Army, U.S. 5th Army Recruiting Brigade, Brooke Army Medical Center (BAMC), Institute of Surgical Research (ISR), U.S. Army Medical Department Center and School, U.S. Army Center Brigade, and U.S. Army Medical Command."[21] Ft. Sam employs military, civilian and contractor personnel to perform functions in support of installation facilities and active, reserve and retired military personnel and their dependents.

Ft. Sam is engaged in limited industrial activities and the generated air pollutants are those typically associated with activities that support the maintenance and operations of buildings and vehicles, the storage and dispensing of fuel, emergency power generation, and the limited use of laboratory chemicals. The 2005 emission inventory report obtained from the Department of Environmental and Natural Resources at Ft. Sam [22] identified the following sources:

- Boilers and Furnaces

[21] Fort Sam Houston, Texas, 2005. Air Emissions Inventory. TCEQ Account Number BG-0070-0, p. 1-1.
[22] *Ibid*.

- Degreasing Operations
- Fuel Storage and Dispensing
- Generators
- Misc. VOC Sources/ Laboratories and Clinics
- Surface Coating

The emissions from operations and facilities that are not under the direct control of the U.S. Army Garrison at Ft. Sam have not been included in this report. The report summarizes the emissions on an annual basis and for duration of ozone season.

Methodology
According to the report obtained from Ft. Sam, 2005 emissions estimates were derived using similar methods and assumptions from the previous 2003 and 2004 reporting years. These methods are described under headings for each category in the following pages.

Area Source Emissions
This section discusses the methods used to calculate emissions for each area source category. Emission factors used for these calculations come from the EPA AP-42, Fifth Edition, Volume 1 document.[23]

Boilers and Furnaces
Actual emissions for over 2,600 boilers, furnaces, and hot water heaters were calculated using emission factors based on fuel consumption. The 2005 annual fuel consumption was 363,011,000 ft^3 of natural gas.

Degreasing Operations
VOC emissions are the main pollutant produced by degreasing operations. Four degreasing facilities are reported in the 2005 EI by Fort Sam. Three of them use “Safety-Kleen” degreasing system that recycles evaporations and one facility applies degreasers that are designed to evaporate. Each of the “Safety-Kleen” degreasing unit has a 30-gallon basin that supplies and reclaims solvents used. VOC emissions rates for degreasing operations were calculated by using mass balance methods. Additionally, an emissions reduction factor of 48% (per AP-42, Section 4.6, Table 4.6-3) was applied to the Safety Kleen degreasing units since they are enclosed units, have solid fluid streams, have proper drainage, are reported to be properly utilized, and have a solvent reclamation capability.

Fuel Storage and Dispensing Operations
Fuel storage and dispensing is another main source of VOC emissions. These facilities primarily service military vehicles and equipment that are operated on post. Eight underground storage tanks were identified on Ft. Sam and BAMC. Two aboveground storage tanks were associated with the golf course maintenance facility. Actual emissions from the fuel storage tanks were estimated using the tank fuel throughputs and the EPA TANKS 4.09 emission calculation software.[24]

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[23] Environmental Protection Agency. AP42 Fifth Edition, Volume 1. Available online: http://www.epa.gov/ttn/chief/ap42/
[24] U.S. Environmental Protection Agency, Oct 3, 2005. TANKS Emission Estimation Software. Available online: http://www.epa.gov/ttn/chief/software/tanks/index.html

Generators
Generators are used for an emergency power source for critical activities (hospitals/clinics) or combat training operations. In addition to emergency situations, the generators were also operated periodically for testing. The testing schedule was part of a fixed maintenance schedule. Emissions from the generators were estimated using hours of operation during the year, hours of operation during the ozone season, and horsepower ratings. Emission factors were obtained from "AP-42; Supplement F, Section 3.3" to calculate generator emissions.[25]

Miscellaneous Volatile Organic Compound Sources
The miscellaneous emitters consist of various solvents, cleaners, and aerosol spray paint used in 2005. Miscellaneous VOC emissions were calculated using mass balance methods. The material safety data sheets (MSDS) were used to determine the VOC content and the density of each chemical. When the percentage VOC content was not provided by the MSDS, the VOC content was assumed to be the sum of the HAP as documented on the MSDS.

Surface Coating Operations
The Directorate of Logistics (DOL) contains an operational paint booth. For these emissions, the MSDS of the coatings were used to provide VOC content. Emissions were determined by multiplying the VOC content by the amount of solvent used.

Results
The total estimated emissions for three criteria pollutants from activities at Fort Sam Houston for calendar year 2005 and the estimated daily emissions for a typical ozone season day are presented in the following table (3-6).

Table 3-6. 2005 Annual and Daily Emissions at Fort Sam Houston

Source	Tons/year			Tons/day		
	VOC	NOx	CO	VOC	NOx	CO
Boilers	1.39	20.45	21.29	0.00296	0.04044	0.04518
Degreasing	0.06	0.00	0.00	0.00022	0.00000	0.00000
Fuel Storage and Dispensing	0.60	0.00	0.00	0.00164	0.00000	0.00000
Generators	0.63	7.74	1.67	0.00024	0.00302	0.00065
Miscellaneous VOC	10.44	0.00	0.00	0.02861	0.00000	0.00000
Surface Coating	0.16	0.00	0.00	0.00044	0.00000	0.00000
Total	13.28	28.19	22.96	0.03411	0.04345	0.04583

Lackland Air Force Base and Kelly Air Field

Lackland Air Force Base is located in Bexar County, Texas, in the west southwestern part of the City of San Antonio. The base is home to the 37th Training Wing whose primary mission is to provide training to new recruits entering the Air Force. Lackland gained a flying mission when adjacent Kelly Air Force Base closed in 2001. The 2-mile-long runway is now a joint-use facility between Lackland AFB and the city of San Antonio. In addition, "with the closure of Kelly AFB Lackland gained the section of base known as Security Hill. Security Hill is home to numerous

[25] EPA. AP42 Fifth Edition, Volume 1. Available online: http://www.epa.gov/ttn/chief/ap42/

Air Combat Command units such as the 67th Network Warfare Wing and the Air Intelligence Agency."[26] Lackland AFB is also home to the Air Force Regional Confinement Facility.

Methodology

This EI report benefits from the work that personnel of MACTEC Engineering and Consulting have performed for the Base in 2003. The Air Emissions Inventory for mobile source conducted by MACTEC[27] contained estimates for the criteria pollutants and description of methodologies for calculating these emissions. The emissions for current military and civilian aircraft operations, ground support equipment, etc. operated at the Kelly Air Field are included in this section. Area source emissions from Lackland Air Force Base and Kelly Air Field are included in the point source emission section of the emission inventory.

Aircraft Flight Operations

All of flight operations at Lackland AFB are conducted at the Kelly Air Field, once part of Kelly AFB. These operations occur within 100 miles of Lackland and are below the mixing level (approx. 3000 feet). To calculate emissions, estimates were made concerning aspects of flight such as, takeoff, level flight, approach, and landing. Taxiing and idle before and after flight were also included in emission calculations for each sortie. The base's two tenant units, the 149th Fighter Wing and 433rd Fighter Wing, account for most of aircraft emissions; but additional emissions are caused by transient and commercial aircraft visiting Lackland.

Information concerning aircraft type, engine type, types of sorties, number of sorties, engine power settings used during phases of sorties and typical duration in each of those power settings was provided by the unit personnel. Emission factors are specific to engine type and size. To calculate emissions, emission factors are multiplied by the total hours of operation. A sample calculation is provided in the next section, which is allocated to the Randolph AFB. Table 3-7 contains VOC, NOx, and CO emissions for all aircrafts at Lackland AFB.

On-Road Emissions

The on-road mobile sources portion of the Lackland emissions inventory is broken down into the following two categories:

- Military owned and operated vehicles (GOV)
- Non-military vehicles (POV) - dependant vehicles, commuter and visiting vehicles, and commercial vehicles

Information on GOV, POV, and the total vehicle miles traveled (VMT) were collected and the emissions for the on-road sources were estimated using the EPA's MOBILE6 model.[28] The total emissions for GOV and the POV were aggregated to generate the total on-road emissions for Lackland AFB in 2005 as shown in table 3-8.

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[26] Wikipedia, 2007. Lackland Air Force Base. Available online: http://en.wikipedia.org/wiki/Lackland_Air_Force_Base

[27] MACTEC Engineering and Consulting, Inc., 2003. Air Emissions Inventories for Multiple AETC Installations (Draft). Contract No.F41624-03-D-8606/003.

[28] U.S. Environmental Protection Agency; August 2003. User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model. Available online: http://www.epa.gov/otaq/m6.htm

Table 3-7. 2005 Emissions from Aircraft Operation at Lackland AFB[29]

Tenant	Aircraft	Emissions (tons/year)			Emissions (tons/day)		
		VOC	NO_X	CO	VOC	NO_X	CO
149th Flying Training Wing	F-16	1.75	24.09	34.06	0.00670	0.09230	0.13048
433rd Flying Training Wing	C-5	24.09	242.30	101.55	0.09231	0.92834	0.38910
Transient Alert	707	3.85	0.61	4.88	0.01476	0.00234	0.01868
	747	1.90	2.42	4.60	0.00730	0.00926	0.01763
	A-10	0.18	0.04	0.81	0.00070	0.00015	0.00310
	AV-8	0.21	0.07	1.23	0.00082	0.00027	0.00470
	C-12	0.23	0.01	0.27	0.00088	0.00006	0.00105
	C-130	0.33	2.06	0.80	0.00127	0.00789	0.00307
	C-141	2.73	0.38	3.13	0.01047	0.00147	0.01201
	C-17	0.08	2.11	0.86	0.00032	0.00809	0.00328
	C-21	0.05	0.10	0.32	0.00021	0.00039	0.00122
	C-5	0.19	0.99	0.66	0.00074	0.00380	0.00252
	C-9	0.39	2.37	1.74	0.00148	0.00907	0.00665
	F-111	0.04	0.02	0.09	0.00017	0.00008	0.00034
	F-14	0.09	0.47	0.38	0.00034	0.00179	0.00146
	F-15	0.52	0.99	1.76	0.00199	0.00378	0.00676
	F-16	0.09	1.40	1.70	0.00035	0.00535	0.00653
	F-18	2.36	0.68	5.38	0.00905	0.00259	0.02061
	F-4	0.06	0.12	0.43	0.00023	0.00044	0.00163
	KC-135	5.82	1.04	6.96	0.02229	0.00399	0.02668
	SW-4	0.45	0.04	0.37	0.00173	0.00015	0.00140
	T-1A	0.63	0.07	0.90	0.00241	0.00027	0.00346
	T-34	0.01	0.04	0.09	0.00002	0.00014	0.00035
	T-37	0.40	0.08	4.68	0.00155	0.00029	0.01791
	T-38	3.31	0.79	38.41	0.01269	0.00302	0.14717
	T-43	0.00	0.03	0.02	0.00002	0.00010	0.00007
	T-44	0.00	0.02	0.04	0.00001	0.00007	0.00013
	T-45	0.04	0.16	0.23	0.00013	0.00060	0.00090
	T-6	0.06	0.02	0.19	0.00024	0.00007	0.00074
	UH-1	0.01	0.01	0.03	0.00004	0.00004	0.00013
Total Emissions		49.91	283.50	216.57	0.19121	1.08620	0.82978

Table 3-8. 2005 On-road Emissions for Lackland AFB

Type	VOC (tons/year)	NOx (tons/year)	CO (tons/year)
GOV Emissions	14.62	35.01	100.97
POV Emissions	97.74	55.31	767.58
Total	112.36	90.31	868.55

[29] *Ibid*. Note: Emissions estimates from the report's Table 3.3-12 (p. 3-30) were converted by AACOG staff from pounds/year to tons/year.

Non-road Emissions

This category includes equipment used in recreational, construction, industrial, commercial, and lawn/garden activities. The Information needed to calculate emissions came from the following sources:

- Vehicle Master List: 37 LRS/LGRV (Logistics Readiness Squadron Vehicle Management Flight) and 433 MXS (433rd Airlift Wing Maintenance Squadron)
- 149 Air National Guard (ANG)
- 37 Civil Engineer Squadron (CES) Aircraft Maintenance Unit 1 (AMU 1)
- 37 CES (AMU 2)
- 37 CES (AMU 3)
- 37 CES (AMU 5)
- 37 CES (Vertical Shop)
- 37 CES/CECS (Saber)
- 37 CES/CEOHH (Heavy Equipment)
- CES/CEOIE (Electrical Shop)
- CES/CEOIG (Power Production)
- CES/CEOMS (Self Help)
- 37 Services Squadron (SVS)/SVBG (Golf Courses)
- Family Housing
- Ground Maintenance Contractor (Goodwill and TRDI)

Information about other non-road vehicles was obtained through interviews with fleet managers at Lackland. These non-roads included golf course maintenance equipment, landscaping equipment, and heavy industrial equipment. In each case, the fleet manager estimated the number of each type of unit in the fleet, determined the horsepower rating and the fuel type, and estimated the number of hours per day that each unit operated.

Sample Calculation

Equation (1)

Annual emissions for each type of non-road equipment:

$$AE_A = (EP_A \times HRS_A \times HP_A \times LF_A \times EF_A) / 453.59 \text{ g/lbs} / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual emissions for each type of equipment A (tons/yr)
EP_A = Equipment population of type A (based on survey)
HRS_A = Annual hours of use for equipment A (based on survey)
HP_A = Average rated horsepower for equipment type A (based on survey)
LF_A = Typical load factor for equipment type A
EF_A = Average emissions of pollutant per unit of use for equipment type A, g/hp-hr

Using these estimates and the load factors and emissions factors from the EPA report for these vehicles, the total annual emissions were calculated. These emissions results were combined to create the following table (3-9).

Table 3-9. 2005 Total Estimated Nonroad Emissions for Lackland AFB

Equipment by Source	Emissions (tons/yr)		
	VOC	NOx	CO
Vehicle Master List Nonroad Equipment	4.27	22.73	30.20
Other Non-road Equipment	46.91	15.73	363.74
Total Non-road	51.18	38.46	393.94

Aerospace Ground Equipment Operations

This category includes emissions associated with use of aerospace ground equipment (AGE) such as air compressors, floodlights, bomb lifts, turbines, generators, heaters, etc. Emissions from AGE were calculated by multiplying the heating value of used fuel and fuel-specific emission factor to the amount of fuel used.

Sample Calculation

Equation (2)

Annual aerospace ground equipment operations emissions:

$$AE_A = FUEL_A \times HV_A \times EF_A \;/\; 453.59 \text{ grams/lbs} \;/\; 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual aerospace ground equipment emissions, tons VOC/yr
$FUEL_A$ = Quantity of fuel used for equipment type A
HV_A = Heating value for equipment type A
EF_A = Emission factor for equipment type A

The sample given in the AEI report for air compressor using JP-8 fuel is as follows:

$$AE_A = 192 \text{ gal/yr} \times 0.12575 \text{ MMBtu/gal} \times 2.07 \text{ lbs/MMBtu} \;/\; 2{,}000 \text{ lbs/ton}$$
$$= 0.02499 \text{ tons CO/yr}$$

Aircraft Engine Testing Emissions

This category includes only aircraft engines that are tested “on-wing.” This means the engines are actually mounted on the aircraft and not at a test stand, as test stand mounted engine testing is considered a stationary source and not included in the AEI performed by MACTEC. All aircraft engine testings are done by the 149^{th} Fighter Wing and the 433^{rd} Airlift Wing at Kelly Air Field. These emissions are calculated similar to calculating emissions from the aircraft flight operations. After the total hours of operation are calculated, emission factors, fuel flow rates, and operation hours are figured together to achieve emissions in lbs/yr

Results

The following table (3-10) contains the overall mobile and non-road source emission results in tons of pollutant per year. The table shows the total and daily emissions by pollutant for each category. Daily emissions were determined utilizing a 261 days per year conversion factor.

Table 3-10. 2005 Total Annual and Daily Emissions at Lackland AFB

Emissions Source	Emissions (tons/year)			Emissions (tons/day)		
	VOC	NOx	CO	VOC	NOx	CO
Aircraft Flight Operations	49.91	283.50	216.57	0.19121	1.08620	0.82978
Aircraft Engine Testing	3.19	52.40	12.60	0.01223	0.20078	0.04826
GSE/AGE/APU	1.01	15.48	5.82	0.00388	0.05933	0.02230
GOV On-Road	14.62	35.00	100.97	0.05602	0.13412	0.38687
POV On-Road	97.74	55.31	767.58	0.37449	0.21191	2.94094
Nonroad	51.18	38.46	393.95	0.19609	0.14737	1.50937
Total	217.65	480.16	1,497.49	0.83391	1.83971	5.73752

Randolph Air Force Base

Randolph Air Force Base (RAFB) is located in Bexar County, Texas, northeast of the City of San Antonio. The base is home to the 12th Flying Training Wing and is one of the few bases that conduct instructor pilot training. The information in this report is from an air emissions inventory[30] that was conducted at RAFB in October 2003, for the calendar year 2002. The report outlined resources and methodologies used to determine mobile source emissions for criteria pollutants. For the purposes of this inventory, mobile source emissions encompass:

- Aircraft Flight Operations
- On-road
- Nonroad
- Aerospace Ground Equipment
- Engine Testing
- Fueling

Area source emissions from Randolph Air Force Base are included in the point source emission section of the emission inventory.

Methodology

In the following pages, more detailed descriptions of methods for collecting information on equipment and calculating emissions for activities associated with these equipment at Randolph base are discussed.

[30] MACTEC Engineering and Consulting, Inc., 2003. Air Emissions Inventories for Multiple AETC Installations (Draft). Contract No.F41624-03-D-8606/003.

Aircraft Flight Operations

The aircraft emissions were determined by obtaining the type of aircraft and number of landings for the aircraft from base personnel. The hours of operation were estimated from the number of landings in a given year. The methodology employed by MACTEC involved obtaining detailed information from each unit. The calculations required multiplying emission factors by the number of hours of operation. Four emission factors (Idle, Approach, Climb Out, and Takeoff) were assigned for each of the three pollutants (VOC, NOx, and CO) based on aircraft type and size of engine. A sample calculation of CO emissions for a T-1A given in the AEI is as follows:

Sample Calculation

Equation (1)

Annual aircraft flight operations emissions:

$$AE = \Sigma\ (TC_A \times EF_A \times FLOW_A \times HOUR_A) / 2{,}000\ \text{lbs/ton}$$

Where,

AE = Annual aircraft flight operations emissions
EF_A = Emission factor for operation type A
$FLOW_A$ = Aircraft flue flow rate for operation type A
$HOUR_A$ = Annual hours for operation type A

Annual CO emissions in pounds/year for a T-1A / JT15D-5B:

AE = [(108.14 lbs/1,000 lbs of fuel x 221 lbs fuel/hr x 1,176.13 hrs/yr) + (35.30 lbs/1,000 lbs of fuel x 496 lbs fuel/hr x 2,205.43 hrs/yr) + (1.63 lbs/1,000 lbs of fuel x 1,359 lbs fuel/hr x 1,001.29 hrs/yr) + (0.20 lbs/1,000 lbs of fuel x 1,630 lbs fuel/hr x 675.14 hrs/yr)] / 2,000 lbs/ton
= 33.0045 tons CO/year

To calculate emissions in tons per day, the 261 days per year conversion factor was used. The resulting VOC, NOx, and CO emissions for each aircraft type in tons per year and tons per day are listed in Table 3-11.

On-road Vehicles

On-road sources include motor vehicles licensed for operation on roads and highways. MOBILE6 was used to calculate the emissions of VOC, NO_x, and CO.[31] On-road mobile source emissions is divided into the following two categories:

- Government owned and operated vehicles (GOV)
- Privately owned vehicles (POV) - dependant vehicles, commuter and visiting vehicles, and commercial vehicles

[31] U.S. Environmental Protection Agency, August 2003. User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model. Available online: http://www.epa.gov/otaq/m6.htm

Table 3-11. 2005 Annual and Daily Emissions for Aircraft Operations at Randolph AFB[32]

Aircraft	Emissions (tons/yr)			Emissions (tons/day)		
	VOC	NO_X	CO	VOC	NO_X	CO
12th Flying Training Wing						
T-1A	15.11	15.64	33.00	0.05790	0.05993	0.12645
T-6A	7.04	9.30	31.09	0.02696	0.03563	0.11913
T-37B	7.31	20.63	284.83	0.02799	0.07903	1.09130
T-38A	28.03	26.23	528.18	0.10739	0.10050	2.02367
T-43A	1.93	53.88	8.77	0.00740	0.20642	0.03359
T-38B	3.13	4.49	61.80	0.01197	0.01720	0.23680
415th Flight Test Flight						
T-38	0.40	0.15	5.31	0.00152	0.00059	0.02036
Vertex Aerospace Corporation						
C-21	0.53	1.01	3.32	0.00203	0.00387	0.01271
Transient Alert						
737	0.00	0.02	0.01	0.00000	0.00006	0.00003
757	0.00	0.01	0.01	0.00000	0.00005	0.00003
A-10	0.28	0.06	1.24	0.00108	0.00023	0.00476
AH-1	0.00	0.02	0.04	0.00001	0.00007	0.00015
AV-8	0.06	0.02	0.33	0.00022	0.00007	0.00125
B-1	0.00	0.03	0.03	0.00000	0.00011	0.00012
BE-35	0.00	0.00	0.01	0.00000	0.00000	0.00004
C-12	0.47	0.03	0.56	0.00180	0.00012	0.00214
C-130	0.07	0.41	0.16	0.00025	0.00157	0.00061
C-135	0.80	0.14	0.96	0.00308	0.00055	0.00369
C-141	0.38	0.05	0.44	0.00145	0.00020	0.00167
C-160	0.00	0.02	0.01	0.00001	0.00006	0.00005
C-17	0.00	0.11	0.05	0.00002	0.00043	0.00017
C-2	0.00	0.00	0.00	0.00000	0.00001	0.00001
C-20	0.00	0.01	0.02	0.00001	0.00004	0.00008
C-21	0.17	0.32	1.00	0.00064	0.00123	0.00382
C-23	0.00	0.00	0.00	0.00000	0.00000	0.00000
C-26	0.03	0.00	0.02	0.00010	0.00001	0.00007
C-414	0.00	0.00	0.01	0.00000	0.00000	0.00004
C-9	0.02	0.10	0.07	0.00006	0.00038	0.00028
C337	0.00	0.00	0.01	0.00000	0.00000	0.00004
Cessna 172	0.00	0.00	0.02	0.00000	0.00000	0.00006
Cessna 182	0.00	0.00	0.04	0.00000	0.00000	0.00016
Cessna 206	0.00	0.00	0.01	0.00000	0.00000	0.00003
Cessna 560	0.00	0.00	0.01	0.00001	0.00000	0.00002
CH-46	0.03	0.01	0.11	0.00010	0.00006	0.00043
CH-47	0.01	0.01	0.01	0.00002	0.00005	0.00005
CH-53	0.01	0.03	0.03	0.00005	0.00013	0.00012
D-8	0.00	0.00	0.00	0.00000	0.00001	0.00001

[32] *Ibid*. Note: Emissions estimates from Table 7.3-25 (pp. 7-61 – 7-63) were converted by AACOG staff from pounds/year to tons/year.

Aircraft	Emissions (tons/yr)			Emissions (tons/day)		
	VOC	NO_X	CO	VOC	NO_X	CO
E-6	0.00	0.05	0.04	0.00001	0.00018	0.00017
E-8	0.06	0.01	0.07	0.00024	0.00004	0.00028
EA-6B	0.02	0.01	0.05	0.00009	0.00003	0.00018
EXTRA 300	0.00	0.00	0.04	0.00000	0.00000	0.00016
F-14	0.00	0.02	0.02	0.00002	0.00010	0.00008
F-15	0.67	1.27	2.27	0.00256	0.00487	0.00871
F-16	0.03	0.41	0.50	0.00010	0.00157	0.00191
F-18	1.01	0.29	2.29	0.00386	0.00111	0.00879
F-4	0.07	0.13	0.46	0.00025	0.00048	0.00178
F-5	0.07	0.02	0.55	0.00025	0.00008	0.00212
FALCON 50	0.00	0.00	0.00	0.00000	0.00000	0.00001
G-5	0.00	0.00	0.00	0.00000	0.00001	0.00002
H-60	0.06	0.04	0.07	0.00021	0.00013	0.00026
KC-10	0.00	0.03	0.02	0.00001	0.00012	0.00006
LR60	0.00	0.00	0.00	0.00000	0.00000	0.00001
M-20F	0.00	0.00	0.01	0.00000	0.00000	0.00002
M20P	0.00	0.00	0.02	0.00000	0.00000	0.00008
MI-8 HELO	0.00	0.00	0.00	0.00001	0.00000	0.00001
P-3	0.01	0.06	0.04	0.00002	0.00021	0.00013
P-40	0.01	0.00	0.03	0.00002	0.00000	0.00012
PA-23	0.00	0.00	0.08	0.00001	0.00000	0.00032
PA-28	0.00	0.00	0.01	0.00000	0.00000	0.00003
RV-6	0.00	0.00	0.02	0.00000	0.00000	0.00008
S-3	0.02	0.01	0.09	0.00007	0.00002	0.00036
SNJ-5	0.01	0.00	0.03	0.00002	0.00000	0.00012
T-1A	0.42	0.05	0.60	0.00160	0.00018	0.00230
T-2	0.01	0.02	0.07	0.00005	0.00006	0.00027
T-34	0.00	0.03	0.07	0.00002	0.00011	0.00026
T-37	0.13	0.02	1.54	0.00051	0.00010	0.00588
T-38	2.19	0.52	25.42	0.00840	0.00200	0.09739
T-39	0.05	0.03	0.49	0.00018	0.00010	0.00188
T-44	0.00	0.02	0.03	0.00001	0.00006	0.00012
T-45	0.00	0.01	0.01	0.00001	0.00002	0.00003
T-6	0.04	0.01	0.11	0.00014	0.00004	0.00043
TH-57	0.00	0.00	0.01	0.00000	0.00000	0.00002
UC-35	0.17	0.02	0.28	0.00063	0.00006	0.00107
UH-1	0.00	0.00	0.01	0.00001	0.00001	0.00003
Total	70.84	135.80	996.88	0.27138	0.52030	3.81943

The GOV category consists of all government-owned vehicles used by various contractors and military units. Their activity records are listed on the Vehicle Master List, general service administration list, housing contractor list, landscaping contractor list, and refuse collecting contractor list (Table 3-12). A registration distribution factor was calculated for each vehicle classification by dividing the number of vehicles registered in the model year by the total number of GOV vehicles per each MOBILE6 vehicle class.

Table 3-12. 2005 VMT by Various List for Government Owned Vehicles at Randolph AFB[33]

Vehicle Class	Vehicle Master List	General Service Administration	Housing Maintenance Contractor	Ground Maintenance Contractor	Refuse Collection Contractor
LDGV	121,420	80,404	80,000	--	--
LDGT1	530,259	30,632	--	250,000	--
LDGT2	--	66,752	--	--	--
LDGT3	53,388	--	--	--	--
LDGT4		--	--	--	--
HDGV2B	52,613	25,840	--	--	--
HDGV3	55,006	--	--	--	--
HDGV4	106,818	--	--	--	--
HDGV5		--	--	--	--
HDGV6		--	--	--	--
HDGV7		--	--	--	--
HDGV8A		--	--	--	--
LDDV		--	5,000	--	--
LDDT12	132,123	--	--	--	--
HDDV2B	84,787	--	--	--	--
HDDV3	28,895	--	--	--	--
HDDV4	1,531	--	--	--	--
HDDV5	4,869	--	--	--	11,040
HDDV6		--	--	--	--
HDDV7	28,695	--	--	--	--
HDDV8A	65,769	--	--	--	--
HDDV8B	--	--	--	--	--
HDGB	--	--	--	--	--
HDDBT	46,621	--	--	--	--
HDDBS	73,597	284	--	--	--

The emissions for GOV were estimated using the data on total miles traveled by these vehicles and emission factors generated by the MOBILE6 model for specific vehicles (Table 3-13). The resulting emissions from the AEI developed by MACTEC have been converted from pounds per year to tons per year and summed by fleet list in Table 3-14. This table also contains the estimated GOV on-road daily emissions at Randolph AFB. The 261 days per year conversion factor was utilized to calculate tons per day values.

Non-military vehicles are privately owned and operated, thus referred to as POV. The on-road mobile source emissions, resulting from POV on Randolph AFB include emissions generated from commute by civilian and military personnel living off base, as well as those generated while on the base. For the purpose of this inventory, only the on-base portion of these emissions is included in this chapter, as the off-base emissions are included in the On-road Sources Section of the EI report. The POV emissions were calculated using a methodology similar to the one employed for the GOV. A standard input file for MOBILE6 was prepared and run to obtain emission factors. These factors were multiplied by VMT to determine total emissions.

[33] *Ibid*. Table 7.6-11 (pp. 7-111 – 7-112).

Table 3-13. 2005 Emission Factors for GOV at Randolph AFB[34]

MOBILE6 Vehicle Class	VOC Grams/Mile	NOx Grams/Mile	CO Grams/Mile
LDGV	0.60	0.56	9.75
LDGT1	1.58	1.11	17
LDGT2	2.37	1.44	22
LDGT3	4.11	2.12	33
LDGT4	3.71	1.97	32.2
HDGV2B	3.65	5.22	16.6
HDGV3	3.18	5.48	21.2
HDGV4	6.49	7	26.8
HDGV5	8.34	8.34	51.7
HDGV6	4.98	5.56	40.7
HDGV7	6.83	7.68	46.2
HDGV8A	9.98	9.38	81.3
HDGV8B	--	--	--
LDDV	0.18	0.59	0.99
LDDT12	3.42	3.04	5.59
HDDV2B	0.43	4.57	1.57
HDDV3	0.47	5.53	1.86
HDDV4	0.72	6.93	1.73
HDDV5	0.94	7.03	2.59
HDDV6	0.62	8.38	2.07
HDDV7	1.05	11.5	4.37
HDDV8A	1.35	17.3	7.57
HDDV8B	1.01	19.2	5.41
MC	2.94	1.13	14.9
HDGB	10.6	8	92.3
HDDBT	1.25	17.8	8.9
HDDBS	1.18	12.4	4.79
LDDT3, 4	0.99	1.44	1.58

Table 3-14. 2005 Emissions for Government Owned Vehicles at Randolph AFB[35]

Fleet	Emissions (tons/yr)			Emissions (tons/day)		
	VOC	NOx	CO	VOC	NOx	CO
Vehicle Master List	3.27	6.95	21.14	0.01251	0.02661	0.08101
General Service Administration	0.39	0.35	3.53	0.00148	0.00132	0.01353
Housing Maintenance Contractor	0.05	0.05	0.86	0.00021	0.00020	0.00331
Ground Maintenance Contractor	0.44	0.31	4.68	0.00167	0.00117	0.01792
Refuse Collection Contractor	0.01	0.09	0.03	0.00004	0.00033	0.00012
Total Emissions	4.15	7.74	30.25	0.01591	0.02964	0.11590

The VMT traveled by POV on Randolph roadways were determined by a short-term study in which the on-base activity was analyzed. MACTEC estimated values for miles per year traveled by each group of POV (Table 3-15).

34 *Ibid*. Table 7.6-9 (p7-109).
35 *Ibid*. Note: Subtotals taken from Table 7.6-12 (pp. 7-113 – 7-115) were converted by AACOG staff from pounds/year to tons/year and totaled.

Table 3-15. 2005 Total Miles Traveled by Privately Owned Vehicles at Randolph AFB[36]

On-base Group Estimated	Miles/Year
Employees Commute to Work from On-base Housing	511,538
Employees Commute to Work from Off-base Housing	4,765,988
Employees Driving to Lunch	3,958,145
Dependents from On-base Housing	1,487,740
Dependents from Off-base Housing	416,000
Retirees Driving On Base	645,736
Air Show Visitors	150,500
Contractors Driving On Base	114,205

Since records of POV are not kept, MACTEC first established the vehicle mix distribution by fuel type based on a comparison between the national fleet vehicle mix, MOBILE6 vehicle classifications, and typical POV mix. The VMT were estimated for on-base and off-base travel for each vehicle type (Table 3-16).

Table 3-16. 2005 VMT for POV by Vehicle Class at Randolph AFB[37]

MOBILE6 Vehicle Class	Annual VMT
LDGV	7,129,483
LDDV	6,422
HDDBS	37,389
LDGT1	4,155,490
HDGV5	45,747
HDDV5	39,713
HDGV2B	324,829
HDDV2B	81,106
MC	229,674
Total	12,049,852

A MOBILE6 command file was prepared with the same input variables used for analysis of emissions from GOV. The registration distribution file, however, was constructed based on the national fleet data. The MOBILE6 model then calculated emissions factors for each vehicle class in 2005. These emission factors are shown in Table 3-17 for each specific vehicle class. The resulting VOC, NOx, and CO emission estimates are aggregated and shown in following Table 3-18. The results have also been converted from pounds per year to tons per year and summed by vehicle category.

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[36] *Ibid*. Totals are from Table 7.7-1 (p. 7-119).

[37] *Ibid*. Note: On-base figures from Table 7.7-6 (p. 7-122).

Table 3-17. 2005 Emission Factors for POV at Randolph AFB[38]

MOBILE6 Vehicle Class	VOC (g/mi)	NO_X (g/mi)	CO (g/mi)
LDGV	2.410	1.180	17.30
LDDV	0.788	1.440	1.780
HDDBS	0.915	11.80	2.950
LDGT1	2.300	1.160	21.40
HDGV5	4.820	5.540	37.60
HDDV5	0.409	5.530	1.520
HDGV2B	2.660	4.330	19.90
HDDV2B	0.308	3.970	1.170
MC	2.940	1.130	14.90

Table 3-18. 2005 On-Base Emissions for Privately Owned Vehicles at Randolph AFB[39]

MOBILE6 Vehicle Class	Emissions (tons/yr)			Emissions (tons/day)		
	VOC	NOX	CO	VOC	NOX	CO
LDGV	18.91	9.29	136.24	0.07245	0.03559	0.52200
LDDV	0.01	0.01	0.01	0.00002	0.00004	0.00005
HDDBS	0.04	0.49	0.12	0.00014	0.00186	0.00047
LDGT1	10.55	5.32	97.96	0.04043	0.02039	0.37531
HDGV5	0.24	0.28	1.90	0.00093	0.00107	0.00727
HDDV5	0.02	0.24	0.07	0.00007	0.00093	0.00025
HDGV2B	0.95	1.55	7.14	0.00365	0.00594	0.02734
HDDV2B	0.04	0.49	0.14	0.00014	0.00189	0.00052
MC	0.75	0.29	3.77	0.00285	0.00109	0.01443
	31.50	17.96	247.33	0.12069	0.06881	0.94764

Non-road Equipment

The methodology outlined in the EPA 1991 report entitled *Non-Road Engine and Vehicle Emission Study* was used to perform calculations for off-road sources. The EPA report contains estimates for horsepower and activity factors, load factors, and estimates of hours per year equipment usage, which all are needed for calculation of emissions associated with the off-road sources. This category includes recreational, construction, industrial, commercial, and lawn/garden equipment.

The vehicle records contained information about the vehicle type, number of vehicles, fuel type, model year, and number of hours of operation. This list, however, did not include information about the load factors, horsepower ratings, or emission factors for these vehicles. The default values from EPA's 1991 report[40] were used for these inputs. Other vehicle parameters were obtained from the Vehicle Master List through the Transportation Squadron Vehicle Maintenance Shop. This accounted for the larger pieces of Government-owned non-road equipment.

[38] *Ibid*. Note: Table 7.7-7 (p. 7-124).
[39] *Ibid*. Note: Emissions estimates from Table 7.7-9 (p. 7-125) were converted by AACOG staff from pounds/year to tons/year.
[40] EPA, 1991. Nonroad Engine and Vehicle Study – Report. Office of Mobile Sources.

The emissions for the Master List equipment, Table 3-35, were calculated by condensing the vehicle list by type and model year. Using the provided emissions factor numbers, EFs were assigned from the emissions factors list. The hours of operation (OH) were totaled as well; and emissions were calculated using the methodology previously mentioned. Using these estimates and the load factors and emissions factors from the EPA report for these vehicles, the total annual emissions were calculated.

Sample Calculation
Equation (1)
Annual emissions for each type of non-road equipment:

$$AE_A = (EP_A \times HRS_A \times HP_A \times LF_A \times EF_A) / 453.59 \text{ g/lbs} / 2{,}000 \text{ lbs/ton}$$

Where,

- AE_A = Annual emissions for each type of equipment A (tons/yr)
- EP_A = Equipment population of type A (based on survey)
- HRS_A = Annual hours of use for equipment A (based on survey)
- HP_A = Average rated horsepower for equipment type A (based on survey)
- LF_A = Typical load factor for equipment type A
- EF_A = Average emissions of pollutant per unit of use for equipment type A (g/hp-hr)

Annual VOC emissions in pounds/year for a 1986 front-end loader:

$$AE = 1 \times 297 \text{ hrs/yr} \times 74 \text{ hp} \times 0.55 \times 1.43 \text{ g/hp-hr} / 453.59 \text{ g/lbs} / 2{,}000 \text{ lbs/ton}$$
$$= 0.01905 \text{ tons VOC/year}$$

Table 3-19 contains the emissions (tons/year) calculated for the larger non-road equipment indicated on the Vehicle Master List. It includes the vehicle type, number of vehicles, model years, load factors, average horsepower rating, and emission factors used in the calculations.

Organizations or shops that typically operate the smaller government-owned equipment and the privately owned equipment include the Civil Engineering Shops (CES), contractors, grounds maintenance, golf course, etc. To obtain the data for their equipment, interviews with fleet managers at Randolph AFB were conducted by MACTEC. These other non-road equipment/vehicles include golf course maintenance equipment, stable grounds equipment, and contracts/landscaping equipment. In each case, the fleet manager estimated the number of each type of unit in the fleet, determined the horsepower rating and the fuel type, and estimated the number of hours per day that each unit operated.

Using these estimates and the load factors and emissions factors from the EPA report for these vehicles, the total annual emissions were calculated. Tables 3-20 provide estimated emissions for each fleet/contractor by equipment type and Table 3-21 summarizes these tables by fleet/contractor. The total emissions for these vehicles are, in some cases, larger than the estimates for the registered off-road vehicles. This is primarily due to discrepancies between the hourly usage data given in the registered vehicle list and the estimates given by the fleet managers. In some cases, the fleet managers may have overestimated the hourly usage of the equipment.

Table 3-19. Master List Non-road Equipment Emissions Estimates, 2002[41]

Equipment Type	Model Years	Number	HP	Total hrs/yr	Load Factor	Emission Factor			Emissions (tons/yr)		
						VOC	NOx	CO	VOC	NOx	CO
Crane	1988	4	194	727	43%	0.6	8.3	3.4	0.0401	0.5549	0.2273
Fire Truck	1987	5	400	582	57%	0.9	9.6	2.8	0.1258	1.4042	0.4096
Fire Truck	1989-1994	5	400	960	57%	1.5	8.6	6.2	0.3619	2.0749	1.4959
Fork Lift	1985-1986	3	83	612	30%	1.6	14.0	6.1	0.0269	0.2352	0.1018
Fork Lift	1989-1995	11	83	1,927	30%	2.2	8.5	8.1	0.1164	0.4496	0.4284
Fuel Truck	1989-1991	11	250	5,397	57%	1.5	8.6	6.2	1.2716	7.2906	5.2560
Fuel Truck	1998	2	250	1,201	57%	0.9	7.1	2.3	0.1698	1.3394	0.4339
Golf Cart	1992-2001	20	10	5,200	46%	36.9	2.1	348.0	0.9729	0.0551	9.1757
Loader	1986	2	74	297	55%	1.4	10.1	6.8	0.0191	0.1346	0.0906
Loader	1993-2002	3	74	2,098	55%	1.5	7.1	2.3	0.1412	0.6683	0.2165
Road Grader	1984	1	159.5	235	61%	1.6	9.6	3.8	0.0396	0.2420	0.0958
Roller	1983	1	7	47	62%	36.9	2.0	429.0	0.0083	0.0005	0.0965
Roller	1992	1	99	22	56%	0.9	8.2	4.4	0.0012	0.0110	0.0059
Sweeper	1984-1986	2	97	1,335	68%	1.6	14.0	6.1	0.1553	1.3589	0.5882
Sweeper	1992	1	97	794	68%	0.9	8.2	1.5	0.0520	0.4734	0.0866
Sweeper	2002	2	97	1,821	68%	0.6	6.8	0.4	0.0794	0.9003	0.0530
Tractor	1990-1996	12	87	3,122	48%	6.5	4.8	198.0	0.9341	0.6884	28.4548
Tractor	1984	1	98	81	55%	1.4	10.1	6.8	0.0069	0.0486	0.0327
Tractor	1990	6	98	3,261	55%	1.5	7.1	2.3	0.2906	1.3756	0.4456
Tractor	1988-1991	2	98	464	55%	2.2	8.5	8.1	0.0607	0.2343	0.2233
Tractor	1996-2001	11	98	2,448	55%	2.2	8.5	8.1	0.3200	1.2363	1.1781
Total		106							5.1936	20.7759	49.0960

[41] MACTEC Engineering and Consulting, Inc., 2003. Air Emissions Inventories for Multiple AETC Installations (Draft). Contract No.F41624-03-D-8606/003. Note: Combination of Tables 7.8-1 (pp. 7-132 – 7-135), 7.8-4 (pp. 7-145 – 7-151), 7.8.5 (pp. 7-152 – 7-161), 7.8-7 (pp. 7-163 – 7-169), 7.8-8 (pp. 7-169 – 7-171), and 7.8-10 (pp. 7-172 – 7-180).

Table 3-20. 2005 Non-road Emissions Estimates

Section	Equipment Type	Model Years	Number	HP	Total hrs/yr	LF	VOC EF	NOx EF	CO EF	VOC tons/yr	NOx tons/yr	CO tons/yr
12 CES[42]	Cart	--	35	10	9,100	46%	36.9	2.09	348	1.70264	0.09644	16.05741
12 CES/CEC (Contracting) Contractors[43]	Backhoe	1992	1	74	2,813	55%	2.2	8.5	8.1	0.27764	1.07270	1.02222
	Bobcat	1993	2	43	5,001	55%	3.9	7.1	11.6	0.50845	0.92564	1.51232
	Cherry Picker	--	1	36	1,250	46%	9.6	2.09	348	0.21905	0.04769	7.94048
	Concrete Truck	1992	1	350	2,813	57%	1.5	8.6	6.2	0.92790	5.31996	3.83532
	Dump Truck	1993	3	350	7,188	57%	1.5	8.6	6.2	2.37104	13.59397	9.80031
	Excavator	1992	1	163	2,813	57%	1.5	8.6	6.2	0.43214	2.47758	1.78616
	Loader	1992	2	74	4,375	55%	2.2	8.5	8.1	0.43181	1.66835	1.58984
	Manlift	--	1	36	1,250	46%	9.6	2.09	348	0.21905	0.04769	7.94048
	Paver	1992	2	84	5,001	62%	0.9	8.2	4.4	0.25839	2.35417	1.26322
	Power Washer	--	1	7	1,250	85%	37	1.98	429	0.30334	0.01623	3.51707
	Roller	1992	2	99	4,375	56%	0.9	8.2	4.4	0.24063	2.19236	1.17639
	Sweeper	1992	1	97	2,813	68%	0.9	8.2	1.5	0.18407	1.67711	0.30679
CES/CECS (SABER) Contractors[44]	Backhoe	1992	1	74	240	55%	2.2	8.5	8.1	0.02369	0.09152	0.08721
	Concrete Saw	--	1	13	240	78%	9.6	2.09	348	0.02575	0.00561	0.93352
	Power Washer	--	1	7	240	85%	37	1.98	429	0.05824	0.00312	0.67528
	Tamper	--	1	4	240	55%	36.9	1.98	429	0.02148	0.00115	0.24968
	Trencher	1992	1	209	240	75%	1.5	8.6	6.2	0.06220	0.35663	0.25710
12 CES/CEOBE (Entomology)[45]	Backpack Sprayer	--	1	1	5	65%	261	0.94	719	0.00094	0.00000	0.00258
	Handheld Sprayer	--	1	1	12	65%	261	0.94	719	0.00224	0.00001	0.00618
	Mosquito Fogger	--	1	18	144	65%	9.6	2.09	348	0.01783	0.00388	0.64629
	Pesticide Sprayer	--	1	5.5	5	65%	37	1.98	429	0.00073	0.00004	0.00845
	Pesticide Sprayer	--	1	8	30	65%	37	1.98	429	0.00636	0.00034	0.07377
12 CES/CEOBP	Asphalt Paver	1998	1	84	60	62%	0.7	6.8	1.3	0.00241	0.02342	0.00448
	Backpack Blower	--	1	2	120	75%	261	0.94	719	0.05179	0.00019	0.14266

[42] _Ibid_. Note: Combination of Tables 7.8-2 (pp. 7-136 – 7-141), 7.8-4 (pp. 7-145 – 7-151), 7.8.5 (pp. 7-152 – 7-161), 7.8-7 (pp. 7-163 – 7-169), 7.8-8 (pp. 7-169 – 7-171), and 7.8-10 (pp. 7-172 – 7-180).
[43] _Ibid_.
[44] _Ibid_.
[45] _Ibid_.

Section	Equipment Type	Model Years	Number	HP	Total hrs/yr	LF	VOC EF	NOx EF	CO EF	VOC tons/yr	NOx tons/yr	CO tons/yr
(Pavement/Heavy Equipment)[46]	Cement Mixer	--	1	7	520	59%	36.9	1.98	429	0.08735	0.00469	1.01556
	Chain Saw	--	4	2.6	480	92%	261	0.94	719	0.33032	0.00119	0.90997
	Concrete Router	--	2	5	240	78%	36.9	1.98	429	0.03807	0.00204	0.44262
	Concrete Saw	--	4	13	4,992	78%	9.6	2.09	348	0.53565	0.11662	19.41730
	Leaf Blower (hand)	--	1	2	120	75%	261	0.94	719	0.05179	0.00019	0.14266
	Plate Tamper	--	1	4	624	55%	36.9	1.98	429	0.05584	0.00300	0.64917
	Power Screed	--	1	1.5	96	59%	36.9	1.98	429	0.00346	0.00019	0.04018
	Skid Loader	1993	2	43	2,600	48%	3.9	7.1	11.6	0.23070	0.41999	0.68618
	Steam Cleaner	1999	1	2	288	30%	1.5	10	5	0.00029	0.00190	0.00095
	Trencher	1997	1	43.5	416	75%	3.9	7.1	11.6	0.05835	0.10622	0.17354
12 CES/CEOIEP (Power Production)[47]	Generator	2000	1	5	16	74%	1.6	5.9	5.6	0.00010	0.00039	0.00037
	Generator	1998	2	7	32	74%	1.5	10	5	0.00027	0.00183	0.00091
	Generator	2002	2	8	32	74%	1.6	5.9	5.6	0.00033	0.00123	0.00117
	Generator	1985	1	13	14	74%	1.5	10	5	0.00022	0.00148	0.00074
	Generator	1988	1	13	25	74%	1.5	10	5	0.00040	0.00265	0.00133
	Generator	1978	1	20	15	74%	1.8	6.9	5	0.00044	0.00169	0.00122
	Generator	1978-1986	2	40	38	74%	1.8	6.9	5	0.00223	0.00856	0.00620
	Generator	1994	1	80	15	74%	0.99	8.3	3.49	0.00097	0.00812	0.00342
	Generator	1986	1	134	15	74%	1.22	8	5	0.00200	0.01312	0.00820
	Generator	1987	1	268	12	74%	1.22	8	5	0.00320	0.02099	0.01312
	Generator	1988	3	268	51	74%	0.68	8.38	2.7	0.00758	0.09343	0.03010
12 CES/CEOZA (Zone A Maintenance)[48]	Arc Welder	1977	1	4	500	45%	1.5	10	5	0.00149	0.00992	0.00496
	Generator	--	1	5	104	68%	37	1.98	429	0.01442	0.00077	0.16721
	Generator	--	1	8	104	68%	37	1.98	429	0.02307	0.00123	0.26754
	Pressure Washer	--	1	5	48	85%	37	1.98	429	0.00832	0.00045	0.09647
	Pump	--	1	4	2	69%	37	1.98	429	0.00023	0.00001	0.00261
	Saw (concrete)	--	1	13	2	78%	9.6	2.09	348	0.00021	0.00005	0.00778

46 *Ibid*.
47 *Ibid*.
48 *Ibid*.

Section	Equipment Type	Model Years	Number	HP	Total hrs/yr	LF	VOC EF	NOx EF	CO EF	VOC tons/yr	NOx tons/yr	CO tons/yr
	Welder	--	1	19	500	51%	9.6	2.09	348	0.05127	0.01116	1.85853
12 CES/CEOZB (Zone B Maintenance)[49]	Generator	--	1	5	24	68%	37	1.98	429	0.00333	0.00018	0.03859
	Pressure Washer	--	2	11	120	85%	9.6	2.09	348	0.01187	0.00258	0.43040
	Pump	--	2	5.5	24	69%	37	1.98	429	0.00371	0.00020	0.04307
	Pump	--	1	4	24	69%	37	1.98	429	0.00270	0.00014	0.03132
	Pump	--	1	9	24	69%	37	1.98	429	0.00608	0.00033	0.07048
	Welder	1995	1	38	48	45%	1.8	6.9	5	0.00163	0.00624	0.00452
12 CES/COE (Contracting) Contractors[50]	Backhoe	1992	1	74	563	55%	2.2	8.5	8.1	0.05557	0.21469	0.20459
	Concrete Saw	--	1	13	563	78%	9.6	2.09	348	0.06041	0.01315	2.18989
	Dump Truck	1992	1	350	563	57%	1.5	8.6	6.2	0.18571	1.06475	0.76761
	Power Washer	--	1	7	563	85%	37	1.98	429	0.13662	0.00731	1.58409
	Tamper	--	1	4	563	55%	9.6	2.09	348	0.01311	0.00285	0.47512
	Trencher	1992	1	209	563	75%	1.5	8.6	6.2	0.14592	0.83659	0.60312
12 SUPS/LGSCO (Supply Squadron)[51]	Cart	--	4	10	2,080	46%	36.9	2.09	348	0.38917	0.02204	3.67026
	Fork Lift	1986	1	83	1,300	30%	1.7	8	10	0.06066	0.28545	0.35681
	Fork Lift	1993-1994	2	83	2,600	30%	2.2	8.5	8.1	0.15700	0.60658	0.57804
	Golf Cart	--	1	11	260	46%	36.9	2.09	348	0.05351	0.00303	0.50466
	Mule (ATV)	--	1	18	1,300	72%	100	9	975	0.10317	0.00929	1.00595
12 SVS/SBBG (Golf Course)[52]	Aerator	--	2	16	32	58%	9.6	2.09	348	0.00314	0.00068	0.11391
	Aerator	--	1	11	5	58%	9.6	2.09	348	0.00034	0.00007	0.01224
	Arc Welder	1977	1	4	520	45%	1.5	10	5	0.00155	0.01032	0.00516
	Backhoe/Front Loader	1990	1	28	80	55%	3.9	7.1	11.6	0.00530	0.00964	0.01575
	Backpack Blower	--	6	1	1,050	75%	261	0.94	719	0.22656	0.00082	0.62413
	Ball Picker	--	1	13	300	60%	9.6	2.09	348	0.02476	0.00539	0.89762
	Beer Cart	--	1	13	100	58%	9.6	2.09	348	0.00798	0.00174	0.28923
	Chain Saw	--	1	2.5	15	92%	261	0.94	719	0.00993	0.00004	0.02734
	Chain Saw	--	1	1.5	10	92%	261	0.94	719	0.00397	0.00001	0.01094

49 *Ibid*.
50 *Ibid*.
51 *Ibid*.
52 *Ibid*.

Section	Equipment Type	Model Years	Number	HP	Total hrs/yr	LF	VOC EF	NOx EF	CO EF	VOC tons/yr	NOx tons/yr	CO tons/yr
	Edger	--	5	3	100	68%	37	1.98	429	0.00832	0.00045	0.09647
	Fairway Mower	1997	1	18	450	65%	9.6	2.09	348	0.05571	0.01213	2.01964
	Fairway Mower	1997-1998	2	38	800	56%	1.8	6.9	5	0.03378	0.12948	0.09383
	Gator (ATV)	--	4	18	5,200	72%	100	9	975	0.41270	0.03714	4.02381
	Generator	--	1	5	104	68%	37	1.98	429	0.01442	0.00077	0.16721
	Generator	--	1	8	104	68%	37	1.98	429	0.02307	0.00123	0.26754
	Greens Mower	--	3	16	1,248	65%	9.6	2.09	348	0.13735	0.02990	4.97879
	Greens Mower	--	2	18	800	65%	9.6	2.09	348	0.09905	0.02156	3.59048
	Groundsmaster	--	1	24	35	65%	9.6	2.09	348	0.00578	0.00126	0.20944
	Hedge Trimmers	--	2	1	10	68%	261	0.94	719	0.00196	0.00001	0.00539
	Lawn Mower	--	1	5.5	5	70%	37	1.98	429	0.00079	0.00004	0.00910
	Mower	1997	1	19	450	56%	1.8	6.9	5	0.00950	0.03642	0.02639
	Pole Saw	--	2	1	100	92%	261	0.94	719	0.02647	0.00010	0.07291
	Pressure Washer	--	1	5	56	85%	37	1.98	429	0.00971	0.00052	0.11255
	Pump	--	1	4	2	69%	37	1.98	429	0.00023	0.00001	0.00261
	SandPro	--	2	16	600	60%	9.6	2.09	348	0.06095	0.01327	2.20952
	Saw	--	1	13	2	92%	37	1.98	429	0.00098	0.00005	0.01131
	Sod Cutter	--	1	5	20	60%	37	1.98	429	0.00245	0.00013	0.02837
	Sprayer	--	1	18	60	65%	37	1.98	429	0.02863	0.00153	0.33196
	Steam Cleaner	1992	1	2	10	30%	1.5	10	5	0.00001	0.00007	0.00003
	Sweeper	--	1	9	20	71%	36.9	1.98	429	0.00520	0.00028	0.06043
	Top Dresser	--	1	9	58	60%	37	1.98	429	0.01277	0.00068	0.14811
	Tractor	1992	1	45	200	55%	3.9	7.1	11.6	0.02128	0.03874	0.06329
	Tractor	1989	1	30	10	55%	3.9	7.1	11.6	0.00071	0.00129	0.00211
	Tractor	1990	1	35	230	55%	3.9	7.1	11.6	0.01903	0.03465	0.05661
	Tractor	2001	1	39	500	55%	1.8	5.7	5.8	0.02128	0.06739	0.06857
	Trash Pump	--	1	3	20	69%	37	1.98	429	0.00169	0.00009	0.01958
	TriPlex Mower	2000	1	38	400	56%	0.8	5.5	2.5	0.00751	0.05160	0.02346
	Truckster	--	1	20	200	46%	9.6	2.09	348	0.01947	0.00424	0.70582
	Weed Eaters	--	6	1	1,500	68%	214	1.3	696	0.24061	0.00146	0.78254
	Welder	--	1	19	520	51%	9.6	2.09	348	0.05332	0.01161	1.93287

Section	Equipment Type	Model Years	Number	HP	Total hrs/yr	LF	VOC EF	NOx EF	CO EF	VOC tons/yr	NOx tons/yr	CO tons/yr
Basewide[53]	Cart	--	41	10	10,660	46%	36.9	2.09	348	1.99452	0.11297	18.81011
Family Housing[54]	Push Mower	--	1,019	4	12,228	70%	37	1.98	429	1.39641	0.07473	16.19078
Grounds Maintenance Contractor[55]	Backpack Blower	2001	5	3.9	6,500	75%	261	0.94	719	5.46987	0.01970	15.06833
	Blower	2001	2	1.2	2,600	75%	261	0.94	719	0.67321	0.00242	1.85456
	Chain Saw	2001	4	1.7	5,200	92%	261	0.94	719	2.33979	0.00843	6.44564
	Chain Saw	2001	2	3.5	2,496	92%	261	0.94	719	2.31227	0.00833	6.36981
	Chain Saw	2001	1	7	104	92%	214	1.3	696	0.15799	0.00096	0.51384
	Chipper	2001	1	82	1,300	73%	0.7	6.9	1	0.06004	0.59187	0.08578
	Gator	2001	2	12	2,600	72%	1.5	5.4	4.6	0.03714	0.13371	0.11390
	Hedge Trimmers	2002	3	1.1	3,900	68%	261	0.94	719	0.83927	0.00302	2.31202
	Lawn Mower	2001	4	26	5,200	70%	9.6	2.09	348	1.00148	0.21803	36.30370
	Pole Chain Saw	2001	1	1.27	416	92%	261	0.94	719	0.13984	0.00050	0.38522
	Power Trimmer	2001	2	5.6	192	68%	37	1.98	429	0.02982	0.00160	0.34574
	Power Washer	2001	1	5	104	85%	37	1.98	429	0.01803	0.00096	0.20901
	Push Mower	2001	1	5	1,248	70%	37	1.98	429	0.17815	0.00953	2.06556
	Stump Grinder	2001	1	35	832	78%	9.6	2.09	348	0.24036	0.05233	8.71289
	Tractor 6410	2001	2	85	2,600	48%	6.5	4.79	198	0.76005	0.56010	23.15238
	Tractor 5400	2001	1	81	1,300	55%	1.5	7.1	2.3	0.09576	0.45326	0.14683
	Tractor 5510	2001	1	89	1,300	55%	1.5	7.1	2.3	0.10522	0.49803	0.16133
	Water Trailer	2001	1	5	832	57%	36.9	1.98	429	0.09645	0.00518	1.12130
	Weed Eaters	2001	18	1.5	23,400	68%	214	1.3	696	5.63024	0.03420	18.31143
Vertex Aerospace Corporation[56]	B1 Tug	1992	2	87	1,040	78%	6.48	5.16	199	0.50410	0.40142	15.48094
	Tug	1992	1	87	520	78%	6.48	5.16	199	0.25205	0.20071	7.74047

[53] *Ibid*.
[54] *Ibid*.
[55] *Ibid*.
[56] *Ibid*.

Table 3-21. 2005 Total Emissions from Other Non-road Equipment and Vehicles at Randolph[57]

Fleet/Contractor	Emissions (tons/yr)			Emissions (tons/day)		
	VOC	NOx	CO	VOC	NOx	CO
12 CES (CE)	1.70	0.10	16.06	0.00652	0.00037	0.06152
12 CES/CEC (Contracting) Contractors	6.37	31.39	41.69	0.02442	0.12028	0.15973
12 CES/CECS (SABER) Contractors	0.19	0.46	2.20	0.00073	0.00175	0.00844
12 CES/CEOBE (Entomology)	0.03	0.00	0.74	0.00011	0.00002	0.00282
12 CES/CEOBP (Pavement/Heavy Eq.)	1.45	0.68	23.63	0.00554	0.00260	0.09052
12 CES/CEOIEP (Power Production)	0.02	0.15	0.07	0.00007	0.00059	0.00026
12 CES/CEOZA (Zone A Maintenance)	0.10	0.02	2.41	0.00038	0.00009	0.00921
12 CES/CEOZB (Zone B Maintenance)	0.03	0.01	0.62	0.00011	0.00004	0.00237
12 CES/COE (Contracting) Contractors	0.60	2.14	5.82	0.00229	0.00820	0.02232
12 SUPS/LGSCO (Supply Squadron)	0.76	0.93	6.12	0.00293	0.00355	0.02343
12 SVS/SBBG (Golf Course)	1.62	0.53	24.12	0.00620	0.00202	0.09240
Basewide	1.99	0.11	18.81	0.00764	0.00043	0.07207
Family Housing	1.40	0.07	16.19	0.00535	0.00029	0.06203
Grounds Maintenance Contractor	20.18	2.60	123.68	0.07734	0.00997	0.47387
Vertex Aerospace Corporation	0.76	0.60	23.22	0.00290	0.00231	0.08897
TOTAL	37.20	39.80	305.36	0.14252	0.15250	1.16997

Aerospace Ground Equipment Operations

This category as described in the AEI by MACTEC includes emissions produced by aerospace grounds equipment (AGE) such as, air compressors, floodlights, bomb lifts, turbines, generators, heaters, etc.

Sample Calculations

Equation (1)

Annual aerospace ground equipment operations emissions:

$$AE_A = FUEL_A \times HV_A \times EF_A / 453.59 \text{ g/lbs} / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual aerospace ground equipment emissions, tons VOC/yr
$FUEL_A$ = Quantity of fuel used for equipment type A
HV_A = Heating value for equipment type A
EF_A = Emission factor for equipment type A

The sample given in the AEI report for air compressor using diesel fuel is as follows:

$$AE_A = 2{,}816 \text{ gal/yr} \times 0.137 \text{ MMBtu/gal} \times 2.07 \text{ lbs/MMBtu} / 2{,}000 \text{ lbs/ton} = 0.39929 \text{ tons CO/yr}$$

The total emissions for AGE are presented in Table 3-22.

[57] MACTEC Engineering and Consulting, Inc., 2003. Air Emissions Inventories for Multiple AETC Installations (Draft). Contract No.F41624-03-D-8606/003; Table 7.8-11 (pp. 7-180 – 7-181).

Table 3-22. Aerospace Ground Equipment Emissions for Randolph AFB, 2005[58]

Equipment Description	Emissions (tons/yr)			Emissions (tons/day)		
	VOC	NO_X	CO	VOC	NO_X	CO
12th Flying Training Wing						
Air Compressor	0.40	0.63	0.40	0.00153	0.00240	0.00153
Air Compressor	0.04	0.49	0.10	0.00015	0.00186	0.00040
Air Compressor	0.09	0.14	0.09	0.00033	0.00052	0.00033
Air Conditioner	0.03	0.23	0.01	0.00011	0.00087	0.00004
Floodlight Set	0.05	4.21	0.32	0.00020	0.01613	0.00123
Gas Turbine Compressor	0.09	1.83	7.34	0.00035	0.00703	0.02811
Generator	0.07	1.40	5.58	0.00027	0.00534	0.02138
Generator, Essex 30 kW	0.35	4.28	0.92	0.00134	0.01639	0.00353
Heater, H-1	0.01	0.24	0.02	0.00004	0.00091	0.00007
Self-Gen. Nitrogen Ser. Cart	0.10	1.20	0.26	0.00038	0.00461	0.00099
Lear Siegler Corporation						
Air Compressor	0.00	0.05	0.01	0.00002	0.00019	0.00004
Air Compressor	0.52	0.82	0.52	0.00199	0.00314	0.00199
Cabin Leak Tester	0.00	0.04	0.01	0.00001	0.00016	0.00003
Floodlight Set	0.00	0.13	0.01	0.00001	0.00048	0.00004
Gas Turbine Compressor	0.01	0.13	0.53	0.00003	0.00051	0.00204
Generator	0.01	0.15	0.61	0.00003	0.00058	0.00233
Generator	1.23	0.66	25.54	0.00473	0.00254	0.09784
Heater	0.01	0.24	0.02	0.00004	0.00091	0.00007
Hydraulic Test Stand	0.05	0.16	0.01	0.00019	0.00059	0.00005
Vertex Aerospace Corporation						
Jet EX 3 APU	0.13	0.07	2.74	0.00051	0.00027	0.01049
Jet EX 4 APU	0.17	0.09	3.42	0.00063	0.00034	0.01312
TOTAL	3.37	17.15	48.45	0.01289	0.06571	0.18563

Aircraft Engine Testing Operations

This category includes only aircraft engines that are tested "on-wing." This means the engines are actually mounted on the aircraft and not a test stand, as test stand mounted engine testing is considered a stationary source and not included in the AEI performed by MACTEC. These emissions are calculated much like the aircraft flight operations. After the hours of operation are determined, emission factors, fuel flow rates, and hours are used to calculate emissions.

Sample Calculation

Equation (1)

Annual aircraft engine testing operations emissions:

$$AE = \Sigma (TC_A \times EF_A \times FLOW_A \times HOUR_A) / 2{,}000 \text{ lbs/ton}$$

Where,

AE = Annual vehicle emissions

[58] *Ibid*. Note: Emission estimates from Table 7.5-6 (p. 7-90) were converted from pounds/year to tons/year by AACOG staff.

EF_A = Emission factor for operation type A
$FLOW_A$ = Aircraft flue flow rate for operation type A
$HOUR_A$ = Annual hours for operation type A

The sample given in the AEI report for a T-1A / JT15D-5B engine is as follows:

AE = [(108.14 lbs/1,000 lbs of fuel x 221 lbs fuel/hr x 784 hrs/yr) + (0.20 lbs/1,000 lbs of fuel x 1,630 lbs fuel/hr x 157 hrs/yr)] / 2,000 lbs/ton
= 9.39600 tons CO/yr

The results are shown in the following table (3-23).

Table 3-23. Estimated Emissions from Engine Testing on Randolph AFB, 2005

Organization	Aircraft	Emissions (tons/yr)			Emissions (tons/day)		
		VOC	NO_X	CO	VOC	NO_X	CO
12th	T-1A	6.91	1.63	9.40	0.02648	0.00625	0.03600
	T-6A	0.71	0.14	2.10	0.00273	0.00052	0.00806
	T-37B	0.44	0.27	6.95	0.00167	0.00102	0.02661
	T-38A	8.07	6.98	113.03	0.03092	0.02674	0.43307
	T-43A	0.12	2.63	0.52	0.00047	0.01006	0.00201
Lear Siegler	T-38	1.02	1.12	12.15	0.00392	0.00428	0.04656
Vertex	C-21	0.07	0.12	0.42	0.00028	0.00047	0.00162
TOTAL		17.35	12.88	144.58	0.06647	0.04935	0.55393

Refueling Operations

This source category covers VOC emissions generated when JP-8, diesel fuel, and gasoline are transferred between refueling tanker trucks and aircrafts, on-road vehicles, or non-road vehicles.[59] VOC emissions due to vapor displacement from fuel spillage and vehicle fueling operations were calculated by multiplying the quantities of fuel transferred by the appropriate emission factor. The results are shown in Table 3-24.[60]

Table 3-24. 2005 Emissions from Fuel Transfer Operations at Randolph AFB

Fuel Transfer Description	Fuel Type	Amount (gal/yr)	VOC (tons/yr)	VOC (tons/day)
Refueling Truck to Aircraft	JP-8	14,212,837	1.341	0.00514
Refueling Truck to Ground Vehicle	Diesel	979	0.000	0.00000
Refueling Truck to Ground Vehicle	Gasoline	1,029	0.005	0.00002
Total	NA	14,214,845	1.346	0.00516

[59] MACTEC Engineering and Consulting, Inc., 2003. Air Emissions Inventories for Multiple AETC Installations (Draft), Contract No.F41624-03-D-8606/003; page 7-205.
[60] *Ibid*. Note: Emission estimates from Table 7.9-6 (p. 7-211) were converted from pounds/year to tons/year by AACOG staff.

Results

The total estimated emissions for three criteria pollutants from activities at Randolph AFB for calendar year 2005 and the estimated daily emissions for a typical ozone season day are presented in Table 3-25.

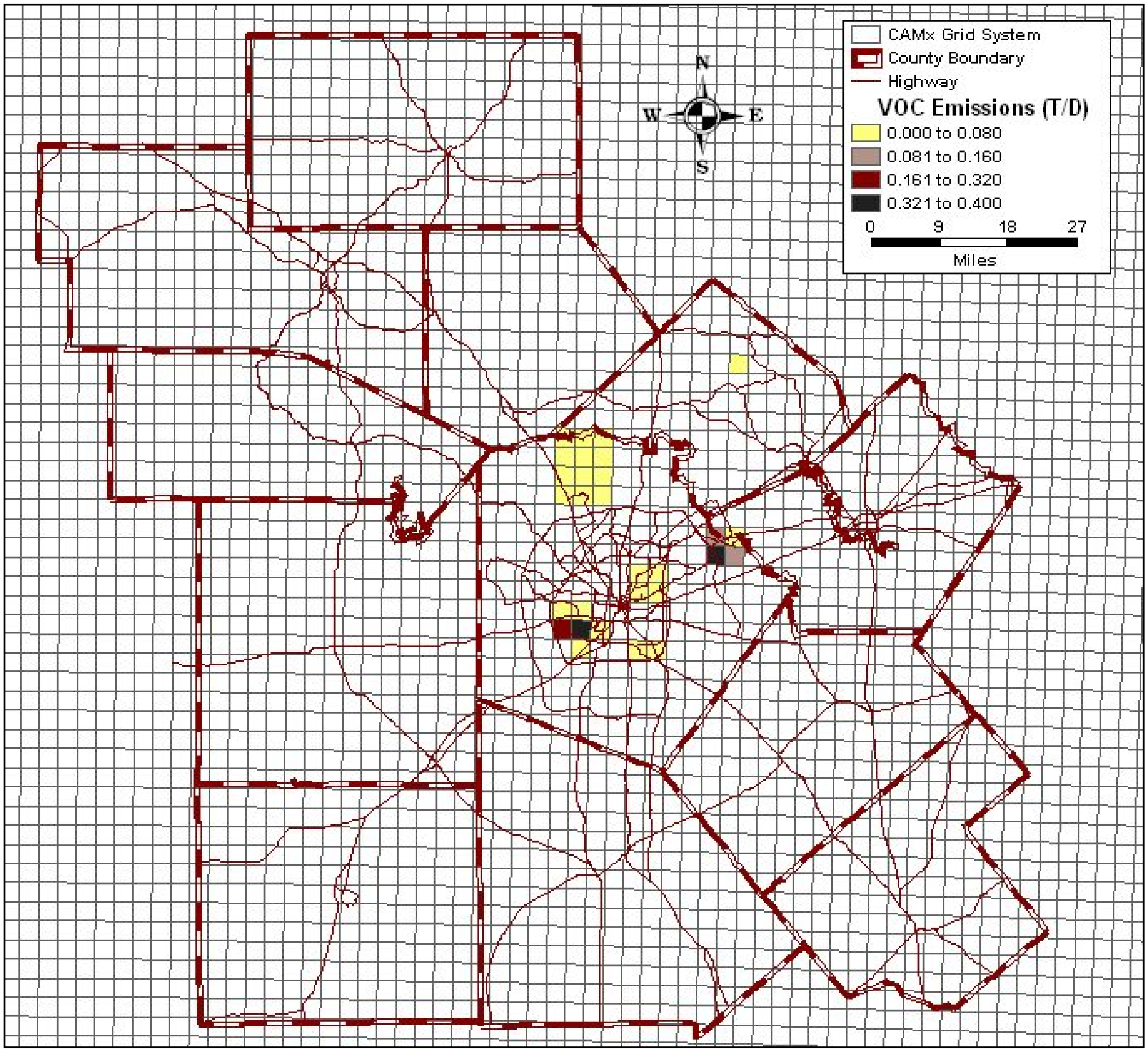
Table 3-25. 2005 Total Annual and Daily Emissions from Mobile Sources at Randolph AFB

Emissions Source	tons/yr			tons/day		
	VOC	NOx	CO	VOC	NOx	CO
Aircraft Operations	70.84	135.80	996.88	0.27138	0.52030	3.81943
Aircraft Engine Testing	17.35	12.88	144.58	0.06647	0.04935	0.55393
GSE/AGE/APU	3.37	17.15	48.45	0.01289	0.06571	0.18563
GOV On-road	4.15	7.75	30.25	0.01590	0.02969	0.11590
POV On-road	31.50	17.96	247.33	0.12069	0.06881	0.94764
Non-road	42.39	60.58	354.46	0.16242	0.23240	1.35808
Fueling	1.35	0.00	0.00	0.00516	0.00000	0.00000
Total	170.95	252.12	1,821.95	0.65491	0.96626	6.98061

Spatial Allocation of Emissions at Military Bases

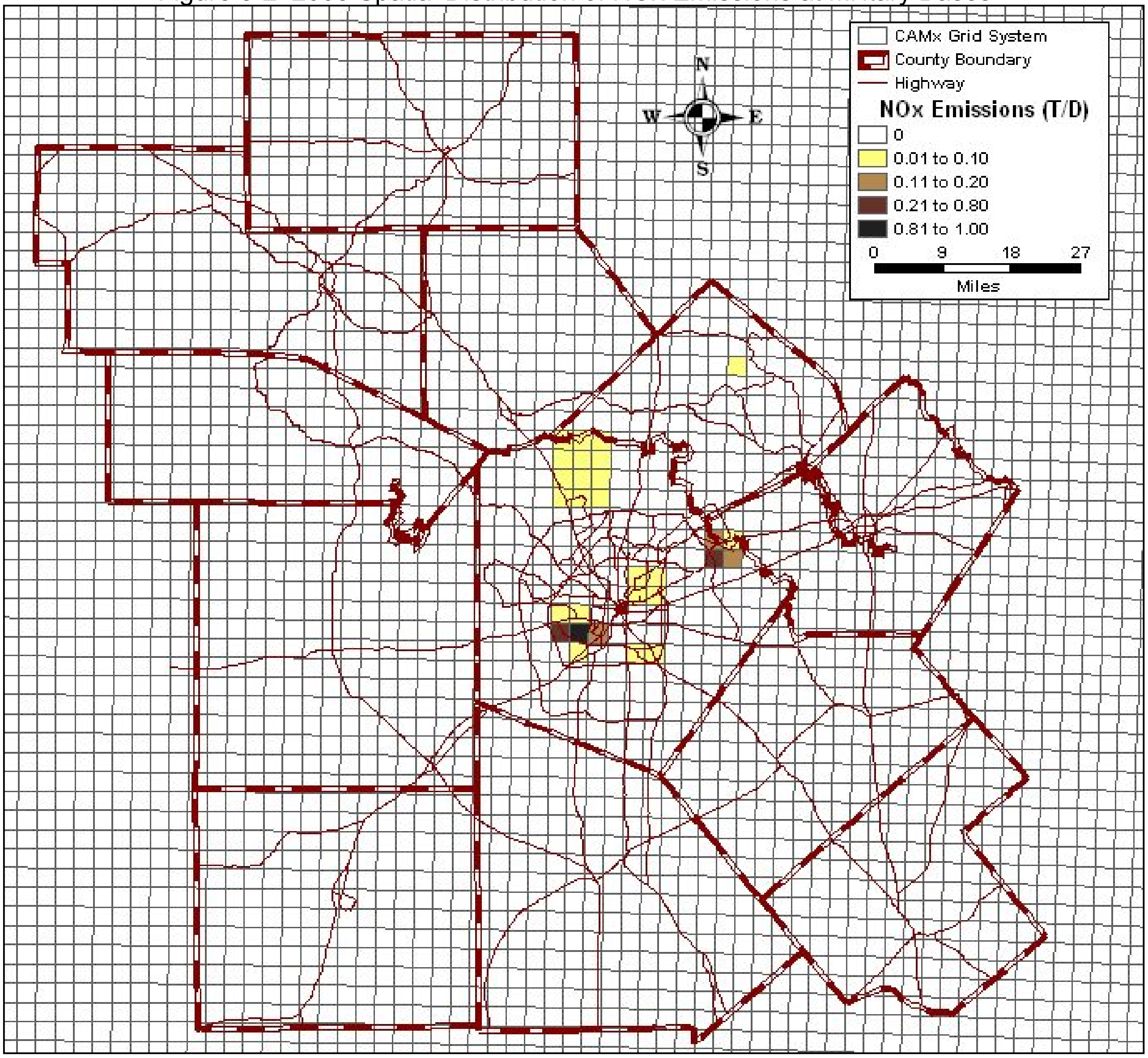
The locations of military bases, within the 12-County region were geo-coded using the TransCAD software and the CAMx model, 4x4 Km, grid system. Then, emissions of NOx and VOC were allocated to the appropriate grid (Figure 3-1 and 3-2).

Figure 3-1. 2005 Spatial Distribution of VOC emissions at Military Bases



Plot Date: February 26, 2007
Map Compilation: February 26, 2007
Source: AACOG, Military EI Reports, 2000 TIGER files

Figure 3-2. 2005 Spatial Distribution of NOx Emissions at Military Bases



Plot Date: February 26, 2007
Map Compilation: February 26, 2007
Source: AACOG, Military EI Reports, 2000 TIGER files

San Antonio International Airport

Introduction

The City of San Antonio Aviation Department operates two municipal airports: San Antonio International Airport and Stinson Municipal Airport. San Antonio International Airport (SAIA) is located approximately seven miles north of the San Antonio central business district. The Federal Aviation Administration (FAA) has established routines and procedures for recording airport activities and aircraft operations. The following are excerpts from the FAA report entitled "Order 7210.3T, Facility Operation and Administration" explaining important terms in regards to data used in this report for the modeling of airports emissions.

"A: Airport Operations Count

The airport operations count is the statistic maintained by the control tower. Basically, it is the number of arrivals and departures from the airport at which the airport traffic control tower is located. Specifically, one airport operation count is taken for each landing and takeoff (LTO), while two airport operations counts; i.e., one landing and one takeoff, are taken for each low approach below traffic pattern altitude, stop and go, or touch and go (TGO) operation.

B: Categories Of Operations

The airport authorities will maintain airport operations data by the following categories:

a. ITINERANT: Operations not classified as "local," including the following subcategories:
   1. Air Carrier
   2. Air Taxi
   3. Military: All classes of military operations.
   4. General Aviation: Civil operations not classified as air carrier or air taxi.
b. LOCAL: Operations remaining in the local traffic pattern, simulated instrument approaches at the airport and operations to or from the airport and a practice area within a 20-mile radius of the tower.
   1. Military: All classes of military operations.
   2. Civil: All civilian operations, including local flights by air carrier and air taxi aircraft."[61]

Emissions occur from daily operations and a diverse range of sources including the following sources within the SAIA facility:

- Aircraft Operations (commercial, general aviation, and military operations)
- Ground Support Equipment (GSE) / Aerospace Ground Equipment (AGE) / Auxiliary Power Unit (APU)
- Stationary Diesel Generators
- Boilers (Heating Plants)
- Parking Lots and Roadways (On-road)
- Aircraft Refueling (Evaporative)
- Fuel Storage
- Non-road Equipment (Lawn and Garden, Commercial, and Light Industrial)

Methodology

Emissions from aircraft, GSE, AGE, and APU operations at SAIA were calculated using the Emission & Dispersion Modeling System (EDMS) model, version 4.21.[62] EDMS model used EPA approved emission factors and estimation methodology. Data on aircraft flight activities were collected from the FAA/FPA Terminal Area Forecast (TAF) software[63] and Airport IQ Data

[61] The Federal Aviation Administration, July 13, 2005. Order 7210.3T: Facility Operation and Administration: Chapter 12 - Facility Statistical Data, Reports, and Forms: Section 2. Airport Operations Data. Available online: http://www.faa.gov/atpubs/FAC/Ch12/s1202.html#12-2-1
[62] The Federal Aviation Administration, Sept. 30, 2004. Emissions & Dispersion Modeling System. Available online: http://www.aee.faa.gov/emissions/edms/EDMShome.htm
[63] Federal Aviation Administration, 2005. Terminal Area Forecast Reports. Washington, DC. Available online: http://www.faa.gov/data_statistics/aviation/taf_reports/

Center.[64] Information on local and itinerant aircraft operations gathered from these sources, in addition to data collected from SAIA authorities for ground level equipment and activities, were entered into the EDMS model to estimate the amount of pollutants attributed to aircraft activities. Based on the information indicated in the TAF software database, the airport activity levels reached a total of 244,589 operations for "local" and "itinerant" categories in the year 2005.

Commercial Aircraft Operations

The data collected from the Internet site "Airport IQ Data Center" included operation data on commercial and civilian aircrafts by landing/take-off cycles and aircraft type for 2003 and part of 2004. To forecast to 2005, the TAF software was used. The 2005 forecasted total for the commercial operations from the TAF software was compared to the 2003 commercial operations to obtain a growth ratio. The percentage change in aircraft operations was then applied equally to every aircraft type.

Table 3-26 lists the type and activity level of commercial "air carrier" and "commuter" aircrafts that were used in the analysis of emissions from commercial aircrafts for the year 2005. In cases where the exact aircraft type was not available in the EDMS software, a comparison of aircraft types was made with those of the EDMS 4.21 default aircraft types to match the most compatible engine types. In two instances, user-defined aircrafts were created because the EDMS database contained no equivalent aircrafts types.

General Aviation Operations

The Airport facility is used for general aviation (GA) purposes, also. Based on information extracted from TAF software, a total of 107,903 general aviation aircraft operations were forecasted for 2005. The GA operations were divided into three types: Jet,[65] Turbo-Prop,[66] and Piston,[67] based on the percentage of total GA operations in 2003. The results are shown in Table 3-27.

[64] GCR & Associates, Inc., 2005. Airport IQ Data Center. Available online: http://www.airportiq.com/
[65] "The principle of all jet engines is essentially the same. The engine draws air in at the front and compresses it. The air then combines with fuel and the engine burns the resulting mixture. The combustion greatly increases the pressure of the gases which are then exhausted out of the rear of the engine.", KnowledgeRush. Available online: http://www.knowledgerush.com/kr/encyclopedia/Jet_engine
[66] "A turboprop …(uses) the power of the jet engine to drive a propeller", Free-Definition. Available online: http://www.free-definition.com/Turboprop.html
[67] A piston-engine with propeller as propulsion

Table 3-26. 2005 Commercial Aircraft Type and Arrival Activity at SAIA

Type	Number of LTO Cycles	Aircraft Name	Number of Engine	Engine Type	Equivalent Aircraft Used in Modeling
A306	550	AIRBUS - A-300B4 - 600	2J/H		
A30B	1	AIRBUS - A-300B4 - 600b	2J/H		A306
A310	107	AIRBUS - A-310 (CC-150 Polaris)	2J/H		
A319	2,640	AIRBUS - A-319, ACJ	2J/L		
A320	87	AIRBUS - A-320	2J/L		
A321	9	AIRBUS - A-321	2J/L		
A331	1	AIRBUS - A-331	2J/L		A-330
AC11	1	Rockwell - Commander	1P/S		
AC90	1	Gulfstream - 690 Jetprop Commander	2T/S	TPE 331	Swearingen Merlin
AC9L	1	Gulfstream Aerospace	2T/S	TPE 331	Swearingen Merlin
AT43	7	Aerospatiale - ATR-42-200/300/320	2T/L		ATR42
B190	276	Beech - 1900 (C-12J)	2T/S+	PT6A-65B	BH-1900
B350	14	Beech - B300 Super King Air 350	2T/S+		
B712	691	Boeing - 717-200	2J/L		
B721	8	Boeing - 727-100 (C-22)	3J/L		
B722	218	Boeing - 727-200	3J/L		
B727	6	Boeing – 727	3J/L		B721
B72Q	569	Boeing - 727 Stage 3 (-100 or -200)	3J/L		B721
B732	1,581	Boeing - 737-200 (Surveiller, CT-43)	2J/L		
B733	11,094	Boeing - 737-300	2J/L		
B734	12	Boeing - 737-400	2J/L		
B735	3,527	Boeing - 737-500	2J/L		
B737	2,971	Boeing - 737-700	2J/L		
B738	972	Boeing - 737-800, BBJ2	2J/L		
B739	94	Boeing - 737-900	2J/L		
B73Q	5,793	Boeing - B737 Stage 3	2J/L		B737
B741	5	Boeing - 747-100	4J/H		
B742	11	Boeing - 747-200 (E-4, VC-25)	4J/H		
B744	4	Boeing - 747-400 (International, winglets)	4J/H		
B752	1,566	Boeing - 757-200 (C-32)	2J/L		
B753	165	Boeing - 757-300	2J/H		
B757	1	Boeing – 757	2J/H		B752
B762	172	Boeing - 767-200	2J/H		
B763	9	Boeing - 767-300	2J/H		
B764	6	Boeing - 767-400	2J/H		
B772	2	Boeing - 777-200	2J/H		
BE10	1	Beech - 100 King Air	2T/S		
BE18	102	Beech - Twin Beech 18/Super H18	1P/S	O-200	Cessna 150
BE19	1	Beech - 19 Musketeer Sport, Sport	1P/S	IO-360-B	Cessna 172
BE20	63	Beech - 200 Super King Air	2T/S+		
BE30	2	Beech - Super King Air300	2T/S+		
BE33	2	Beech - 33 Debonair	1P/S	IO-360-B	Cessna 172
BE35	9	Beech - 35 Bonanza	1P/S	O-200	Cessna 150
BE36	20	Beech - 36 Bonanza	1P/S	IO-360-B	Cessna 172
BE3B	1	Beech - B300 Super King Air 350	2T/S+		
BE40	285	Beech - 400 Beechjet	2J/S+		
BE55	5	Beech - 55 Baron	2P/S	IO-360-B	Cessna T337
BE58	13	Beech - 58 Baron	2P/S	IO-360-B	Cessna T337

Type	Number of LTO Cycles	Aircraft Name	Number of Engine	Engine Type	Equivalent Aircraft Used in Modeling
BE60	1	Beech - 60 Duke	2P/S	IO-360-B	Cessna T337
BE90	1	Beech - King Air C-90	2P/S	IO-360-B	Cessna T337
BE9L	11	Beech - 90, A90 to E90 King Air (T-44)	2T/S		
C172	8	Cessna - 172	1P/S		
C177	1	Cessna - 177, Cardinal	1P/S	O-200	Cessna 150
C182	6	Cessna - 182	1P/S	O-200	Cessna 150
C206	14	Cessna - 206, Super Skywagon	1P/S	O-200	Cessna 150
C208	1,472	Cessna - 208 Caravan 1	1T/S		
C210	20	Cessna - 210, T210, Centurion	1P/S	O-200	Cessna 150
C310	6	Cessna - 310, T310 (U-3, L-27)	1P/S	IO-360-B	Cessna 172
C340	1	Cessna – 340	2P/S	IO-360-B	Cessna T337
C401	127	Cessna – 401	2P/S	IO-360-B	Cessna T337
C402	325	Cessna - 401, 402, Utililiner, Businessliner	2P/S	IO-360-B	Cessna T337
C404	4	Cessna - 404 Titan	2P/S	IO-360-B	Cessna T337
C414	2	Cessna - 414	2P/S	IO-360-B	Cessna T337
C421	2	Cessna - 421, Golden Eagle	2P/S	IO-360-B	Cessna T337
C425	1	Cessna - 425, Corsair, Conquest 1	2T/S	PT6A-112	User Defined
C500	2	Cessna - 5000 Citation, Citation 1	2J/S		
C501	1	Cessna - 501 Citation 1SP	2J/S		C500
C525	62	Cessna - Citationjet 525	2J/S	FJ44-1A	C500
C550	127	Cessna – Citation 2	2J/S+		
C56	2	Lockheed - C-56 Loadstar - Army	2T/S+	Historical	B300 Super King Air
C560	354	Cessna - 560 Citation 5	2J/S+		
C56X	280	Cessna - 560 Citation 5	2J/S+		C560
C650	197	Cessna – Citation 3	2J/S+	CF34-3A	CL601-3A
C72R	1	Cessna - 172RG, Cutlass RG	1P/S		C172
C750	377	Cessna - 750 Citation 10	2J/S+		
CJR9	1	Unknown	0		Cessna 172
CL30	1	Bombardier – BD-100 Challenger 300	2J/S+	AS-907	400 Beechjet
CL60	111	Canadair - CL-600 Challenger	2J/L	CF34-3A	CL601-3A
CL64	1	Canadair - CL-600 Challenger	2J/L	CF34-3A	CL601-3A
CR2	1	Crossair	2J/S+		400 Beechjet
CRJ	1	Canadair - 850 Bombardier	2J/L		CL601-3A
CRJ1	299	Canadair - CL-600 Regional Jet CRJ-100	2J/L		
CRJ2	5,611	Canadair - Regional Jet 100/200	2J/L		CRJ1
CRJ7	584	Canadair - CL-600 Regional Jet CRJ-700	2J/L		
CRJ9	950	Canadair - CL-600 Regional Jet CRJ-900	2J/L		
CVLT	8	Convair - CV-580 - Navy	2T/S+	Historical	B300 Super King Air
D328	5	Dornier – 328	2T/S+		
DC10	270	McDonnell-Douglas - DC-10	3J/H		
DC3	1	McDonnell-Douglas - Skytrain	2P/S+	PT6A-65B	BH-1900
DC8	4	McDonnell-Douglas - DC-8	4J/H		
DC87	1	McDonnell-Douglas - DC-8-70	4J/H		
DC8Q	224	McDonnell-Douglas - DC-8 Stage 3	4J/H		DC8
DC9	12	McDonnell-Douglas - DC-9	2J/L		DC91
DC91	15	McDonnell-Douglas - DC-9-10	2J/L		
DC93	166	McDonnell-Douglas - DC-9-30 (C-9)	2J/L		
DC94	12	McDonnell-Douglas - DC-9-40	2J/L		

Type	Number of LTO Cycles	Aircraft Name	Number of Engine	Engine Type	Equivalent Aircraft Used in Modeling
DC95	12	McDonnell-Douglas - DC-9-50	2J/L		
DC9Q	358	McDonnell-Douglas - DC-9 Stage 3	2J/L		DC91
DR20	1	Unknown	0		Cessna 172
E110	503	Embraer - 110/111 Bandeirante (C-95)	2T/S+		
E120	4	Embraer - EMB-120 Brasilia (VC-97)	2T/S+		
E135	33	Embraer - EMB-135	2J/L		
E140	1	Embraer - EMB-140	2J/L		
E145	1,868	Embraer - EMB-145, ERJ-145	2J/L		
E45X	735	Embraer - EMB-145XR	2J/L		E145
F100	627	Fokker - 100	2J/L		
F2TH	87	Dassault - Breguet - Falcon 2000	2J/S+		
F900	2	Dassault – Falcon 900	3J/L	TFE731	Falcon 20 - 3
FA10	2	Dassault – Falcon (Mystere) 10	2J/S+		FA20
FA20	82	Dassault – Falcon (Mystere) 20	2J/S+		
FA50	38	Dassault – Falcon 50	3J/S+		
FJ2	1	Hawker Sea Fury - Army	1T/S+	Historical	Porter PC6/B2
GALX	40	Israel IAI-1126 Galaxy - 1126	2J/S+		
GL25	1	F 104 Starfighter - Army	1J/S+	Historical	A-7E Corsair
GLEX	1	Bombardier - BD-700-1A10	2J/S+		
GLF2	2	Gulfstream Aerospace - C-20J,/VC-111	2J/L		
GLF3	2	Gulfstream Aerospace	2J/L		
GLF4	25	Gulfstream Aerospace	2J/L		
GLF5	1	Gulfstream Aerospace G-V Gulfstream V	2J/L		
GLS4	1	Unknown	0		Cessna 172
H125	1	British Aerospace - Hawker Siddeley 125	2J/S+		
H25	2	British Aerospace	2J/S+		
H25A	8	British Aerospace - BAe HS 125 Series	2J/S+		
H25B	238	British Aerospace - BAe-125-700/800	2J/S+		
H25C	77	British Aerospace - Hawker Siddel. HS 125	2J/S+		
HS25	1	British Aerospace - Hawker Siddel. HS 125	2J/S+		
J328	4	Fairchild Dornier - 328JET, Envoy 3	2J/S+		
LJ23	1	Bombardier - Learjet 23	2J/S	TFE731-2-2B	Learjet 35/36
LJ24	28	Bombardier - Learjet 24	2J/S+		
LJ25	75	Bombardier - Learjet 25	2J/S+		
LJ31	28	Bombardier - Learjet 31	2J/S+		
LJ35	498	Bombardier - Learjet 35	2J/S+		
LJ36	1	Bombardier - Learjet 36	2J/S+		Learjet 35/36
LJ45	79	Bombardier - Learjet 45	2J/S+	TFE731-2-2B	Learjet 35/36
LJ55	39	Bombardier - Learjet 55	2J/S+	TFE731-2-2B	Learjet 35/36
LJ60	110	Bombardier - Learjet 60	2J/S+	TFE731-2-2B	Learjet 35/36
LR24	1	Bombardier - Learjet 24	2J/S		
LR25	1	Bombardier - Learjet 25	2J/S+		
LR31	2	Bombardier - Learjet 31	2J/S+		
LR35	6	Bombardier - Learjet 35	2J/S+		Learjet 35/36
LR36	1	Bombardier - Learjet 36	2J/S+		Learjet 35/36
LR45	1	Bombardier - Learjet 45	2J/S+	TFE731-2-2B	Learjet 35/36
LR60	2	Bombardier - Learjet 60	2J/S+	TFE731-2-2B	Learjet 35/36
M20	1	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172

Type	Number of LTO Cycles	Aircraft Name	Number of Engine	Engine Type	Equivalent Aircraft Used in Modeling
M20J	1	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172
M20K	1	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172
M20P	6	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172
MD10	141	McDonnell-Douglas - MD-10	3J/H		DC10
MD11	28	McDonnell-Douglas - MD-11	3J/H		
MD80	1,763	McDonnell-Douglas - MD-80	2J/L		
MD81	46	McDonnell-Douglas - MD-81	2J/L		
MD82	6,489	McDonnell-Douglas - MD-82	2J/L		
MD83	1,388	McDonnell-Douglas - MD-83	2J/L		
MD87	13	McDonnell-Douglas - MD-87	2J/L		
MD88	8	McDonnell-Douglas - MD-88	2J/L		
MD90	1	McDonnell-Douglas - MD-90	2J/L		
MO20	1	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172
MU2	504	Mitsubishi Aircraft - MU-2, Marquise	2T/S	PT6A-65B	BH-1900
MU2B	1	Mitsubishi Aircraft - MU-2, Marquise	2T/S	PT6A-65B	BH-1900
MU30	1	Mitsubishi Aircraft - MU-300 Diamond	2J/S+		
MX7	1	Mitsubishi Aircraft - Super Rocket, Star	1P/S	0-360-C1F	Cessna 172
P180	1	Piaggio - P-180 Avanti	2T/S	PT6A-66	BH-1900
P28A	8	Piper - Archer, Cadet, Cherokee	1P/S		
P28R	2	Piper - Archer, Cadet, Cherokee	1P/S		
P32T	1	Piper - Lance 2	1P/S	IO-360-B	Cessna 172
P46T	12	Piper - PA-46-500TP Malibu Meridian	1P/S	IO-360-B	Cessna 172
PA24	1	Piper - Comanche	1P/S	IO-360-B	Cessna 172
PA27	5	Piper - PA-23-235/250 Aztec	2P/S		
PA28	4	Piper - Archer, Cadet, Cherokee	1P/S		
PA30	8	Piper - PA-30/39 Twin Comanche	2P/S	IO-360-B	Cessna T337
PA31	11	Piper - Navajo, Navajo Chieftain, Chieftain	2P/S		
PA32	39	Piper - PA-32 Cherokee Six, Six, Saratoga	1P/S	IO-360-B	Cessna 172
PA44	1	Piper - Seminole, Turbo Seminole	2P/S	IO-360-B	Cessna T337
PA46	9	Piper - Malibu, Malibu Mirage	1P/S	IO-360-B	Cessna 172
PA60	1	Piper - Aerostar	2P/S	IO-360-B	Cessna T337
PAY2	1	Piper - PA-31T-620.T2-620	2T/S	PT6A-45	ATR42-400
PC12	40	Pilatus Flugzaugwerke (Fairchild) PC-12	1T/S	PT6A-67B	User Defined
PRM1	18	Beech - Premier 1, 390	2J/S+	FJ442A	400 Beechjet
R722	2	Boeing - 727-200RE Super 27	3J/L		
SBR1	6	Rockwell - NA-265 Sabre 40/60/65	2J/S+	JT8D-7	400 Beechjet
SF34	428	Saab - SF-340	2T/S+		
SH36	6	Short Brothers - 360, SD3-60	2T/S+		
SR20	1	Cirrus - SR20	1P/S	IO-360-B	Cessna 172
SW2	4	Fairchild - Merlin 2	2T/S	TPE 331	Swearingen Merlin
SW3	92	Fairchild - Merlin 3, Fairchild 300	2T/S+	TPE 331-3	Swearingen Metro 2
SW4	344	Fairchild - SA-226AC, SA-227AC/AT Metro	2T/S+	TPE 331-3	Swearingen Metro 2
T38	2	Northrop - T-38, AT-38 Talon	2J/S+	TFE731-2-2B	Learjet 35/36
TB7	1	Grumman – Avenger - Army	1T/S+	Historical	Porter PC6/B2
WW24	2	IAI/Gulfstream - 1124 Westwind	2J/S+		
Total	62,452*				

*Due to rounding of aircraft operations, this total is slightly different than the total operations used in the EDMS model.

Table 3-27. Aircraft Engine Type and Total LTO Cycles and Operations at SAIA

Aircraft type	2003 Percentage of Total GA Operations	2005 Number of LTO Cycles	2005 Operations by Engine type
Jet	47.8%	25,783	51,566
Turbo Propeller	15.4%	8,323	16,646
Piston	36.8%	19,844	39,688
Total	100.0%	53,950	107,900

The following tables (3-28, 3-29, and 3-30) list the type and activity level of GA aircrafts that were used in the SAIA emission analysis for the year 2005. When the exact aircraft type was not available in EDMS, an equivalent aircraft type, which had similar engine(s), was used. In four cases, a user-defined aircraft had to be created for this category because equivalent aircrafts were not available in the EDMS database.

Table 3-28. 2005 SAIA Jet Engines GA Flights

Aircraft Name	Engine Type	Number of LTO Cycles
Bell 206	250B17B	170
Beechjet 400	JT15D-5 (A & B)	874
Beechjet 400 (Premier 1390)	JT15D-5 (A & B)	64
B747-200	JT9D-7Q	21
B737-700	CFM56-7B22	43
B757-200	PW2037	43
Bombardier CRJ700	CF34-8C1	362
Learjet 24D	CJ610-6	213
Learjet 25B	CJ610-6	852
Learjet 31	TFE731-2	916
Learjet 35/36	TFE 731-2-2B	3,346
BAE 125-700	TFE731-3	2,131
CL601-3A	CF34-3A	511
560 Citation V	JT15D-5 (A & B)	3,260
CITATION X	AE3007C	469
CL601-3A	CF34-3A	767
500 Citation	JT15D-1A & 1B	5,114
Falcon 2000EX	PW308C	170
Falcon 20	CF700-2D	1,214
Falcon 50	TFE731-3	490
Gulfstream V	BR700-710A1-10 Gulf V	256
Gulfstream IV	TAY Mk611-8	1,108
IAI 1124	TFE731-3	1,215
C-141	TF33-P-3/103	192
MU-300	JT15D-4 (B,C,D)	234
Beechjet 400 (Rockwell 265 Sabre)	JT15D-5 (A & B)	256
Galaxy (IAI) G200	PW306A	1,492
Total		25,783

Table 3-29. 2005 SAIA Turbo-Prop Aircrafts GA Flights

Aircraft Name	Engine Type	Number of LTO Cycles
TBM TB-700 Aerosp	User-Created	602
Beech King Air 100	PT6A-28	498
Beech King Air 200	PT6A-41	1,432
Beech King Air 90	PT6A-28	2,926
Beech King Air 350	PT6A-60, -60A, -60AG	851
C425	User-Created	228
Cessna 441 Conquest2	TPE331-8	602
Swearingen Metro 2	TPE331-3	436
Swearingen Merlin	TPE331-3	394
BH-1900	PT6A-65B	333
PC12	User-Created	21
TBM TB-700 Aerosp	User-Created	602
Total		8,323

Table 3-30. 2005 SAIA Piston Aircrafts GA Flights

Aircraft Name	Engine Type	Number of LTO Cycles
Aztec	TIO-540-J2B2	32
Cessna T337	IO-360-B	6,335
Cherokee six	TIO-540-J2B2	645
Twin Comanche	IO-320-D1AD	129
Twin Beech 18	User-Created	97
Cessna 150	O-200	3,224
Cessna 172 Skyhawk	IO-360-B	7,625
Cessna 208 Caravan	PT6A-114	113
Piper PA-28	O-320	951
PA-31T Cheyenne	PT6A-28	580
Rockwell Commander	IO-360-B	113
Total		19,844

Military Aircraft

The military uses the SAIA amenities for training purposes; TAF software maintains records on military activities at SAIA. Table 3-31 contains flight characteristics for military operations occurring at SAIA, which were used as input data to the EDMS model to calculate emissions.

Table 3-31. 2005 Military Aircraft Activity at the San Antonio International Airport

Aircraft	LTO	TGO	Total
T-43	0	4,048	4,048
T-34/T-37	238	0	238
F-16	0	1,079	1,079
C-130	39	347	386
C-21	52	90	142
Total	329	5,564	5,893

GSE, AGE, and APU
Use of ground service equipment is an essential part of daily operations at airports and must be included in the emissions calculations. Based on the type of aircraft, the EDMS model, estimates emissions from GSE/AGE/APU.

Stationary Diesel Generator
SAIA removed the generator in Terminal 1 in 2003. Consequently, no emission calculations were performed. Portable generators are included in the analysis of emissions from non-road equipment.

Boilers (Heating Plants)
In 1993, 341,329 cubic meters of natural gas were burned. According to the airport Master Plan,[68] this rate of natural gas consumption is projected to increase to 504,000 cubic meters per year in 2015. The 2005 annual value, 411,389 cubic meters, was estimated by using a straight-line interpolation. The consumption rate and boiler characteristics were entered into EDMS model to estimate emissions.

Parking Lots and Roadways (On-road)
The EDMS model was also utilized to calculate emissions for parking lots and roadway vehicles. The 2005 Texas Department of Transportation (TxDOT) network from the San Antonio travel demand model was used to identify roadways leading into the airport facilities. Airport Boulevard South Terminal Drive, and Airport Loop were identified and modeled using their length, average daily traffic (ADT) volumes, and assigned speed limits (Table 3-32). Airport Loop volume was estimate to be half of the Airport Boulevard volume based on site visits.

Table 3-32. Roadways Used in the Inventory of SAIA Emissions

Roadway	Length (mi.)	2005 Daily Volume	Speed (mph)
Airport Blvd.	0.28	29,870	35
South Terminal Dr.	0.30	24,040	35
Airport Loop	0.89	14,935	35

For this study, the parking lots at SAIA included employee, long term, hourly, and economy lots and garages. The City of San Antonio provided the 2005 utilization data for these parking facilities.[69] Annual vehicle counts for the public parking lots and the average length of trips inside of the lots were assessed using San Antonio data and schematics of the parking lots. For use in the EDMS model, a speed of 10 mph and a 2-minute idle time per car were assumed for inside parking lots based on a site visit to the airport. The information regarding usage frequency, idling time, and trip lengths (Table 3-33) were entered into the EDMS model. Emissions factors used in the model are from MOBILE6.[70]

[68] Ricondo & Associates, Inc, Jan. 1998. San Antonio International Airport Master Plan Study, Volume 3.
[69] Greg Lawrence, July 28, 2005 email, "Information on SAT Parking Activities", Parking Manager, San Antonio International Airport.
[70] U.S. Environmental Protection Agency, August 2003. User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model. Available online: http://www.epa.gov/otaq/m6.htm

Table 3-33. Parking Facilities Used in the Inventory of SAIA Emissions

Facility	Average Length Traveled per Vehicle (ft.)	2005 Annual Number of Vehicles	Speed (mph)
Employee Parking	820.21	339,450	10
Long Term Parking	5,809.48	334,705	10
Hourly Parking	2,640.68	1,009,955	10
Economy Parking	1,584.42	45,625	10

Refueling

As described in the Appendix D of publication entitled "Air Quality Procedures for Civilian Airports & Air Force Bases", commercial or *Itinerant* "evaporative related emissions are small due to the low vapor pressure of the fuel and quick-connect refueling nozzles."[71] The EDMS model, therefore, does not estimate refueling emissions. For the purpose of this report, the emissions for this commercial and itinerant refueling emissions were negligible.

The refueling losses for general aviation aircrafts were calculated are described below. Most general aviation aircrafts are powered by piston engines, which are fueled with aviation gasoline (AvGas). Aviation gasoline has a much higher volatility than jet fuel and fuel tanks are vented to the atmosphere resulting in significant VOC evaporation. Evaporative emissions are calculated for general aviation aircrafts that are based at the airport and not *Itinerant* aircrafts. Evaporative emissions are associated with refueling, diurnal, and pre-flight safety procedures.

Sample Calculations

Equation (1)

EPA-approved methodology for aircraft includes a refueling and spillage loss of 4.61 grams of Hydrocarbon (HC) per gallon of fuel consumed.[72] The 2005, per aircraft, fuel consumption rate for general aviation was estimated only for based piston engine aircrafts using a straight-line calculation with the TTI 1999 and 2007 fuel consumption as follows:

AE = [(FC07 - FC99) x 6 / 8 + FC99] x NUM x EF x CON / 453.59 g/lbs / 2,000 lbs/ton

Where,

AE = Annual refueling and spillage emissions, tons VOC/yr
FC07 = Fuel consumption for 2007 (7,370 gal /aircraft)
FC99 = Fuel consumption for 1999 (6,090 gal /aircraft)
NUM = Number of based aircraft (181)
EF = Emission factor (4.61 HC g/gal)
CON = HC to VOC conversion ratio (1.005)

Annual refueling and spillage emissions:

AE = [(7,370 gal /aircraft - 6,090 gal /aircraft) x 6 / 8 + 6,090 gal /aircraft] x

[71] Federal Aviation Administration, April 1997. Office of Environment and Energy. Washington, DC. p. D-5. Available online: http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/media/App_D.PDF

[72] J. Borowiec, T. Qu, and C. Bell, March 2000. 1996, 1999, and 2007 Airport Emission Inventory.Texas Transportation Institute, College Station, TX.

181 x 4.61 HC g/gal x 1.005 / 453.59 g/lbs / 2,000 lbs/ton
= 6.52 tons VOC/yr

Equation (2)
The following equation, introduced in Appendix D of the EPA publication entitled, "Air Quality Procedures for Civilian Airports & Air Force Bases,"[73] was used for quantifying HC evaporative emissions resulting from GA aircraft diurnal losses.

AE = NUM x EF x CON x DAY / 2,000 lbs/ton

Where,

AE	= Annual diurnal emissions, tons VOC/yr
NUM	= Number of based aircraft (181)
EF	= Emission factor (0.15 lbs/day/based aircraft)
CON	= HC to VOC conversion ratio (1.005)
DAY	= Number of days

Annual diurnal emissions:

AE = 181 x 0.15 lbs/day/based aircraft x 1.005 x 365 / 2,000 lbs/ton
= 4.98 tons VOC/yr

Equation (3)
To calculate emissions from pre-flight safety checks, the number of local operations by piston-engine aircraft is needed. According to the TAF software database, the total local operation by all aircraft types is 6,196 annually. The total number of based aircraft at SAIA is 263,[74] of which 181 aircrafts are piston-engine aircrafts, or 69% of the total. The following equation for pre-flight safety check emissions was also obtained from "Air Quality Procedures for Civilian Airports & Air Force Bases."

AE = (OPS / 2) x PERP x EF x CON / 2,000 lbs/ton

Where,

AE	= Annual pre-flight safety checks emissions, tons VOC/yr
OPS	= Number operations for all aircraft types (6,196 operation, 2 ops per LTO cycle)
PERP	= Percentage of piston aircraft (69%)
EF	= Emission factor (0.20 lbs per LTO cycle)
CON	= HC to VOC conversion ratio (1.005)

Annual pre-flight safety checks emissions:

AE = (6,198 ops / 2) x 0.69 x 0.20 lbs per LTO cycle x 1.005 / 2,000 lbs/ton
= 0.21 tons VOC/yr

[73] Federal Aviation Administration, April 1997. Office of Environment and Energy. Washington, DC. p. D-5. Available online: http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/media/App_D.PDF
[74] Fltplan.co. Available online: http://www.fltplan.com/AwMainPageSelect.exe?a=1

Fuel Storage

Fuel storage emissions include evaporative VOC emissions due to the transfer of fuel from and to storage tanks or bulk terminals by tanker trucks. To calculating emissions, information on the total fuel consumption for the general aviation flights was used. General aviation aircrafts, according to the email from Brenton Baker, the Airport Environmental Protection Officer, consumed 7,457,293 gallons of general aviation fuel, which includes consumption of both AvGas and jet fuel in year 2005. Piston-powered aircrafts consume virtually all of the AvGas consumed each year, approximately 24 percent of the general aviation fuel consumption per year.[75] Therefore, 24 percent of 7,457,293 gallons of fuel consumed in year 2005 at SAIA (1,789,750 gallons) was calculated to estimate evaporative emissions from storage tanks.

Sample Calculation

Equation (1)

According to the methodology described in the EPA 2002 NEI, Appendix A - Criteria and HAP,[76] the non-fugitive VOC emission factor for storage tank filling is 1081 mg/L and the procedure for calculating VOC emissions is as following:

AE = FUEL x PERF x EF x 3.78 L/gal / 453.59 g/lbs / 2,000 lbs/ton

Where,

AE = Annual pre-flight safety checks emissions, tons VOC/yr
FUEL = Amount of fuel consumed (7,457,293 gal)
PERF = Percentage of fuel consumed by piston aircraft (24%)
EF = Emission factor (1.081 g/L)

Annual pre-flight safety checks emissions:

AE = 7,457,293 gal x 0.24 x 1.081 g/L x 3.78 L/gal / 453.59 g/lbs / 2,000 lbs/ton
= 8.06 tons VOC/yr

Non-road Equipment

Emissions were calculated for lawn and garden equipment, construction equipment, commercial equipment and light industrial equipment. Emissions estimations are based on the local data collected through surveys from the SAIA (Table 3-34) and on national data used in the EPA 2004 NONROAD Model.[77] The survey questionnaire requests information on:

- Equipment type and quantity
- Activity rates – total annual hours of use
- Temporal profiles – hrs of use on weekdays and weekends
- Horse-power (HP) or engine capacity in cubic centimeter (cc) if HP was not available

[75] National Business Aviation Association. Business Aviation Industry Statistics. Available online: http://www.nbaa.org/factbook/2000/section4.htm

[76] EPA, July 2006. Documentation for the Final 2002 Non-point Sector (Feb 06 Version) National Emission Inventory for Criteria and Hazardous Air Pollutants. prepared by: E.H. Pechan & Associates, Inc. Available online: ftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/nonpoint/2002nei_final_nonpoint_documentation0206version.pdf

[77] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

- Fuel type

The emissions were converted to tons/day for typical summer ozone-season days by using NONROAD model seasonal adjustment factors.

Sample Calculation

Equation (1)

Annual emissions for each type of non-road equipment:

$$AE_A = (EP_A \times HRS_A \times HP_A \times LF_A \times EF_A) / 453.59 \text{ g/lbs} / 2{,}000 \text{ lbs/ton}$$

Where,

- AE_A = Annual emissions for each type of equipment A (tons/yr)
- EP_A = Equipment population of type A (based on survey)
- HRS_A = Annual hours of use for equipment A (based on survey)
- HP_A = Average rated horsepower for equipment type A (based on survey)
- LF_A = Typical load factor for equipment type A (NONROAD model)
- EF_A = Average emissions of pollutant per unit of use for equipment type A, g/hp-hr (NONROAD model)

Annual emissions for Leaf Blower/Vacuum (SCC 2260004031):

$$AE_A = 1 \times 2{,}088 \text{ hrs} \times 2.5 \text{ hp} \times 0.94 \times 95.067 \text{ g/hp-hr} / 453.59 \text{ g/lbs} / 2{,}000 \text{ lbs/ton}$$
$$= 0.514 \text{ tons VOC/yr}$$

Temporal Allocation

Processing emissions in a photochemical model includes such steps as chemical speciation, temporal allocation, and spatial allocation of emissions data. These steps necessitate the conversion of the aircraft emissions data to the grid-cell based modeling system and the conversion of daily emissions data to hourly data as required by the comprehensive air quality model with extensions (CAMx).[78] In Figure 3-3, the hourly temporal distribution of annual arrival and departure times for GA aircrafts are displayed graphically. The air career flight schedules, for September 2005, were analyzed to determine the temporal distribution, as well as the peak hours of arrival and departure times for commercial flights. The results indicated that the commercial arrival and departure pattern varied from that of GA operations; while the peak hour for the GA flights is around 5:00 pm, the peak hour for the commercial flights is around 12:00 noon. The commercial hourly distribution is shown in the Figure 3-4.

[78] ENVIRON, July 13, 2005. Comprehensive Air Quality Model with Extensions (CAMx). Novato, California. Available online: http://www.camx.com/

Table 3-34. 2005 Non-road Equipment Survey Results for SAIA

Equipment Type	Engine Type:	SCC	HP	Equip. Pop.	Daily Hrs/Unit Operated (M - F)	Daily Hrs/Unit Operated (Sa & Su)
Lawn & Garden Equipment:						
Rotary Tillers	Gasoline 2-cycle	2260004016	0.9	1	1.8	0
Chainsaws	Gasoline 2-cycle	2260004021	3.0	2	1	0
Trimmers/Edgers/Brush Cut	Gasoline 2-cycle	2260004026	1.3	9	4	0
Trimmers/Edgers/Brush Cut	Gasoline 2-cycle	2260004026	0.9	3	2	0
Leaf Blowers/Vacuums	Gasoline 2-cycle	2260004031	2.5	4	2	0
Lawn Mowers	Gasoline 4-cycle	2265004011	12.5	2	4	0
Rear Engine Riding Mowers	Gasoline 4-cycle	2265004041	20.0	2	6	0
Rear Engine Riding Mowers	Diesel	2270004041	23.0	1	6	2
Front Mowers	Diesel	2270004046	18.0	1	4	0
Front Mowers	Diesel	2270004046	40.0	1	6	2
Lawn and Garden Tractors	Diesel	2270004056	18.0	1	2	0
Commercial Turf Equipment	Diesel	2270004071	86.0	5	5	2
Commercial Turf Equipment	Diesel	2270004071	105.0	5	5	2
Other Equipment:						
Paint Machines - Other Ind. Equip.	Gasoline 4-cycle	2265003040	5.0	1	0.5	0
Paint Machines - Other Ind. Equip.	Gasoline 4-cycle	2265003040	3.0	2	2	0.5
Portable Generators	Diesel	2270006005	8.0	3	0.5	0
Generator	Diesel	2270006005	71.2	1	1.8	0
Air Compressors	Diesel	2270006015	80.0	2	0.5	0
Air Compressors	Diesel	2270006015	24.0	2	0.5	0

Figure 3.3. Hourly Distribution of General Aviation Operations by Aircraft Type at SAIA, 2005

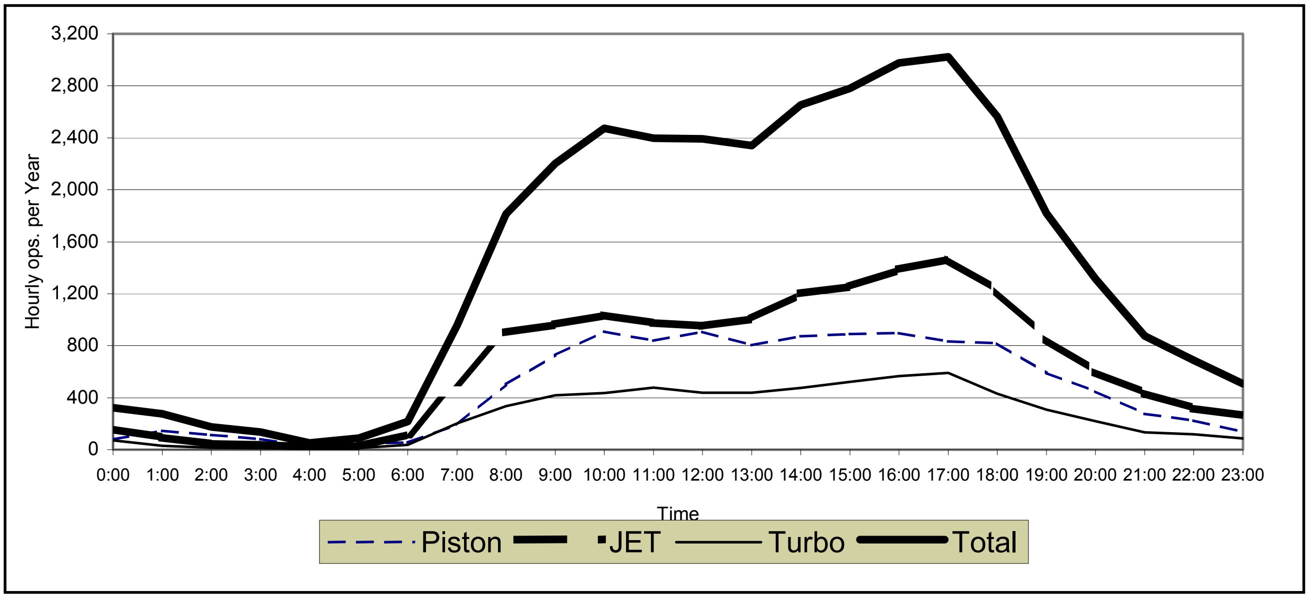
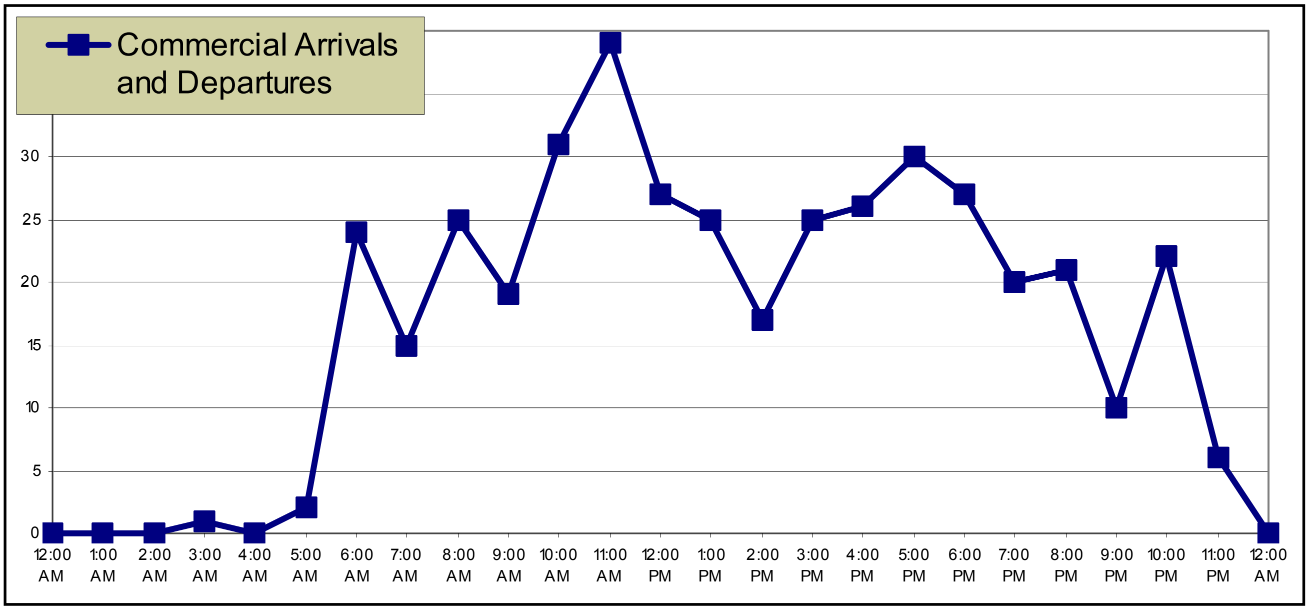


Figure 3.4. Hourly Distribution of Commercial Aircraft Operations at SAIA, September 2005



Spatial Allocation

To allocate emissions spatially, information on runway patterns of specific aircraft traffic was obtained from the San Antonio Department of Aviation. The information provided percentage of annual flights that take place at each end of a runway, and made it possible to assign EDMS generated aircraft emissions to each end of the runways for arrival and departure flights. Tables 3-35 and 3-36 contain the breakdown by the aircraft types: commercial, jet, turbo, and piston aircraft type. To calculate hourly emissions by runway and aircraft classification, the following formula was used:

Equation (1)

AE_A = PAO x EM x (HR / x DAY)

Where,

AE_A = Aircraft emissions for hour A, tons VOC/yr
PAO = Percentage of aircraft operations allocated by runway and aircraft type (Table 3-35 and 3-36)
EM = Emission by mode for each aircraft type
HR = Number of operation for hour A (Figure 3-3 and 3-4)
DAY = Total number of operations per day

Take off NOx emissions calculation for commercial flights at 12:00 noon on runway 12R:

AE_A = 45% x 0.438 tons/day x (27 ops/hr / 409 ops/day)
= 0.013 tons NOx/hr at 12:00 noon

The directional assignment of commercial flight emissions, for example, is shown in Table 3-37.

Table 3-35. Percentage of Departure Emissions Allocated by Runway, Operation, and Direction

Runway	Direction	Commercial	Jet	Turbo	Piston
RW 12R	East	45%	61%	58%	51%
RW 12L	East-Small	0%	3%	1%	4%
RW 21	South	2%	2%	2%	4%
RW 30R	West-Small	0%	0%	2%	3%
RW 30L	West	14%	18%	14%	11%
RW 3	North	38%	16%	23%	27%
Total		100%	100%	100%	100%

Table 3-36. Percentage of Arrival Emissions Allocated by Runway, Operation, and Direction

Runway	Direction	Commercial	Jet	Turbo	Piston
RW 12R	West	74%	70%	72%	58%
RW 12L	West-Small	0%	2%	5%	13%
RW 21	North	3%	2%	2%	4%
RW 30R	East-Small	0%	0%	1%	4%
RW 30L	East	13%	15%	11%	10%
RW 3	South	10%	11%	9%	11%
Total		100%	100%	100%	100%

In the next step, aircraft emissions for flight modes of take-off (0 – 1,000 feet @ 0 – 305 meters), climb out (1,000 – 3,000 feet @ 305 – 914 meters), and approach (3,000 – 0 feet @ 914 – 0 meters), were allocated to the Comprehensive Air Quality Model with Extensions (CAMx)[79] photochemical grid-cell system. Emissions from aircraft above 3,000 feet in elevation were not calculated. At those elevations, aircraft are usually above the mixing height for San Antonio and emissions would have a minor impact on ground-level ozone formation.

[79] ENVIRON, July 13, 2005. Comprehensive Air Quality Model with Extensions (CAMx). Novato, California. Available online: http://www.camx.com/

Table 3-37. Distribution of Annual Commercial Aircraft Emissions by Runway and Mode of Flight

Runway	Departure					Arrival		
	Direction	Take - Off		Climb - Out		Direction	Approach	
		VOC	NOx	VOC	NOx		VOC	NOx
RW 12R	East	0.53	72.59	0.59	48.18	West	3.96	55.72
RW 12L	East	0.00	0.00	0.00	0.00	West	0.00	0.00
RW 21	South	0.02	3.23	0.03	2.14	North	0.16	2.26
RW 30R	West	0.00	0.00	0.00	0.00	East	0.00	0.00
RW 30L	West	0.17	22.58	0.18	14.99	East	0.70	9.79
RW 3	North	0.45	61.30	0.50	40.68	South	0.54	7.53
Total		1.17	159.69	1.30	105.99		5.35	75.29

To allocate emissions to the CAMx grid cells, height, latitude, and longitude were calculated for 8 nodes at incremental ground distances from the ends of each runway. The GIS software TransCAD[80] was utilized for this purpose. Figure 3-5, which provides a diagram of the layout and dimensions of runways at SAIA, was used to calculate the latitude and longitude of each node.[81] For quality assurance of nodal positioning, in Figure 3-6 the nodes are superimposed on an aerial photograph of the airport to illustrate the location and distance of these nodes relative to both ends of each runway.

GIS software was used to determine the latitudes and longitudes of the end points for each runway. After consulting with Texas Commission on Environmental Quality (TCEQ) staff and applying EDMS defaults for landing, an angle of 3º was estimated for aircraft landings and an angle of 9º was estimates for departures. This information, in addition to the formula below, was used to locate 8 nodes within the CAMx horizontal and vertical grid cells to replicate the 3-dimensonal paths of aircrafts. The aircraft emissions per runway were then equally distributed and allocated to these nodes.

Sample Calculation
Equation (2)
Aircraft emissions per runway were equally distributed and allocated to these nodes using the following formula:

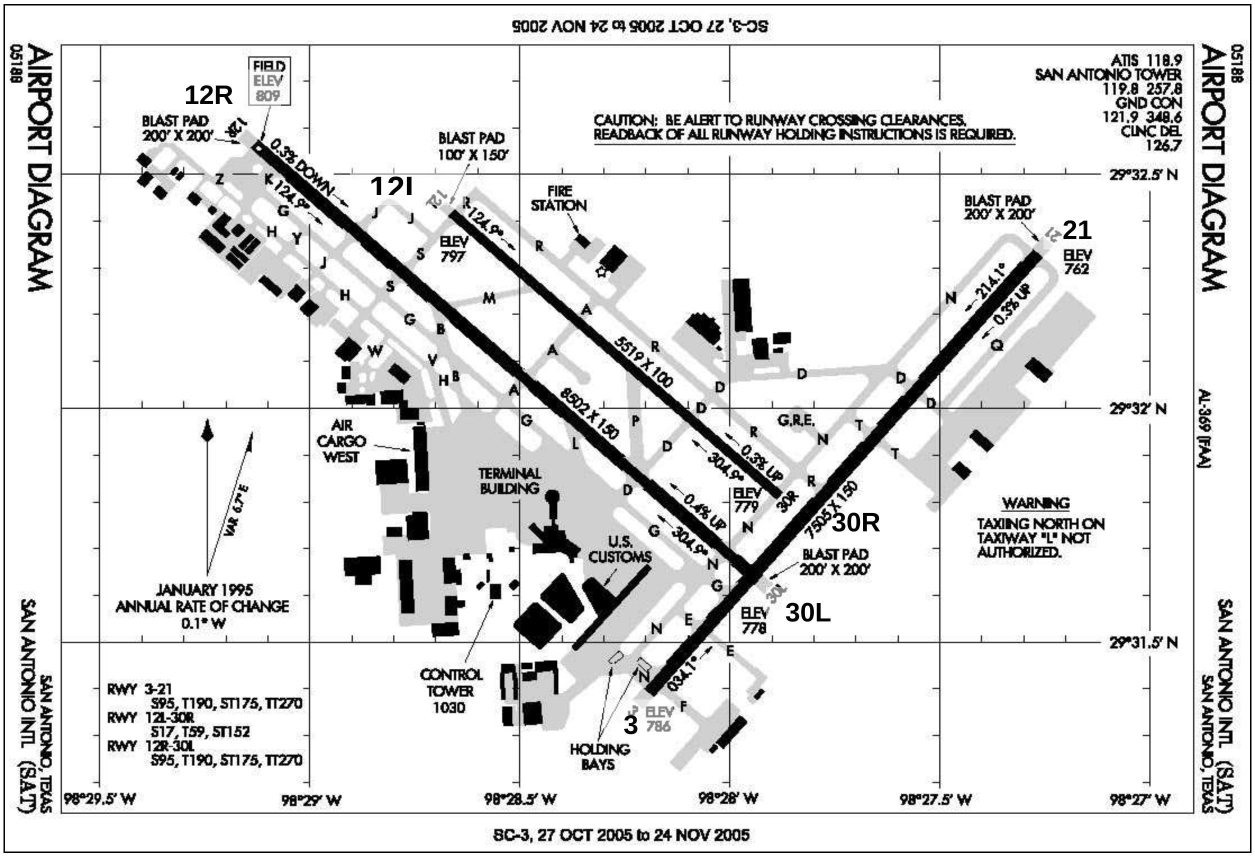
$$NH = DIS \times TAN\ (9 \times PI / 180)$$

Where,

NH = Height of the node
DIS = Ground distance from the runway end point
TAN = tangent of 9° for take off and climb out; tangent of 3° for landing
PI = mathematical constant pi (≈3.14159)

[80] Caliper Corporation, 2005. TRANSCAD: Transportation GIS Software Version 4.7. Newton MA.
[81] Federal Aviation Administration, 2005. National Flight Database. Available online: http://naco.faa.gov/index.asp?xml=naco/online/d_tpp

Figure 3.5. SAIA Runway Schematic



For example, Table 3-38 contains the height, latitude, and longitude of nodes for runway 3/21. Four nodes were used to allocate take off and four nodes were used to allocate climb out emissions. For landing emissions, six nodes were used. These were spaced in 1,000-meter increments from the end of the runway. The height of the landing nodes starts at 264 meters (which is the height of the plane at 5,000 meters ground distance from the airport) due to the uncertainty of aircraft direction before the aircraft gets within this distance of the airport.

A graphic illustration of the vertical height by the three different aircraft modes and CAMx vertical grid layers is shown in Figure 5. Aircraft emissions were allocated to the first 8 vertical layers of the CAMx modeling grid system. Once the emissions were geocoded to correct location and height, the data was converted to a format suitable for photochemical modeling.

Figure 3-6. Aerial View of Calculated Nodes

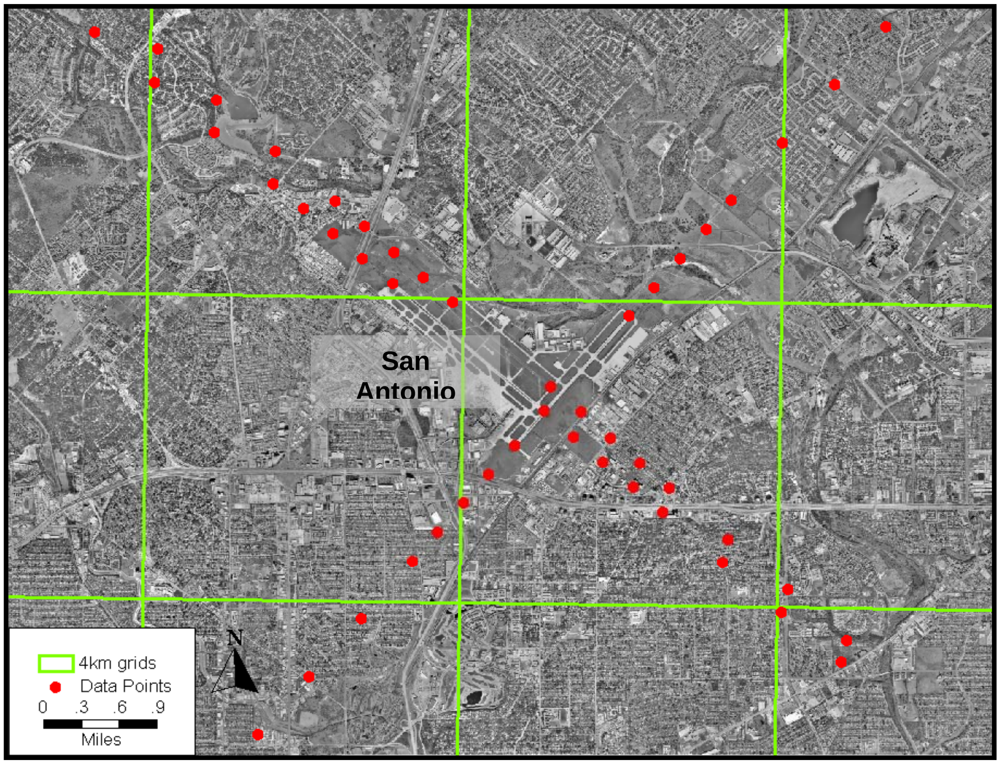
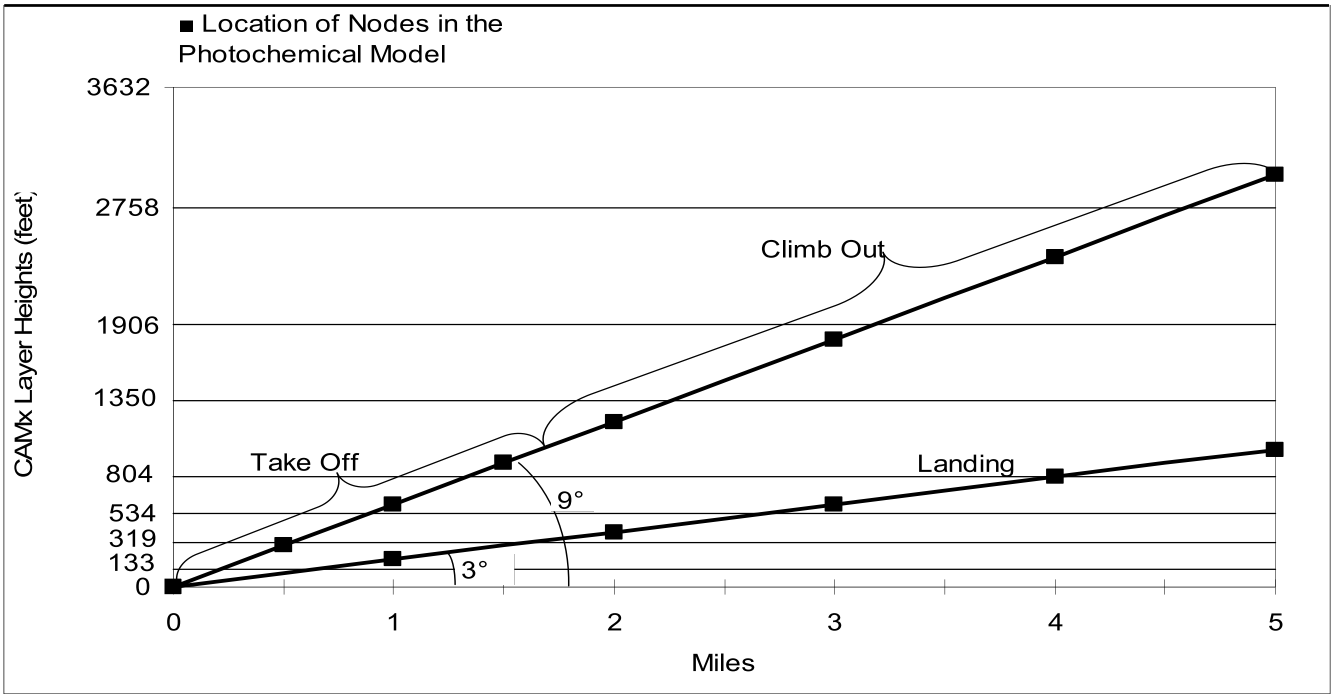


Table 3-38. Heights of Selected Nodes for Take-off and Landing Operations at Runway 3/21

Direction/ Runway Nodes	Distance from End Point (Km)	Latitude	Longitude	Node Height (m) for 9° Take-off	Node Height (m) for 3° Landing
North East Direction					
Runway 3 Nodes	0.0	-1157.69	150.96	0	0
	0.5	-1157.31	151.27	79	N/A
	1.0	-1156.94	151.58	158	53
	1.5	-1156.56	151.89	238	N/A
	2.0	-1156.18	152.20	317	106
	3.0	-1155.43	152.83	475	158
	4.0	-1154.68	153.45	634	211
	5.0	-1153.92	154.08	792	264
South West Direction					
Runway 21 Nodes	0.0	-1159.41	149.53	0	0
	0.5	-1159.79	149.22	79	N/A
	1.0	-1160.17	148.90	158	53
	1.5	-1160.54	148.59	238	N/A
	2.0	-1160.92	148.28	317	106
	3.0	-1161.67	147.66	475	158
	4.0	-1162.43	147.03	634	211
	5.0	-1163.18	146.41	792	264

N/A: These nodes were not used for emissions from landing

Figure 3-7. Calculated Heights of Nodes for LTO Operations at End of Runways*



*Note: The angles in diagram are not to scale

Results

The total estimated emissions for three criteria pollutants from activities at San Antonio International Airport for calendar year 2005 and the estimated daily emissions for a typical ozone season day are presented in Table 3-39.

Table 3-39. 2005 Total Annual and Daily Emissions from San Antonio International Airport

Emissions Source	tons/yr			tons/day		
	VOC	NOx	CO	VOC	NOx	CO
Boilers	0.04	1.38	0.59	0.00011	0.00378	0.00162
Aircraft Evaporative Loss	11.71	0.00	0.00	0.03208	0.00000	0.00000
Aircraft Operation	153.75	445.69	687.94	0.42123	1.22107	1.88477
GSE/AGE/APU	93.35	128.21	2,477.41	0.25575	0.35126	6.78744
Roadways/Parking Lots	26.72	24.08	262.65	0.07320	0.06598	0.71958
Non-road	3.07	4.34	35.14	0.01444	0.01841	0.16737
Fueling	8.06	0.00	0.00	0.02208	0.00000	0.00000
Total	296.69	603.704	3463.73	0.81889	1.66050	9.56078

Stinson Municipal Airport

Stinson Municipal Airport is the second oldest general aviation airport in continuous operation in the United States. As the primary reliever for general aviation traffic in San Antonio, Stinson is extremely appealing to operators of light aircraft, individuals, and private aviation companies. Stinson Municipal Airport is located south of downtown San Antonio on Mission Road. It is approximately 6 minutes from San Antonio's central business district and easily accessible to Interstate Highway Loop 410, Interstate Highway 37, Interstate Highway 35, and Interstate Highway 10. It is approximately 14 miles due south of San Antonio International Airport. Military aircraft, specifically the T-37 and T-6, only fly touch-&-go approaches.

Methodology

According to the information obtained from Stinson,[82] there were 119,085 operations for the year 2005. The breakdown on estimated 2005 total "local" and "itinerant" for civil and military aircraft operations during the first half of 2005 was obtained from City of San Antonio. Since information for the second half of 2005 was not available, data for the second half of 2004 was used (Table 3-40).

The data collected from the Internet site "Airport IQ Data Center"[83] included operation data on commercial and civilian aircrafts by landing/take-off cycles and aircraft type for 2003 and part of 2004. To forecast to 2005, the data provided by the city of San Antonio was used. The 2005 forecasted total for the commercial operations from city of San Antonio was compared to the commercial operations Airport IQ Data Center to obtain a growth ratio. The 21% reduction in aircraft operations was equally applied to every aircraft type. Similar to the procedure applied for the San Antonio International Airport, exhaust emissions for the Stinson were calculated using the Emission & Dispersion Modeling System version 4.21 (EDMS).[84]

Table 3-40. 2005 Monthly Operations at Stinson Municipal Airport

Month	Itinerant					Local		
	Air Carrier	Air Taxi	General Aviation	Military	Total	Civil	Military	Total
Jan	0	6	2,635	560	3,201	4,464	0	4,464
Feb	0	0	2,536	539	3,075	4,202	0	4,202
Mar	0	4	3,489	776	4,269	5,405	26	5,431
Apr	0	2	3,421	598	4,021	5,093	36	5,129
May	0	0	3,983	670	4,653	7,833	0	7,833
Jun	0	5	3,718	631	4,354	6,880	44	6,924
Jul	0	0	3,974	632	4,606	6,502	74	6,576
Aug	0	1	3,785	686	4,472	6,278	30	6,308
Sep	0	6	3,972	492	4,470	7,411	8	7,419
Oct	0	3	3,568	668	4,239	6,416	24	6,440
Nov	0	2	3,115	536	3,653	4,361	0	4,361
Dec	0	2	3,334	506	3,842	5,133	10	5,143
Total	0	31	41,530	7,294	48,855	69,978	252	70,230

[82] Beatrice Valdez-Heidari, City of San Antonio. email dated 7/14/2005.
[83] GCR & Associates, Inc., 2005. Airport IQ Data Center. Available online: http://www.airportiq.com/
[84] The Federal Aviation Administration, Sept. 30, 2004. Emissions & Dispersion Modeling System. Available online: http://www.aee.faa.gov/emissions/edms/EDMShome.htm

Table 3-41. 2002 and 2005 Commercial/GA Aircraft Annual Landing Activity at Stinson Airport

Aircraft Name	Engine Type	2002 Annual Landing	2005 Annual Landing
Beech King Air 200	PT6A-41	1	1
Beech King Air 300	PT6A-60, -60A, -60AG	1	1
Beechjet 400	JT15D-5 (A & B)	4	3
Cessna 150	O-200	1	1
500 Citation	JT15D-1A & 1B	2	2
560 Citation V	JT15D-5 (A & B)	4	3
CITATION X	AE3007C	1	1
Embraer ERJ 135/140	AE3007A1/3	1	1
BAE 125-700	TFE731-3	1	1
Cessna 172 Skyhawk	IO-360-B	24,472	19,290
Aztec	TIO-540-J2B2	1	1
Cessna T337	IO-360-B	2	1
Beechjet 400	JT15D-5 (A & B)	104	82
Bell 206	250B17B	186	147
Learjet 24D	CJ610-6	90	71
Learjet 25B	CJ610-6	78	61
Learjet 31	TFE731-2	268	211
Learjet 35/36	TFE 731-2-2B	1,756	1,384
BAE 125-700	TFE731-3	38	30
CL601-3R	CF34-3A	78	61
CITATION I	JT15D-1A & 1B	406	320
CITATION V	JT15D-5 (A & B)	52	41
CITATION X	AE3007C	75	59
CITATION II	JT15D-4 (B, C, D)	26	20
ATR42	PW120	34	27
**TBM TB-700 Aerosp	10-360-B	17	13
Beech King Air 100	PT6A-28	68	54
Beech King Air 200	PT6A-41	658	519
Beech King Air 90	PT6A-28	832	656
Beech King Air 350	PT6A-60, -60A, -60AG	221	174
**C425	PT6A-114	51	40
Cessna 441 Conquest2	TPE331-8	51	40
EMB-110	PT6A-34	34	27
Gulfstream I	RDa7	17	13
BH-1900	PT6A-67D	68	54
PA-31T Cheyenne	PT6A-28	170	134
Swearingen Merlin	TPE331-3	324	255
Swearingen Metro 2	TPE331-2	273	215
**Twin Beech 18	O-200	119	94
Cessna 150	O-200	10,562	8,326
Cessna 208 Caravan	PT6A-114	119	94
Cessna T337	IO-360-B	14,485	11,418
**PC12	O-200	2,444	1,927
Aztec	TIO-540-J2B2	3,912	3,084
Piper PA-28	O-320	7,093	5,591
Comanche	TIO-540-J2B2	1,311	1,033
Rockwell Commander	O-320	238	188
Total	N/A	70,749	55,769

** User created aircraft

Military Aircraft
Total military operations were divided between two military training aircrafts, T-37 and T-6 Texan, based on information obtained from the City of San Antonio. The military also uses the Airport's amenities for training purposes and the information on the military use of the Airport can be obtained from the City or the TAF software. The following table (3-42) indicates military operations occurring at Stinson. The TGO-based information on military aircraft activities and the LTO-based data for civil flights and aircraft types were then entered into the EDMS model to estimate the amount of air pollutants attributed to the aircraft activities for the year 2005.

Table 3-42. Military Operations at Stinson Municipal Airport by Aircraft Type

Aircraft Mix	2002 Aircraft Activity		2005 Aircraft Activity	
	LTO	TGO	LTO	TGO
T43A	0	32	0	0
T-1A	0	138	0	0
T-34/T-37	0	3,417	0	1,851
T-6 Texan	-	-	0	1,922
Total Operations	7,170		7,546	

Note: each TGO equals to 2 operations

Refueling
As described in the Appendix D of publication entitled "Air Quality Procedures for Civilian Airports & Air Force Bases", commercial or *Itinerant* "evaporative related emissions are small due to the low vapor pressure of the fuel and quick-connect refueling nozzles."[85] The EDMS model, therefore, does not estimate refueling emissions. For the purpose of this report, the emissions for itinerant refueling emissions were negligible.

The refueling losses for general aviation aircrafts were calculated as a component of "Evaporative Losses" described below. Most general aviation aircrafts are powered by piston engines, which are fueled by aviation gasoline (AvGas). Aviation gasoline has a much higher volatility than jet fuel and fuel tanks are vented to the atmosphere resulting in significant VOC evaporation. Evaporative emissions are calculated for general aviation aircrafts that are based at the airport and not *Itinerant* aircrafts. Evaporative emissions are associated with refueling, diurnal, and pre-flight safety procedures.

Sample Calculations
Equation (1)
EPA-approved methodology for aircraft includes a refueling and spillage loss of 4.61 grams of Hydrocarbon (HC) per gallon of fuel consumed.[86] The 2005, per aircraft, fuel consumption rate for general aviation was estimated only for based piston engine aircrafts using a straight-line calculation with the TTI 1999 and 2007 fuel consumption as follows:

[85] Federal Aviation Administration, April 1997. Office of Environment and Energy. Washington, DC. p. D-5. Available online: http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/media/App_D.PDF
[86] J. Borowiec, T. Qu, and C. Bell, March 2000. 1996, 1999, and 2007 Airport Emission Inventory.Texas Transportation Institute, College Station, TX.

AE = [(FC07 - FC99) x 6 / 8 + FC99] x NUM x EF x CON / 453.59 g/lbs / 2,000 lbs/ton

Where,

AE = Annual refueling and spillage emissions, tons VOC/yr
FC07 = Fuel consumption for 2007 (7,370 gal /aircraft)
FC99 = Fuel consumption for 1999 (6,090 gal /aircraft)
NUM = Number of based aircraft (138)
EF = Emission factor (4.61 HC g/gal)
CON = HC to VOC conversion ratio (1.005)

Annual refueling and spillage emissions:

AE = [(7,370 gal /aircraft - 6,090 gal /aircraft) x 6 / 8 + 6,090 gal /aircraft] x 138 x 4.61 HC g/gal x 1.005 / 453.59 g/lbs / 2,000 lbs/ton
= 4.97 tons VOC/yr

Equation (2)
The following equation, introduced in Appendix D of the EPA publication entitled, “Air Quality Procedures for Civilian Airports & Air Force Bases,”[87] was used for quantifying HC evaporative emissions resulting from aircraft diurnal losses.

AE = NUM x EF x CON x DAY / 2,000 lbs/ton

Where,

AE = Annual diurnal emissions, tons VOC/yr
NUM = Number of based aircraft (138)
EF = Emission factor (0.15 lbs/day/based aircraft)
CON = HC to VOC conversion ratio (1.005)
DAY = Number of days

Annual diurnal emissions:

AE = 138 x 0.15 lbs/day/based aircraft x 1.005 x 365 / 2,000 lbs/ton
= 3.80 tons VOC/yr

Equation (3)
To calculate emissions from pre-flight safety checks, the number of local operations by piston-engine aircraft is needed. According to the TAF software database, the total local operation by all aircraft types is 6,196 annually. The total number of based aircraft at SAIA is 263[88], of which 181 aircrafts are piston-engine aircrafts, or 69% of the total. The following equation for pre-flight safety check emissions was also obtained from “Air Quality Procedures for Civilian Airports & Air Force Bases.”

AE = (OPS / 2) x PERP x EF x CON / 2,000 lbs/ton

[87] Federal Aviation Administration, April 1997. Office of Environment and Energy. Washington, DC. p. D-5. Available online: http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/media/App_D.PDF
[88] Fltplan.co. Available online: http://www.fltplan.com/AwMainPageSelect.exe?a=1

Where,

AE = Annual pre-flight safety checks emissions, tons VOC/yr
OPS = Number operations for all aircraft types (70,230 operation, 2 ops per LTO cycle)
PERP = Percentage of piston aircraft (92.1%)
EF = Emission factor (0.20 lbs per LTO cycle)
CON = HC to VOC conversion ratio (1.005)

Annual pre-flight safety checks emissions:

AE = (70,230 ops / 2) x 0.921 x 0.20 lbs per LTO cycle x 1.005 / 2,000 lbs/ton
= 3.25 tons VOC/yr

Non-road Equipment

Emissions were calculated for lawn and garden, construction, commercial, and light industrial equipment. Emissions estimations are based on the local data collected through based on a survey from Stinson Airport and on national data used in the EPA 2004 NONROAD Model.[89] The survey questionnaire requests information on:

- Equipment type and quantity
- Activity rates – total annual hours of use
- Temporal profiles – hrs of use on weekdays and weekends
- Horse-power (HP) or engine capacity in cubic centimeter (cc) if HP was not available

The emissions were converted to tons/day for typical summer ozone-season days by using NONROAD model seasonal adjustment factors.

Sample Calculation

Equation (1)

Annual emissions for each type of non-road equipment:

AE_A = (EP_A x HRS_A x HP_A x LF_A x EF_A) / 453.59 g/lbs / 2,000 lbs/ton

Where,

AE_A = Annual emissions for each type of equipment A (tons/yr)
EP_A = Equipment population of type A (based on survey)
HRS_A = Annual hours of use for equipment A (based on survey)
HP_A = Average rated horsepower for equipment type A (based on survey)
LF_A = Typical load factor for equipment type A (from NONROAD model)
EF_A = Average emissions of pollutant per unit of use for equipment type A, g/hp-hr (from NONROAD model)

Annual emissions for diesel tractors (SCC 2270002066):

AE_A = 4 x 1,135 hrs × 94.98 hp x 0.21 x 1.7098 g/hp-hr / 453.59 g/lbs / 2,000 lbs/ton
= 0.171 tons VOC/yr

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[89] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

Results
The results of our emission inventory for the Stinson Municipal Airport are presented in the following table. For tons per day emissions, the tons/year emissions were divided by 365 days/year to achieve average daily emissions.

Table 3-43. 2005 Emission Inventory Results for the Stinson Municipal Airport

Source	Ton/Year			Ton/Day		
	VOC	NO_x	CO	VOC	NO_x	CO
Aircraft Evaporative Loss	12.02	0.00	0.00	0.03292	0.00000	0.00000
Aircraft Operations	14.82	5.45	449.36	0.04060	0.01493	1.23112
GSE/AGE/APU	2.56	4.17	65.22	0.00701	0.01142	0.17868
Non-road	0.70	1.01	9.20	0.00330	0.00443	0.04372
Total	30.10	10.63	523.78	0.08384	0.03079	1.45353

Small Airports

This section describes the process of calculating air pollutant emissions attributed to aircraft operations at small airports within the AACOG region. Emissions from lawn and garden equipment used for maintenance of these small airports were also calculated. However, due to insignificance of on-road vehicle emissions at these airports, they were not calculated.

Methodology
Data on aircraft types, which were used to calculate exhaust emissions, are from the "Airport IQ Data Center."[90] The Airport IQ Data Center uses the FAA 5010 database to report on the "local" and "itinerant" operational activities by aircraft type. Updated 2005 operation data was obtained from either FltPlan.com[91] or AirNav.com,[92] aviation related websites.

General Aviation Aircraft
General aviation aircrafts were divided in to three categories of Jet, Turbo-Prop, and Piston for each airport (Table 3-44). When entering aircraft operation, either the exact aircraft type was used or an equivalent aircraft was created. Helicopter operations were included in the jet category due to use of jet fuel by this aircraft, however helicopters emissions were calculated separately.

To calculate exhaust emissions, 2005 civil and military aircraft operation data, collected for specific small airport, were compared to the 2002 aircraft operations and the ratios of growth in operations were calculated. These ratios were applied to the 2002 aircraft operation by aircraft type. As an example, Kestrel airport, which demonstrated significant increase in aircraft activities between 2002 and 2005, is shown in Table 3-45. Table 3-46 contains the number of base aircraft and operations at each small airport for 2005. Exhaust emissions for the each small airport were calculated using the Emission & Dispersion Modeling System version 4.21 (EDMS).[93]

[90] GCR & Associates, Inc., 2005. Airport IQ Data Center. Available online: http://www.gcr1.com/5010WEB/
[91] Fltplan.com. Available online: http://www.fltplan.com/AwMainPageSelect.exe?a=1
[92] AirNav, LLC. AirNav.com. Available online: http://www.airnav.com/airports/
[93] The Federal Aviation Administration, Sept. 30, 2004. Emissions & Dispersion Modeling System. Available online: http://www.aee.faa.gov/emissions/edms/EDMShome.htm

Table 3-44. Small Airports Aircraft Population by Aircraft Type Percentage

Airport	County	Aircraft Type		
		Jet	Turbo	Piston
Pleasanton Municipal Airport	Atascosa	2.4%	23.6%	74.0%
Boerne Stage Field Airport	Bexar	1.9%	2.4%	95.7%
Horizon Airport	Bexar	0.0%	0.0%	100.0%
San Geronimo Airpark	Bexar	0.0%	0.0%	100.0%
Triple R Airport	Bexar	0.0%	0.0%	100.0%
Twin-Oaks Airport	Bexar	3.2%	0.0%	96.8%
Bulverde Airpark	Comal	0.0%	0.0%	100.0%
Kestrel Airpark	Comal	10.1%	0.0%	89.9%
Dilley Airpark	Frio	7.4%	50.0%	42.6%
McKinley Field Airport	Frio	27.5%	11.9%	60.7%
Gillespie County Airport	Gillespie	8.8%	6.6%	84.7%
Huber Airpark Civic Club LLC Airport	Guadalupe	0.0%	0.0%	100.0%
New Braunfels Municipal Airport	Guadalupe	22.4%	13.8%	63.8%
Karnes County Airport	Karnes	3.3%	17.2%	79.4%
Kerrville Municipal Airport/Louis Schreiner	Kerr	25.4%	15.5%	59.1%
Castroville Municipal Airport	Medina	5.7%	2.6%	91.7%
Devine Municipal Airport	Medina	0.0%	0.0%	100.0%
Hondo Municipal Airport	Medina	30.1%	16.7%	53.2%

Sample Calculations
Equation (1)
Number of operations for each aircraft type at each airport:

$$NUM05_A = (OPS05 / OPS02) \times NUM02_A$$

Where,

$NUM05_A$ = Number of aircraft type A in 2005
OPS05 = Number of operations in 2005 (FltPlan.com or AirNav.com)
OPS02 = Number of operations in 2002 (Airport IQ Data Center)
$NUM02_A$ = Number of aircraft type A in 2005

Number of Cessna 172 Sky Hawk Operations at Kestrel Airport in 2005:

$$NUM05_A = (1{,}560 / 212) \times 82$$
$$= 603$$

Table 3-45. 2005 Increased Aircraft Activity at Kestrel Airport

Aircraft Type In EDMS Model	Engine Type In EDMS Model	2002 Annual Operations	2005 Annual Operations
Learjet 35/36	TFE 731-2-2B	2	15
BAE 125-700	TFE731-3	2	15
CL600	CF34-3B	4	29
CITATION I	JT15D-1A & 1B	2	15
CITATION V	JT15D-5 (A & B)	4	29
Falcon 50	TFE731-3	2	15
Cessna 150	O-200	36	265
Cessna 172 Sky Hawk	IO-360-B	82	603
Cessna T337	IO-360-B	36	265
**PC12	User-Created	6	44
Aztec	TIO-540-J2B2	14	103
Piper PA-28	O-320	18	132
Twin Comanche	IO-320-D1AD	4	29
Total LTO		212	1,560

Table 3-46. Operations and Based Aircraft at Small Airports, 2005

Airport	Based Aircraft	Local Operation	Itinerant and Military Operations	Total Operations
Pleasanton	27	3,000	3,280	6,280
New Braunfels	145	10,000	16,000	26,000
Hondo	22	4,400	20,920	25,320
Castroville	72	14,400	7,200	21,600
Devine	16	4,200	1,400	5,600
Karnes	5	500	730	1,230
Gillespie/Fredericksburg	52	10,200	5,475	15,675
Kerrville	126	11,972	47,888	59,860
Kestrel Airpark	30	780	780	1,560
Dilley	2	400	200	600
McKinley Airport	9	3,003	897	3,900
San Geronimo Airpark	46	9,293	4,577	13,870
Boerne Stage Field	81	16,200	8,100	24,300
Bulverde Airpark	83	16,400	8,200	24,600
Horizon	8	2,400	400	2,800
Triple R	9	3,000	1,200	4,200
Twin-Oaks	21	2,100	4,200	6,300
Total	754	112,248	131,447	243,695

Refueling

Refueling losses for general aviation aircrafts were calculation methodology was described in the Stinson airport section. Most general aviation aircrafts are powered by piston engines, which are fueled by aviation gasoline (AvGas). Aviation gasoline has a much higher volatility than jet fuel and fuel tanks are vented to the atmosphere resulting in significant VOC evaporation. Evaporative emissions are calculated for general aviation aircrafts that are based at the airport and not *Itinerant* aircrafts. Evaporative emissions are associated with refueling, diurnal, and pre-flight safety procedures.

Military Aircraft

The military also uses three airports for training purposes: Hondo Municipal Airport, Pleasanton Municipal Airport, and Gillespie County Airport. The FltPlan.com site maintains records on these military activities and these data, in addition to data collected by phone calls, were used to calculate the aircraft emissions. The data for military activates at Hondo Municipal Airport came from the AirNav.com[94] website; also the Randolph military base, that uses the airport for T-6 Texan training, was contacted. Table 3-47 lists statistics for military operations at these airports, which were used as input data to the EDMS model to calculate emissions from military activities at small airports.

Table 3-47. Annual TGO Military Operations at Small Airports by Aircraft Type, 2005

Aircraft Name	Pleasanton Municipal Airport	Gillespie County Airport	Hondo Municipal Airport
T-6 Texan			9,360
AH-1J Cobra		30	
AH-1W Super Cobra		57	
Beech King Air 90	135		
Jet stream 32	135		
Piper PA23-160	135		
Piper PA-42	135		
Total	540	87	9,360

Lawn and Garden Equipment

The EI of lawn and garden equipment for small airports accomplishes two goals:

1 Provides a foundation that will allow for better assessment of lawn and garden equipment activity emissions at airport in the AACOG twelve-county area for the year 2005.
2 Provides a mechanism to determine the representative emissions that would occur on any given day in the typical lawn and garden equipment use period.

This inventory takes into account the following types and categories of equipment:

- 2260004026 2-stroke commercial trimmers/edgers/brush cutters
- 2260004031 2-stroke commercial leaf blowers/vacuums
- 2265004011 4-stroke commercial lawnmowers
- 2265004046 4-stroke commercial front mowers
- 2265004056 4-Stroke commercial lawn and garden Tractors
- 2265002066 4-Stroke tractors/loaders/backhoes
- 2270007010 Diesel shredders > 5 HP

Emissions were calculated for lawn and garden equipment based on the local data collected through surveys from the SAIA (Table 3-34) and on national data used in the EPA 2004

[94] AirNav, LLC. AirNav.com. Available online: http://www.airnav.com/airports/

NONROAD Model.[95] This methodology involved the following steps:

1. Conduct a survey of small airport lawn and garden equipment to determine the equipment usage rates and equipment type.
2. Estimate equipment population and usage levels for the small airports that did not respond to the survey. This was accomplished by using the available equipment population data for small airports that responded to surveys. Typical averages were calculated and applied to the small airports with missing data.
3. Estimate VOC, NOx, and CO annual emissions by using the NONROAD model equipment population and converting the annual tonnages of emissions into estimates of daily tonnages for a typical weekday for the summer ozone season.

Step 1:
A survey of equipment used at small airports within the AACOG region was conducted. A copy of the survey questionnaire is attached to the end of this section. There are 18 small airports in the AACOG region and 21 percent responded to the survey. The following information was extracted from the survey:

- Equipment type and quantity
- Activity rates – total annual hours of use
- Temporal profiles – hrs of use on weekdays and weekends
- Horse-power (HP) Activity
- Fuel Type

Step 2:
A ratio of equipment type per airport was calculated for small airports by dividing the total pieces of equipment counted for each category by the total number of airports. This ratio was used to calculate estimated equipment population for the remaining airports, which did not respond to the survey.

Sample Calculations
Equation (1)
Number of equipment type A from small airports in the AACOG region:

$$NUM_A = EQ_A / SAIR \times (SHRS / DHRS) \times TAIR$$

Where,

NUM_A = Number of equipment type A in the AACOG region at small airports
EQ_A = Number of pieces of equipment type A from the airports that responded to the survey (Table 3-48)
SAIR = Number of airports that responded to the survey (4)
SHRS = Average number of hours equipment type A is used from the survey (Table 3-48)
DHRS = Default number of hours equipment type A is used from the NONROAD model (Table 3-48)
TAIR = Total number of small airports in the AACOG region (18)

Estimated number of trimmers in the AACOG region from small airports:

[95] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

NUM = 7 / 4 x (213 / 137) x 18
= 49 trimmers

Step 3:
After equipment population was calculated, the information was entered into the EPA 2004 NONROAD Model[96] to calculate VOC, NOx, and CO emissions. The model uses annual activity for each equipment type to calculate yearly emission. The model also calculates inventories on a seasonal (i.e., summer, fall, winter, spring), monthly, or daily (i.e., weekday or weekend day) basis by allocating annual activity to these time periods.

Equipment Population
Data on population, activity hours, and horsepower values were summed up and grouped by equipment category. The survey-based equipment population estimates were multiplied by the ratio of activity hours extracted from the surveys in lieu of the NONROAD default activity hours. NONROAD default values for most of the equipment types were lower than survey responses. For instance, the model's default activity levels for front-engine mowers were very low at only 120 hours per year. On the other hand, the survey showed that the small airports tend to use lawn mowers and shredders less often than what the NONROAD model anticipates.

Table 3-48. 2005 AACOG Survey-Based Equipment Estimates for Small Airports

Small Airport Lawn And Garden Equipment	SCC	Engine Type	Est. Equip. Pop.	Hours/Year Per Each Equip.	NONROAD Model Default Hrs	Adjustment Factor	Equip. Pop.
Trimmers/ Edgers/ Brush Cutters	2260004026	Gasoline 2-cycle	32	213	137	1.55	49
Leaf Blowers/ Vacuums	2260004031	Gasoline 2-cycle	14	324	282	1.15	16
Lawn Mowers	2265004011	Gasoline 4-cycle	17	144	406	0.36	6
Front Mowers	2265004046	Gasoline 4-cycle	5	268	120	2.24	10
Lawn and Garden Tractors	2265004056	Gasoline 4-cycle	13	1,305	721	1.81	9
Shredders	2270007010	Diesel	12	605	1,068	0.57	7
Total			91				96

The NONROAD allocation file was also updated with data for the horsepower (HP) estimates from the survey. Table 3-49 compares the NONROAD 2004 default HP values from with average HP values from the survey responses. In almost all cases, the horsepower levels between the default values and the survey responses were very similar. However, small airports tended to use larger lawn and garden tractors and smaller leaf blowers. For the NONROAD model run, equipment populations were allocated to horsepower bins based on survey responses.

[96] U.S. Environmental Protection Agency, September 2004. NONROAD 2004 Model. Available online: http://www.epa.gov/otaq/nonrdmdl.htm

Table 3-49. 2005 AACOG Survey-Based Estimates of Equipment Horse Power

Equipment	Engine Type	SCC	NONROAD Default HP	Estimated Equipment HP
Trimmers/ Edgers/ Brush Cutters	Gasoline 2-cycle	2260004026	1.5	0.9
Leaf Blowers/ Vacuums	Gasoline 2-cycle	2260004031	2.0	1.0
Lawn Mowers	Gasoline 4-cycle	2265004011	4.1	4.4
Front Mowers	Gasoline 4-cycle	2265004046	13.5	15.0
Lawn and Garden Tractors	Gasoline 4-cycle	2265004056	14.4	48.0
Shredders	Diesel	2270007010	N/A	15.0

NONROAD Model Allocation File

For use an input file to the NONROAD model an allocation file was created to properly allocate emissions to each county. The file was created by borrowing default values from the NONROAD model landscape allocation file for the state of Texas named, TX_LSCAP.AOL, and replacing values for employees in landscape and horticulture service with zeros for all counties except those in the study area. Values for counties within the AACOG region were allocated based on the number of small airports in each county. These values were summed and this total was used to replace the allocation value for the entire state of Texas (Table 3-50). This procedure allowed the NONROAD model to calculate emissions for the entire AACOG region and distribute the emissions by each county within the AACOG region based on the proportion of small airports in each county.

Table 3-50. 2005 Allocation of Small Airports Lawn and Garden Equipment, AACOG Region

FIPS	County	Number of Small Airport	Percentage of Total
48013	Atascosa	1	5.5%
48019	Bandera	0	0.0%
48029	Bexar	5	27.8%
48091	Comal	2	11.1%
48163	Frio	2	11.1%
48171	Gillespie	1	5.5%
48187	Guadalupe	2	11.1%
48255	Karnes	1	5.5%
48259	Kendall	0	0.0%
48265	Kerr	1	5.5%
48325	Medina	3	16.7%
48493	Wilson	0	0.0%
Total		18	100.0%

NONROAD model Seasonal File

The weekly temporal activity allocation feature of NONROAD2004 allows the user to distribute activity of equipment between weekdays and weekend days. This feature, with model's ability to allocate equipment activity to a specific month and season, allows the user to model a typical weekday or weekend day during a given month and season (e.g., a typical summer weekend day in June). A weekday versus weekend adjustment factor of 0.1116428 per weekday and 0.2208930 per weekend day was used in the emissions calculations. The results were based on the reported total hours for each time period in the survey of lawn and garden equipment and are shown in the following table (3-51).

Table 3-51. 2005 AACOG Survey-Based Estimates of Equipment Usage

Lawn & Garden Equipment	Engine Type	Avg. Weekday Hourly Use	Avg. Weekend Hourly Use
Trimmers/ Edgers/ Brush Cutters	Gasoline 2-cycle	0.3	1.4
Leaf Blowers/ Vacuums	Gasoline 2-cycle	0.0	3.0
Lawn Mowers	Gasoline 4-cycle	0.1	1.1
Front Mowers	Gasoline 4-cycle	0.3	0.0
Lawn and Garden Tractors	Gasoline 4-cycle	2.1	0.2
Shredders	Diesel	2.2	0.3

Spatial Distribution of Small Airport Pollution

NOx and VOC emissions from small airports, Stinson, and San Antonio International Airport, within the 12-County area, were geo-coded to the 4x4 km, grid system.

Alamo Area Council Of Governments

October 3, 2004

[COMPANY NAME]
[STREET ADDRESS]
[CITY] [STATE] [ZIP]

ATTENTION: OPERATIONS MANAGER

Re: San Antonio Regional Emissions Inventory

The Alamo Area Council of Governments (AACOG) requests your assistance in the development of the air quality emission inventory for Bexar County and the surrounding counties. AACOG is conducting this inventory in order to assess and quantify local air quality within the metropolitan area of San Antonio and contiguous counties. This inventory is especially significant because the San Antonio region has been declared in non-attainment deferred of federal air quality standards, the National Ambient Air Quality Standards.

AACOG will calculate the equipment source component of this inventory from information submitted by local organizations involved in landscaping, lawn and garden and such activities in and around the San Antonio region using the enclosed survey. With this survey, we are requesting information on any lawn and garden, construction, or industrial equipment used during the 2004 calendar year within Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. The purpose of this survey is to provide better information and services to the region, as well as help minimize additional regulation on the community.

Your input is vital to this process and will serve to achieve a true and correct emissions inventory. Please provide your responses on the attached survey and return it to us in the self-addressed envelope by the date indicated. The information you provide will be considered strictly confidential and unavailable to public information requests. Please submit your response by October 20, 2004.

Thank you for your time and participation. If you have any questions or comments please feel free to contact Steven Smeltzer at (210) 362-5266.

Regionally yours,

Al J. Notzon III
Executive Director

Enclosures (2)

	Internal Combustion Equipment Type	Engine Type Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas Electric	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
COMMERCIAL LAWN AND GARDEN EQUIPMENT						
1	Lawn Mowers					
2	Rear Engine Riding Mowers					
3	Front Mowers					
4	Rotary Tillers					
5	Chain Saws					
6	Chippers/Stump Grinders/Mulchers					
7	Trimmers/Edgers/ Brush Cutters					
8	Commercial Turf Equipment/ Sod Cutters					
9	Leaf Blowers/ Vacuums					
10	Lawn and Garden Tractors					
11	Shredders					
12	Other Lawn and Garden Equipment: (Please Describe): ________________					

Airport/Military Emissions - Atascosa County, 2005

Small Airports - Pleasanton Municipal Airport

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	0.97	0.00	0.00	0.00266	0.00000	0.00000
AREA	**TOTAL**	**0.97**	**0.00**	**0.00**	**0.00266**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.03	0.00	0.08	0.00008	0.00000	0.00022
2-Str Leaf Blower/Vacuum	2260004031	0.03	0.00	0.11	0.00007	0.00000	0.00031
4-Str Tractors/Loaders/Backhoes	2265002066	0.04	0.05	1.06	0.00011	0.00012	0.00304
4-Str Lawn Mowers (Com)	2265004011	0.01	0.00	0.14	0.00003	0.00000	0.00040
4-Str Front Mowers (Com)	2265004046	0.01	0.00	0.29	0.00002	0.00000	0.00085
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.31	0.00001	0.00000	0.00091
Dsl - Shredders > 5 HP	2270007010	0.00	0.01	0.01	0.00000	0.00002	0.00002
Aircraft	2275050000	1.21	0.59	22.06	0.00333	0.00162	0.06043
GSE/AGE/APU	2270008000	0.32	0.64	8.43	0.00088	0.00175	0.02308
Aircraft Evaporative Loss	2275900000	0.85	0.00	0.00	0.00233	0.00000	0.00000
NON-ROAD	**TOTAL**	**2.50**	**1.29**	**32.47**	**0.00686**	**0.00352**	**0.08927**

ATASCOSA AREA	**TOTAL**	**0.97**	**0.00**	**0.00**	**0.00266**	**0.00000**	**0.00000**
ATASCOSA NON-ROAD	**TOTAL**	**2.50**	**1.29**	**32.47**	**0.00686**	**0.00352**	**0.08927**
ATASCOSA EMISSIONS	**TOTAL**	**3.47**	**1.29**	**32.47**	**0.00952**	**0.00352**	**0.08927**

Airport/Military Emissions - Bandera County, 2005

- - NO EMISSIONS RECORDED - -

Airport/Military Emissions - Bandera County, 2005

Bandera County

Airport/Military Emissions - Bexar County, 2005

San Antonio International Airport

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day (Mon. - Fri.)		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	8.06	0.00	0.00	0.02208	0.00000	0.00000
Boilers	2102006001	0.04	1.38	0.59	0.00011	0.00378	0.00162
AREA	**TOTAL**	**8.10**	**1.38**	**0.59**	**0.02219**	**0.00378**	**0.00162**
Non-Road Emissions:							
Roadways/Parking Lots	2201001000	26.72	24.08	262.65	0.07320	0.06598	0.71958
2-Str Rotary Tiller	2260004016	0.02	0.00	0.06	0.00012	0.00000	0.00030
2-Str Chain Saw < 6 HP	2260004021	0.14	0.00	0.46	0.00055	0.00001	0.00176
2-Str Trimmers/Edgers/Bush Cutters	2260004026	1.22	0.02	4.33	0.00594	0.00009	0.02113
2-Str Leaf Blower/Vacuum	2260004031	0.51	0.01	1.84	0.00251	0.00004	0.00897
4-Str Other General Industrial Equipment	2265003040	0.07	0.01	1.93	0.00024	0.00004	0.00693
4-Str Lawn Mowers (Com)	2265004011	0.42	0.03	6.43	0.00203	0.00016	0.03137
4-Str Rear Engine Riding Mowers (Com)	2265004041	0.24	0.07	18.40	0.00118	0.00037	0.08976
Dsl - Rear Engine Riding Mowers (Com)	2270004046	0.02	0.12	0.07	0.00009	0.00053	0.00031
Dsl - Front Mowers (Com)	2270004046	0.05	0.27	0.16	0.00020	0.00119	0.00070
Dsl - Lawn & Garden Tractors (Com)	2270004056	0.00	0.03	0.02	0.00002	0.00014	0.00008
Dsl - Commercial Turf Equipment	2270004071	0.36	3.69	1.40	0.00151	0.01551	0.00590
Dsl - Generator Sets	2270006005	0.00	0.01	0.01	0.00001	0.00004	0.00002
Dsl - Air Compressors	2270006015	0.01	0.08	0.04	0.00003	0.00031	0.00013
GSE/AGE/APU	2270008000	93.35	128.21	2,477.41	0.25575	0.35126	6.78744
Aircraft Evaporative Loss (refueling)	2275900000	6.52	0.00	0.00	0.01786	0.00000	0.00000
Aircraft Evaporative Loss (preflight testing)	2275900000	0.21	0.00	0.00	0.00058	0.00000	0.00000
Aircraft Evaporative Loss (diurnal)	2275900000	4.98	0.00	0.00	0.01364	0.00000	0.00000
Aircraft Operation	2275050000	153.75	445.69	687.94	0.42123	1.22107	1.88477
NON-ROAD	**TOTAL**	**288.59**	**602.33**	**3,463.15**	**0.79670**	**1.65672**	**9.55916**
San Antonio International Airport	**TOTAL**	**296.69**	**603.71**	**3,463.74**	**0.81889**	**1.66050**	**9.56078**

Small Airports - Boerne Stage Field, Horizon, San Geronimo, Triple R, & Twin-Oaks Airports

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	5.95	0.00	0.00	0.01630	0.00000	0.00000
AREA	**TOTAL**	**5.95**	**0.00**	**0.00**	**0.01630**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.13	0.00	0.38	0.00039	0.00001	0.00109
2-Str Leaf Blower/Vacuum	2260004031	0.13	0.00	0.55	0.00037	0.00001	0.00157
4-Str Tractors/Loaders/Backhoes	2265002066	0.20	0.23	5.30	0.00057	0.00060	0.01521
4-Str Lawn Mowers (Com)	2265004011	0.05	0.00	0.68	0.00014	0.00001	0.00199
4-Str Front Mowers (Com)	2265004046	0.03	0.01	1.44	0.00008	0.00002	0.00424
4-Str Lawn & Garden Tractors (Com)	2265004056	0.02	0.01	1.54	0.00006	0.00002	0.00455
Dsl - Shredders > 5 HP	2270007010	0.01	0.04	0.05	0.00002	0.00008	0.00010
Aircraft - Boerne Stage Field	2275050000	2.04	0.67	90.99	0.00558	0.00183	0.24930
GSE/AGE/APU - Boerne Stage Field	2270008000	0.30	0.78	7.14	0.00082	0.00214	0.01956
Aircraft - Horizon	2275050000	0.16	0.04	10.70	0.00045	0.00012	0.02932
GSE/AGE/APU - Horizon	2270008000	0.01	0.06	0.01	0.00002	0.00016	0.00004
Aircraft - San Geronimo	2275050000	0.84	0.20	52.77	0.00230	0.00056	0.14457
GSE/AGE/APU - San Geronimo	2270008000	0.02	0.28	0.07	0.00007	0.00078	0.00018
Aircraft - Triple R.	2275050000	0.26	0.06	16.05	0.00017	0.00017	0.04398
GSE/AGE/APU - Triple R.	2270008000	0.01	0.08	0.02	0.00002	0.00023	0.00005
Aircraft - Twin-Oaks Airport	2275050000	0.52	0.20	23.86	0.00142	0.00054	0.06536
GSE/AGE/APU - Twin-Oaks Airport	2270008000	0.06	0.17	1.38	0.00016	0.00045	0.00378
Aircraft Evaporative Loss	2275900000	6.15	0.00	0.00	0.01685	0.00000	0.00000
NON-ROAD	**TOTAL**	**10.93**	**2.84**	**212.92**	**0.02947**	**0.00771**	**0.58489**
SMALL AIRPORTS	**TOTAL**	**16.88**	**2.84**	**212.92**	**0.04577**	**0.00771**	**0.58489**

Airport/Military Emissions - Bexar County, 2005

Stinson Municipal Airport

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
AREA	**TOTAL**	**0.00**	**0.00**	**0.00**	**0.00000**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Chain Saw < 6 HP	2260004021	0.06	0.00	0.18	0.00021	0.00000	0.00068
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.08	0.00	0.29	0.00039	0.00001	0.00140
2-Str Leaf Blower/Vacuum	2260004031	0.16	0.00	0.59	0.00080	0.00001	0.00286
4-Str Cement & Mortar Mixers	2265002042	0.01	0.00	0.29	0.00004	0.00001	0.00131
4-Str Lawn Mowers	2265004011	0.05	0.00	0.80	0.00025	0.00002	0.00390
4-Str Rotary Tillers < 5 HP	2265004016	0.04	0.00	0.67	0.00022	0.00002	0.00328
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.01	0.00	0.29	0.00007	0.00001	0.00140
4-Str Rear Engine Riding Mower (Com)	2265004046	0.06	0.02	4.51	0.00029	0.00009	0.02202
4-Str Sprayers	2265005035	0.01	0.00	0.22	0.00004	0.00001	0.00114
4-Str Pressure Washers	2265006030	0.02	0.00	0.55	0.00007	0.00001	0.00211
Dsl - ATV	2270001030	0.01	0.01	0.02	0.00002	0.00007	0.00009
Dsl - Tractors/Loaders/Backhoes	2270002066	0.17	0.76	0.71	0.00081	0.00342	0.00320
Dsl - Air Compressor	2270006015	0.02	0.20	0.09	0.00008	0.00076	0.00033
GSE/AGE/APU*	2270008000	2.56	4.17	65.22	0.00701	0.01142	0.17868
Aircraft	2275050000	14.82	5.45	449.36	0.04060	0.01493	1.23112
Aircraft Evaporative Loss	2275900000	12.02	0.00	0.00	0.03292	0.00000	0.00000
NON-ROAD	**TOTAL**	**30.10**	**10.63**	**523.78**	**0.08384**	**0.03079**	**1.45353**
STINSON	**TOTAL**	**30.10**	**10.63**	**523.78**	**0.08384**	**0.03079**	**1.45353**

Brooks City-Base

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Internal Combustion	2102006002	0.13	1.54	0.33	0.00048	0.00590	0.00126
External Combustion	2270006005	0.14	2.42	1.83	0.00054	0.00927	0.00701
Fuel Storage / Dispensing	2501060100	6.08	0.00	0.00	0.02330	0.00000	0.00000
General Processes	2275001000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Waste Incineration	2601020000	0.00	0.02	0.02	0.00001	0.00008	0.00008
Welding	2840000020	0.00	0.00	0.00	0.00000	0.00000	0.00000
Misc. VOC	9275001000	1.81	0.00	0.00	0.00694	0.00000	0.00000
AREA	**TOTAL**	**8.16**	**3.98**	**2.18**	**0.03126**	**0.01525**	**0.00835**
Non-Road Mobile Emissions:							
Roadways	2201001000	4.39	7.07	47.81	0.01203	0.01937	0.13099
NON-ROAD	**TOTAL**	**4.39**	**7.07**	**47.81**	**0.01203**	**0.01937**	**0.13099**
BROOKS CITY-BASE	**TOTAL**	**12.55**	**11.05**	**49.99**	**0.04328**	**0.03462**	**0.13934**

Camp Bullis

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Boilers and Furnaces	2102006000	0.04	1.07	0.15	0.00000	0.00000	0.00000
Degreasing Operations	2415000000	0.06	0.00	0.00	0.00024	0.00000	0.00000
Woodworking & Fabrication	2307060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
AREA	**TOTAL**	**0.10**	**1.07**	**0.15**	**0.00024**	**0.00000**	**0.00000**
Non-Road Emissions:							
Dsl - Generator set	2270006005	0.05	0.67	0.14	0.00006	0.00072	0.00005
Fuel Storage / Dispensing	2275900000	0.08	0.00	0.00	0.00021	0.00000	0.00000
NON-ROAD	**TOTAL**	**0.14**	**0.67**	**0.14**	**0.00027**	**0.00072**	**0.00005**
CAMP BULLIS	**TOTAL**	**0.23**	**1.74**	**0.29**	**0.00051**	**0.00072**	**0.00005**

Airport/Military Emissions - Bexar County, 2005

Fort Sam Houston

Area Emissions:	SCC	VOC	NOx	CO	VOC	NOx	CO
			tons/year			tons/day	
Boilers and Furnaces	2102006000	1.39	20.45	21.29	0.00296	0.04044	0.04518
Degreasing Operations	2415000000	0.06	0.00	0.00	0.00022	0.00000	0.00000
Misc. VOC	9275001000	10.44	0.00	0.00	0.02861	0.00000	0.00000
Surface Coating	2401990000	0.16	0.00	0.00	0.00044	0.00000	0.00000
AREA	**TOTAL**	**12.05**	**20.45**	**21.29**	**0.03223**	**0.04044**	**0.04518**
Non-Road Emissions:							
Dsl - Generator set	2270006000	0.63	7.74	1.67	0.00024	0.00302	0.00065
Fuel Storage / Dispensing	2275900000	0.60	0.00	0.00	0.00164	0.00000	0.00000
NON-ROAD	**TOTAL**	**1.23**	**7.74**	**1.67**	**0.00188**	**0.00302**	**0.00065**
FORT SAM HOUSTON	**TOTAL**	**13.28**	**28.19**	**22.96**	**0.03411**	**0.04346**	**0.04583**

Lackland Air Force Base & Kelly Air Field

Area Emissions:	SCC	VOC	NOx	CO	VOC	NOx	CO
			tons/year			tons/day	
Jet Engine Testing	2810040000	3.19	52.40	12.60	0.01223	0.20078	0.04826
AREA	**TOTAL**	**3.19**	**52.40**	**12.60**	**0.01223**	**0.20078**	**0.04826**
Non-Road Emissions:							
Industrial Equipment							
Dsl - Heavy Industrial Equipment	2270003000	2.57	1.08	53.79	0.00985	0.00415	0.20610
Recreational Equipment							
2-Str Specialty Vehicles/Cart	2260001060	6.03	1.36	40.72	0.02309	0.00523	0.15603
4-Str Golf Cart	2265001050	3.47	2.48	84.86	0.01330	0.00952	0.32513
Lawn and Garden Equipment							
Total Off-road Equipment	2270004000	34.84	10.80	184.37	0.13348	0.04139	0.70639
Other							
Roadways/Mobile	2201001000	112.36	90.31	868.56	0.43051	0.34603	3.32780
Non-road Equipment	2265001000	4.27	22.73	30.20	0.01636	0.08709	0.11571
GSE/AGE/APU	2270008000	1.01	15.48	5.82	0.00388	0.05933	0.02230
Aircraft	2275001000	49.91	283.50	216.57	0.19121	1.08620	0.82978
NON-ROAD	**TOTAL**	**214.46**	**427.76**	**1,484.89**	**0.82169**	**1.63893**	**5.68924**
LACKLAND AFB & KELLY AIR FIELD	**TOTAL**	**217.65**	**480.16**	**1,497.49**	**0.83391**	**1.83971**	**5.73750**

Randolph Air Force Base

Area Emissions:	SCC	VOC	NOx	CO	VOC	NOx	CO
			tons/year			tons/day	
Jet Engine Testing	2810040000	17.35	12.88	144.58	0.06647	0.04935	0.55393
AREA	**TOTAL**	**17.35**	**12.88**	**144.58**	**0.06647**	**0.04935**	**0.55393**
Non-Road Emissions:							
Construction Equipment							
4-Str Tampers/Rammers	2265002006	0.09	0.01	1.37	0.00035	0.00003	0.00526
4-Str Paving Equipment	2265002021	0.00	0.00	0.04	0.00001	0.00000	0.00015
4-Str Paving Equipment	2265002021	0.00	0.02	0.00	0.00001	0.00009	0.00002
4-Str Concrete/Industrial Saws	2265002039	0.62	0.14	22.55	0.00238	0.00052	0.08639
4-Str Cement & Mortar Mixers	2265002042	0.09	0.00	1.02	0.00033	0.00002	0.00389
Dsl - Pavers	2270002003	0.26	2.38	1.27	0.00100	0.00911	0.00486
Dsl - Rollers	2270002015	0.27	2.40	1.36	0.00103	0.00921	0.00522
Dsl - Trenchers	2270002030	0.27	1.30	1.03	0.00102	0.00498	0.00396
Dsl - Excavators	2270002036	0.43	2.48	1.79	0.00166	0.00949	0.00684
Dsl - Off-highway Trucks	2270002051	5.41	32.09	22.00	0.02074	0.12294	0.08429
Dsl - Tractors/Loaders/Backhoes	2270002066	3.82	9.52	57.90	0.01464	0.03646	0.22183
Dsl - Skid Steer Loaders	2270002072	0.23	0.42	0.69	0.00088	0.00161	0.00263
Dsl - Grader	2270002048	0.04	0.24	0.10	0.00015	0.00093	0.00037
Dsl - Other Construction Equipment	2270002081	0.51	0.93	1.51	0.00195	0.00355	0.00579

Airport/Military Emissions - Bexar County, 2005

	SCC	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day		
Light Commercial Equipment							
4-Str Generator Sets	2265006005	0.08	0.00	0.91	0.00030	0.00002	0.00348
4-Str Pumps	2265006010	0.01	0.00	0.17	0.00006	0.00000	0.00065
4-Str Welders	2265006025	0.10	0.02	3.79	0.00040	0.00009	0.01453
4-Str Pressure Washers	2265006030	0.55	0.03	6.62	0.00209	0.00012	0.02538
Dsl-Generator Sets	2270006005	0.02	0.15	0.07	0.00007	0.00059	0.00026
Dsl-Welders	2270006025	0.00	0.03	0.01	0.00002	0.00010	0.00006
Dsl-Pressure Washers	2270006030	0.02	0.00	0.21	0.00007	0.00000	0.00080
Industrial Equipment							
4-Str Aerial Lifts	2265003010	0.44	0.10	15.88	0.00168	0.00037	0.06085
4-Str Sweepers/Scrubbers	2265003030	0.01	0.00	0.06	0.00002	0.00000	0.00023
Off-highway Forklifts	2265002057	0.36	1.58	1.47	0.00138	0.00604	0.00561
Dsl - Sweepers/Scrubbers	2270003030	0.18	1.68	0.31	0.00071	0.00643	0.00118
Recreational Equipment							
4-Str ATVs	2265001030	0.06	0.01	2.21	0.00023	0.00005	0.00847
4-Str Golf Carts	2265001050	4.16	0.24	39.75	0.01594	0.00091	0.15229
4-Str Specialty Vehicles / Carts	2265001060	0.97	0.06	9.18	0.00373	0.00021	0.03516
Dsl- ATVs	2270001030	0.45	0.17	4.14	0.00172	0.00065	0.01585
Lawn and Garden Equipment							
2-Str Chain Saws < 6 HP (Com)	2260004021	0.37	0.00	1.02	0.00142	0.00001	0.00391
2-Str Leafblowers/Vacuums (Com)	2260004031	5.47	0.02	15.07	0.02096	0.00008	0.05773
4-Str Lawn Mowers (Com)	2265004011	1.40	0.07	16.20	0.00535	0.00029	0.06207
4-Str Trimmers/Edgers/Brush Cutters (Com)	2265004026	0.25	0.00	0.88	0.00096	0.00001	0.00339
4-Str Leafblowers/Vacuums (Com)	2265004031	0.28	0.00	0.77	0.00107	0.00000	0.00294
4-Str Rear Engine Riding Mower (Com)	2265004041	0.24	0.05	8.78	0.00093	0.00020	0.03363
4-Str Commercial Turf Equipment (Com)	2265004071	0.10	0.02	3.26	0.00038	0.00007	0.01247
4-Str Other Lawn & Garden Equip. (Com)	2265004076	0.01	0.00	0.15	0.00002	0.00000	0.00059
Dsl - Lawn Mowere	2270004010	0.18	0.01	2.07	0.00068	0.00004	0.00791
Dsl -Chain Saw < 4 HP	2270004020	4.95	0.02	13.71	0.01897	0.00007	0.05255
Dsl - Trimmers/Edgers/Brush Cutters (Com)	2270004026	6.50	0.04	20.97	0.02490	0.00015	0.08034
Dsl - Leafblowers/Vacuums (Com)	2270004031	0.67	0.00	1.85	0.00258	0.00001	0.00711
Dsl - Rear Engine Riding Mower (Com)	2270004041	0.02	0.09	0.06	0.00007	0.00034	0.00023
Dsl - Front Mowers (Com)	2270004045	1.09	0.36	38.42	0.00418	0.00138	0.14719
Dsl - Lawn & Garden Tractors (Com)	2270004056	1.02	1.65	23.65	0.00392	0.00634	0.09062
Gasoline Weedeater	2260004075	0.24	0.00	0.78	0.00092	0.00001	0.00300
Dsl - Chippers/Stump Grinders (Com)	2270004066	0.30	0.64	8.80	0.00115	0.00247	0.03371
4-Str Chain Saw > 4HP	2265007005	0.00	0.00	0.01	0.00000	0.00000	0.00004
Water Trailer/Small Engines	2265004075	0.12	0.01	0.01	0.00047	0.00003	0.00003
Agricultural Equipment							
2-Str Sprayers	2260005035	0.01	0.00	0.09	0.00004	0.00000	0.00035
4-Str Sprayers	2265005035	0.04	0.00	0.41	0.00014	0.00001	0.00159
Dsl - Hydro Power Units	2270005050	0.00	0.00	0.00	0.00000	0.00001	0.00000
4-Str Other Agriculture Equipment	2265005055	0.13	0.51	1.14	0.00051	0.00197	0.00437
Other							
Roadways	2201001000	35.65	25.71	277.58	0.13659	0.09850	1.06354
Fuel Storage / Dispensing	2275900000	1.35	0.00	0.00	0.00516	0.00000	0.00000
GSE/AGE/APU	2275070000	3.37	17.15	48.45	0.01289	0.06571	0.18563
Aircraft	2275001000	70.84	135.80	996.88	0.27138	0.52030	3.81943
NON-ROAD	**TOTAL**	**154.05**	**238.16**	**1,678.41**	**0.59020**	**0.91248**	**6.43067**
RANDOLPH AFB	**TOTAL**	**171.40**	**251.04**	**1,822.98**	**0.65667**	**0.96182**	**6.98460**

BEXAR AREA	**TOTAL**	**54.90**	**92.17**	**181.38**	**0.18091**	**0.30960**	**0.65734**
BEXAR NON-ROAD	**TOTAL**	**703.89**	**1,297.19**	**7,412.77**	**2.33607**	**4.26973**	**23.84918**
BEXAR EMISSIONS	**TOTAL**	**758.78**	**1,389.36**	**7,594.15**	**2.51699**	**4.57933**	**24.50652**

Airport/Military Emissions - Comal County, 2005

Small Airports - Bulverde & Kestrel Airparks

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	4.07	0.00	0.00	0.01115	0.00000	0.00000
AREA	**TOTAL**	**4.07**	**0.00**	**0.00**	**0.01115**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.05	0.00	0.15	0.00016	0.00000	0.00044
2-Str Leaf Blower/Vacuum	2260004031	0.05	0.00	0.22	0.00015	0.00000	0.00063
4-Str Tractors/Loaders/Backhoes	2265002066	0.08	0.09	2.12	0.00023	0.00024	0.00608
4-Str Lawn Mowers (Com)	2265004011	0.02	0.00	0.27	0.00006	0.00000	0.00080
4-Str Front Mowers (Com)	2265004046	0.01	0.00	0.58	0.00003	0.00001	0.00170
4-Str Lawn & Garden Tractors (Com)	2265004056	0.01	0.00	0.62	0.00003	0.00001	0.00182
Dsl - Shredders > 5 HP	2270007010	0.00	0.01	0.02	0.00001	0.00003	0.00004
Aircraft - Bulverde	2275050000	1.49	0.36	94.03	0.00409	0.00098	0.25762
GSE/AGE/APU - Bulverde	2270008000	0.04	0.49	0.12	0.00012	0.00135	0.00032
Aircraft - Kestrel	2275050000	0.14	0.08	5.60	0.00039	0.00021	0.01535
GSE/AGE/APU - Kestrel	2270008000	0.03	0.06	0.82	0.00008	0.00018	0.00225
Aircraft Evaporative Loss	2275900000	3.83	0.00	0.00	0.01049	0.00000	0.00000
NON-ROAD	**TOTAL**	**5.77**	**1.11**	**104.54**	**0.01583**	**0.00302**	**0.28704**
SMALL AIRPORTS	**TOTAL**	**9.84**	**1.11**	**104.54**	**0.02698**	**0.00302**	**0.28704**

Canyon Lake Recreational Center

Non-Road Emissions:

2-Str Chain Saw	2260004021	0.08	0.00	0.27	0.00019	0.00000	0.00060
4-Str Lawn Mower	2265004011	0.03	0.00	0.51	0.00007	0.00001	0.00115
Dsl - Tractor	2270002066	0.02	0.07	0.07	0.00003	0.00014	0.00013
NON-ROAD	**TOTAL**	**0.13**	**0.08**	**0.85**	**0.00029**	**0.00015**	**0.00189**

COMAL AREA	**TOTAL**	**4.07**	**0.00**	**0.00**	**0.01115**	**0.00000**	**0.00000**
COMAL NON-ROAD	**TOTAL**	**5.90**	**1.19**	**105.39**	**0.01612**	**0.00317**	**0.28893**
COMAL EMISSIONS	**TOTAL**	**9.97**	**1.19**	**105.39**	**0.02727**	**0.00317**	**0.28893**

Airport/Military Emissions - Frio County, 2005

Small Airports - Dilley Airpark & McKinley Field Airport

Area Emissions:	SCC	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	0.39	0.00	0.00	0.00107	0.00000	0.00000
AREA	**TOTAL**	**0.39**	**0.00**	**0.00**	**0.00107**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.05	0.00	0.15	0.00016	0.00000	0.00044
2-Str Leaf Blower/Vacuum	2260004031	0.05	0.00	0.22	0.00015	0.00000	0.00063
4-Str Tractors/Loaders/Backhoes	2265002066	0.08	0.09	2.12	0.00023	0.00024	0.00608
4-Str Lawn Mowers (Com)	2265004011	0.02	0.00	0.27	0.00006	0.00000	0.00080
4-Str Front Mowers (Com)	2265004046	0.01	0.00	0.58	0.00003	0.00001	0.00170
4-Str Lawn & Garden Tractors (Com)	2265004056	0.01	0.00	0.62	0.00003	0.00001	0.00182
Dsl - Shredders > 5 HP	2270007010	0.00	0.01	0.02	0.00001	0.00003	0.00004
Aircraft - Dilley	2275050000	0.21	0.08	1.58	0.00056	0.00021	0.00434
GSE/AGE/APU - Dilley	2270008000	0.08	0.11	2.44	0.00023	0.00029	0.00668
Aircraft - McKinley	2275050000	1.11	0.63	11.59	0.00305	0.00173	0.03176
GSE/AGE/APU - McKinley	2270008000	0.37	0.54	9.62	0.00101	0.00147	0.02634
Aircraft Evaporative Loss	2275900000	0.45	0.00	0.00	0.00123	0.00000	0.00000
NON-ROAD	**TOTAL**	**2.45**	**1.47**	**29.20**	**0.00675**	**0.00401**	**0.08062**

FRIO AREA	**TOTAL**	**0.39**	**0.00**	**0.00**	**0.00107**	**0.00000**	**0.00000**
FRIO NON-ROAD	**TOTAL**	**2.45**	**1.47**	**29.20**	**0.00675**	**0.00401**	**0.08062**
FRIO EMISSIONS	**TOTAL**	**2.84**	**1.47**	**29.20**	**0.00782**	**0.00401**	**0.08062**

Airport/Military Emissions - Gillespie County, 2005

Small Airports - Gillespie County Airport

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	1.87	0.00	0.00	0.00512	0.00000	0.00000
AREA	**TOTAL**	**1.87**	**0.00**	**0.00**	**0.00512**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.05	0.00	0.15	0.00016	0.00000	0.00044
2-Str Leaf Blower/Vacuum	2260004031	0.05	0.00	0.22	0.00015	0.00000	0.00063
4-Str Tractors/Loaders/Backhoes	2265002066	0.08	0.09	2.12	0.00023	0.00024	0.00608
4-Str Lawn Mowers (Com)	2265004011	0.02	0.00	0.27	0.00006	0.00000	0.00080
4-Str Front Mowers (Com)	2265004046	0.01	0.00	0.58	0.00003	0.00001	0.00170
4-Str Lawn & Garden Tractors (Com)	2265004056	0.01	0.00	0.62	0.00003	0.00001	0.00182
Dsl - Shredders > 5 HP	2270007010	0.00	0.01	0.02	0.00001	0.00003	0.00004
Aircraft - Gillespie	2275050000	2.54	1.20	52.97	0.00696	0.00329	0.14512
GSE/AGE/APU - Gillespie	2270008000	0.69	1.25	17.47	0.00189	0.00344	0.04787
Aircraft Evaporative Loss	2275900000	1.86	0.00	0.00	0.00510	0.00000	0.00000
NON-ROAD	**TOTAL**	**5.32**	**2.57**	**74.41**	**0.01460**	**0.00702**	**0.20448**

GILLESPIE AREA	**TOTAL**	**1.87**	**0.00**	**0.00**	**0.00512**	**0.00000**	**0.00000**
GILLESPIE NON-ROAD	**TOTAL**	**5.32**	**2.57**	**74.41**	**0.01460**	**0.00702**	**0.20448**
GILLESPIE EMISSIONS	**TOTAL**	**7.19**	**2.57**	**74.41**	**0.01972**	**0.00702**	**0.20448**

Airport/Military Emissions - Guadalupe County, 2005

Small Airports - New Braunfels Municipal & Huber Airpark Civic Club LLC Airports

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	5.22	0.00	0.00	0.01430	0.00000	0.00000
AREA	**TOTAL**	**5.22**	**0.00**	**0.00**	**0.01430**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.05	0.00	0.15	0.00016	0.00000	0.00044
2-Str Leaf Blower/Vacuum	2260004031	0.05	0.00	0.22	0.00015	0.00000	0.00063
4-Str Tractors/Loaders/Backhoes	2265002066	0.08	0.09	2.12	0.00023	0.00024	0.00608
4-Str Lawn Mowers (Com)	2265004011	0.02	0.00	0.27	0.00006	0.00000	0.00080
4-Str Front Mowers (Com)	2265004046	0.01	0.00	0.58	0.00003	0.00001	0.00170
4-Str Lawn & Garden Tractors (Com)	2265004056	0.01	0.00	0.62	0.00003	0.00001	0.00182
Dsl - Shredders > 5 HP	2270007010	0.00	0.01	0.02	0.00001	0.00003	0.00004
Aircraft	2275050000	7.63	3.89	84.60	0.02091	0.01065	0.23179
GSE/AGE/APU	2270008000	2.48	3.33	64.83	0.00678	0.00912	0.17761
Aircraft Evaporative Loss	2275900000	4.31	0.00	0.00	0.01181	0.00000	0.00000
NON-ROAD	**TOTAL**	**14.65**	**7.33**	**153.40**	**0.04015**	**0.02007**	**0.42090**

GUADALUPE AREA	**TOTAL**	**5.22**	**0.00**	**0.00**	**0.01430**	**0.00000**	**0.00000**
GUADALUPE NON-ROAD	**TOTAL**	**14.65**	**7.33**	**153.40**	**0.04015**	**0.02007**	**0.42090**
GUADALUPE EMISSIONS	**TOTAL**	**19.87**	**7.33**	**153.40**	**0.05445**	**0.02007**	**0.42090**

Airport/Military Emissions - Karnes County, 2005

Small Airports - Karnes County Airport

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	0.18	0.00	0.00	0.00049	0.00000	0.00000
AREA	**TOTAL**	**0.18**	**0.00**	**0.00**	**0.00049**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.03	0.00	0.08	0.00008	0.00000	0.00022
2-Str Leaf Blower/Vacuum	2260004031	0.03	0.00	0.11	0.00007	0.00000	0.00031
4-Str Tractors/Loaders/Backhoes	2265002066	0.04	0.05	1.06	0.00011	0.00012	0.00304
4-Str Lawn Mowers (Com)	2265004011	0.01	0.00	0.14	0.00003	0.00000	0.00040
4-Str Front Mowers (Com)	2265004046	0.01	0.00	0.29	0.00002	0.00000	0.00085
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.31	0.00001	0.00000	0.00091
Dsl - Shredders > 5 HP	2270007010	0.00	0.01	0.01	0.00000	0.00002	0.00002
Aircraft	2275050000	0.20	0.07	4.17	0.00055	0.00019	0.01141
GSE/AGE/APU	2270008000	0.06	0.09	1.80	0.00017	0.00024	0.00492
Aircraft Evaporative Loss	2275900000	0.16	0.00	0.00	0.00044	0.00000	0.00000
NON-ROAD	**TOTAL**	**0.54**	**0.22**	**7.95**	**0.00149**	**0.00059**	**0.02208**

KARNES AREA	**TOTAL**	**0.18**	**0.00**	**0.00**	**0.00049**	**0.00000**	**0.00000**
KARNES NON-ROAD	**TOTAL**	**0.54**	**0.22**	**7.95**	**0.00149**	**0.00059**	**0.02208**
KARNES EMISSIONS	**TOTAL**	**0.72**	**0.22**	**7.95**	**0.00198**	**0.00059**	**0.02208**

Airport/Military Emissions - Kendall County, 2005

- - NO EMISSIONS RECORDED - -

Airport/Military Emissions - Kendall County, 2005

Kendall County

Airport/Military Emissions - Kerr County, 2005

Small Airports - Kerrville Municipal Airport

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	4.54	0.00	0.00	0.01244	0.00000	0.00000
AREA	**TOTAL**	**4.54**	**0.00**	**0.00**	**0.01244**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.03	0.00	0.08	0.00008	0.00000	0.00022
2-Str Leaf Blower/Vacuum	2260004031	0.03	0.00	0.11	0.00007	0.00000	0.00031
4-Str Tractors/Loaders/Backhoes	2265002066	0.04	0.05	1.06	0.00012	0.00012	0.00304
4-Str Lawn Mowers (Com)	2265004011	0.01	0.00	0.14	0.00003	0.00000	0.00040
4-Str Front Mowers (Com)	2265004046	0.01	0.00	0.29	0.00002	0.00000	0.00085
4-Str Lawn & Garden Tractors (Com)	2265004056	0.00	0.00	0.31	0.00001	0.00000	0.00091
Dsl - Shredders > 5 HP	2270007010	0.00	0.01	0.01	0.00000	0.00002	0.00002
Aircraft	2275050000	18.12	9.80	187.00	0.04963	0.02685	0.51232
GSE/AGE/APU	2270008000	6.32	8.39	165.55	0.01731	0.02299	0.45357
Aircraft Evaporative Loss	2275900000	3.83	0.00	0.00	0.01049	0.00000	0.00000
NON-ROAD	**TOTAL**	**28.38**	**18.25**	**354.54**	**0.07776**	**0.04999**	**0.97164**

KERR AREA	**TOTAL**	**4.54**	**0.00**	**0.00**	**0.01244**	**0.00000**	**0.00000**
KERR NON-ROAD	**TOTAL**	**28.38**	**18.25**	**354.54**	**0.07776**	**0.04999**	**0.97164**
KERR EMISSIONS	**TOTAL**	**32.92**	**18.25**	**354.54**	**0.09020**	**0.04999**	**0.97164**

Airport/Military Emissions - Medina County, 2005

Small Airports - Castroville, Devine, and Hondo Municipal Airports

	SCC	VOC	NOx	CO	VOC	NOx	CO
Area Emissions:		tons/year			tons/day		
Fueling (Tanker Truck Unloading/Tank Fill)	2501080050	3.96	0.00	0.00	0.01085	0.00000	0.00000
AREA	**TOTAL**	**3.96**	**0.00**	**0.00**	**0.01085**	**0.00000**	**0.00000**
Non-Road Emissions:							
2-Str Trimmers/Edgers/Bush Cutters	2260004026	0.08	0.00	0.23	0.00023	0.00000	0.00065
2-Str Leaf Blower/Vacuum	2260004031	0.08	0.00	0.33	0.00022	0.00000	0.00094
4-Str Tractors/Loaders/Backhoes	2265002066	0.12	0.14	3.18	0.00035	0.00036	0.00913
4-Str Lawn Mowers (Com)	2265004011	0.03	0.00	0.41	0.00008	0.00001	0.00119
4-Str Front Mowers (Com)	2265004046	0.02	0.00	0.86	0.00005	0.00001	0.00255
4-Str Lawn & Garden Tractors (Com)	2265004056	0.01	0.00	0.93	0.00004	0.00001	0.00273
Dsl - Shredders > 5 HP	2270007010	0.01	0.02	0.03	0.00001	0.00005	0.00006
Aircraft - Castroville	2275050000	2.38	1.03	77.85	0.00651	0.00282	0.21330
GSE/AGE/APU - Castroville	2270008000	0.50	1.05	12.22	0.00137	0.00288	0.03347
Aircraft - Devine	2275050000	0.34	0.08	21.41	0.00093	0.00022	0.05865
GSE/AGE/APU - Devine	2270008000	0.01	0.01	0.03	0.00002	0.00003	0.00007
Aircraft - Hondo	2275050000	3.90	4.81	30.67	0.01068	0.01318	0.08402
GSE/AGE/APU - Hondo	2270008000	0.79	1.03	20.93	0.00216	0.00281	0.05733
Aircraft Evaporative Losses	2275900000	4.02	0.00	0.00	0.01101	0.00000	0.00000
NON-ROAD	**TOTAL**	**12.28**	**8.19**	**169.05**	**0.03368**	**0.02240**	**0.46408**

MEDINA AREA	**TOTAL**	**3.96**	**0.00**	**0.00**	**0.01085**	**0.00000**	**0.00000**
MEDINA NON-ROAD	**TOTAL**	**12.28**	**8.19**	**169.05**	**0.03368**	**0.02240**	**0.46408**
MEDINA EMISSIONS	**TOTAL**	**16.24**	**8.19**	**169.05**	**0.04453**	**0.02240**	**0.46408**

Airport/Military Emissions - Wilson County, 2005

- - NO EMISSIONS RECORDED - -

Airport/Military Emissions - Wilson County, 2005

Wilson County

CHAPTER 4 – AREA SOURCE EMISSIONS

Agricultural Desiccant Application

Desiccants are harvest-aid chemicals that are applied to cotton crops to artificially accelerate the drying of plant tissues, namely leaves.[1] Desiccants are contact herbicides that dry the cotton plants down by causing the plant cells to rupture their contents and water, rapidly killing the leaves. Advantages to using desiccants include the ability to harvest the crop earlier, increased quality grades because of reduced leaf trash, reduction in insect harborage sites and infestation, increased stripper harvesting efficiency, and the control of late-season weeds.[2] The Environmental Protection Agency (EPA) regulates agricultural desiccants as pesticides, requiring them to be registered for use in the State. Currently, Cyclone Max is the only desiccant registered for use in Texas.[3]

Methodology

The preferred methodology for calculating emissions from agricultural desiccants is the EPA Emission Inventory Improvement Program (EIIP) agricultural pesticide applications methodology. This methodology calculates VOC emissions using the percentage of active and inert ingredients in the desiccant, an emission factor based on the vapor pressure of the active ingredient, the fraction of VOC in the formulation (method of allocating the desiccant), and the application rate of the desiccant. These factors were multiplied by the number of acres of cotton crops per county to estimate the total emissions of desiccants for each county.[4]

A per acre emission factor was calculated for both active and inert ingredients. The active ingredient emission factor in pounds per acre was calculated by multiplying the fraction of the active ingredient in the desiccant by the pounds per ton active ingredient emission factor, based on vapor pressure, and the average application rate for pounds of desiccant per acre. The inert ingredient emission factor in pounds per acre was calculated by multiplying the fraction of the inert ingredient, the average application rate in pounds per acre, and the pounds per ton inert ingredient emission factor based on vapor pressure. The calculated pounds per acre emission factors for both the active and inert ingredient were added together to get a total pounds per acre emission factor for cotton. Table 4-1 lists the emission factors for both active and inert ingredients.

To calculate the tons per year VOC emissions from agricultural desiccant use in each county in the AACOG region, the total cotton crop-acreage for each county is multiplied by the total tons per acre emission factor. Total crop-acreage for each county was obtained from the U.S. Department of Agricultures National Agriculture Statistics Service[5] and is located in Table 4-2.

[1] University of Florida, Institute of Food and Agricultural Sciences Extension, February 2006. Defoliates and Desiccants. Available online: http://edis.ifas.ufl.edu/PI138

[2] College of Agriculture and Home Economics Cooperative Extension Office, New Mexico State University, March 2004. Defoliates, Desiccants, and Growth Regulators Used on New Mexico Cotton. Available online: http://cahe.nmsu.edu/pubs/_a/A-217.pdf

[3] Texas Cooperative Extension, San Angelo Research and Extension Center. August 2002. Cotton Harvest-Aid Recommendations for the 2002 Crop: West Central Texas. Available online: http://sanangelo.tamu.edu/agronomy/harvest/index.htm

[4] U.S. Environmental Protection Agency, June 2001. Emissions Inventory Improvement Program: Volume 3, Chapter 9 – Pesticides – Agricultural and Nonagricultural. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii09_jun2001.pdf

[5] Texas Field Office of USDA's National Agricultural Statistics Service, Texas Crop & Livestock County Estimates. July 2005. Available online: http://www.nass.usda.gov/tx/mce.htm

Table 4-1. Cotton Desiccant Usage and Emission Factors

Desiccant	Active Ingredient					Inert Ingredient			Total EF per acre (Inert + Active) (lbs/ton)
	Active Ingredient	Percentage of Active Ingredient	Vapor Pressure[6]	EF of Active Ingredient (lbs/ton)	Active EF per acre	Inert Formulation Type	EF of Inert Ingredient (lbs/ton)	Inert EF per acre	
Cyclone Max	Paraquat dichloride	30.50%	1.0E-07	0.35	0.05	Pressurized Sprays	0.39	0.14	0.19

Table 4-2. Acres of Planted Cotton per County, 2004

County	Cotton (Acres)
Atascosa	2,200
Bandera	0
Bexar	1,300
Comal	0
Frio	3,900
Gillespie	0
Guadalupe	0
Karnes	3,600
Kendall	0
Kerr	0
Medina	11,900
Wilson	1,900

*2004 crop-acreage data was used because it was the most recent data available at the time of the emission calculations

Sample Calculation

The active ingredient of Cyclone Max is paraquat dichloride and has a vapor pressure of 1.0×10^{-7}. Since the vapor pressure is less then 1×10^{-4}, the emission factor is 700 lbs/ton or 0.35.[7] In addition, Cyclone Max is applied in a pressurized spray formulation that has an emission factor of 0.39 lbs/ton.[8] The application rates for Cyclone Max range from 5.3 to 10.7 ounces per acre.[9]

Equation (1)
Calculating an average pounds per acre application rate:

$$AR = [[(HAR - LAR) / 2] + LAR] \times CF$$

[6] U.S. National Library of Medicine, March 2007. Haz-map Occupational Exposure to Hazardous Agents: Paraquat dichloride(CAS # 1910-42-5). Bethesda, Maryland. Available online: http://hazmap.nlm.nih.gov/cgi-bin/hazmap_generic?tbl=TblAgents&id=82

[7] U.S. Environmental Protection Agency, June 2001. Emissions Inventory Improvement Program: Volume 3, Chapter 9 – Pesticides – Agricultural and Nonagricultural. Research Triangle Park, North Carolina, p. 9.4-22. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii09_jun2001.pdf

[8] Cotton Harvest-Aid Recommendations for the 2002 Crop: West Central Texas, August 2002. Cyclone Max Product Label. p. 12. Available online: http://sanangelo.tamu.edu/agronomy/harvest/cycloneml.pdf

[9] Texas Agricultural Extension Service, 2000 High Plains and Northern Rolling Plains Cotton Harvest-Aid Guide. Available online: http://lubbock.tamu.edu/focus/Focus2000/Sept_7/harvest/HarvGuide2k.html

Where,

AR	= Average application rate (lbs/acre)
HAR	= Highest application rate (10.7 oz./acre)
LAR	= Lowest application rate (5.3 oz./acre)
CF	= Conversion factor (0.0625 lbs/oz.)

The average pounds per acre application rate for Cyclone Max:

AR = [[(10.7 oz./acre – 5.3 oz./acre)/2] + 5.3 oz./acre] x 0.0625 lbs/oz.
= 0.5 lbs/acre

Equation (2)
Active ingredient emission factor in pounds per acre:

$$AEF = AR \times FAI \times EF_A$$

Where,

AEF	= Active ingredient emission factor (lbs/acre)
AR	= Average application rate (0.5 lbs/acre), Equation (1)
FAI	= Fraction of active ingredient, Table 4-1
EF_A	= Active ingredient emission factor based on vapor pressure (lbs/ton), Table 4-1

The pounds per acre active ingredient emission factor for Cyclone Max:

AEF = 0.5 lbs/acre x 0.305 x 0.35 lbs/ton
= 0.05 lbs/acre

Equation (3)
Inert ingredient emission factor in pounds per acre:

$$IEF = AR \times FII \times EF_I$$

Where,

IEF	= Inert ingredient emission factor (lbs/acre)
AR	= Average application rate (0.5 lbs/acre), Equation (1)
FII	= Fraction of inert ingredient, Table 4-1
EF_I	= Inert ingredient emission factor based on vapor pressure (lbs/ton), Table 4-1

The pounds per acre inert ingredient emission factor for Cyclone Max:

AEF = 0.5 lbs/acre x 0.70 x 0.39 lbs/ton
= 0.14 lbs/acre

Equation (4)
Total pounds per acre emission factor:

$$TEF = AEF + IEF$$

Where,

TEF	= Total emission factor (lbs/acre)

AEF = Active ingredient emission factor (lbs/acre)
IEF = Inert ingredient emission factor (lbs/acre)

The total pounds per acre emission factor for Cyclone Max:

TEF = 0.05 lbs/acre + 0.14 lbs/acre
= 0.19 lbs/acre

Equation (5)
Annual VOC emissions from cotton crop desiccants:

AE = (CA x TEF) / 2,000 lbs/ton

Where,
AE = Annual VOC emissions (tons/yr)
CA = Cotton crop acreage per county
TEF = Total emission factor (lbs/acre)

The annual VOC emissions from desiccants applied to the 2,200 acres of cotton crops in Atascosa County:

AE = (2,200 acres x 0.19 lbs/acre) / 2,000 lbs
= 0.209 tons VOC/yr

Equation (6)
Daily VOC emissions from cotton crop desiccant:

DE = AE x PER / DAY

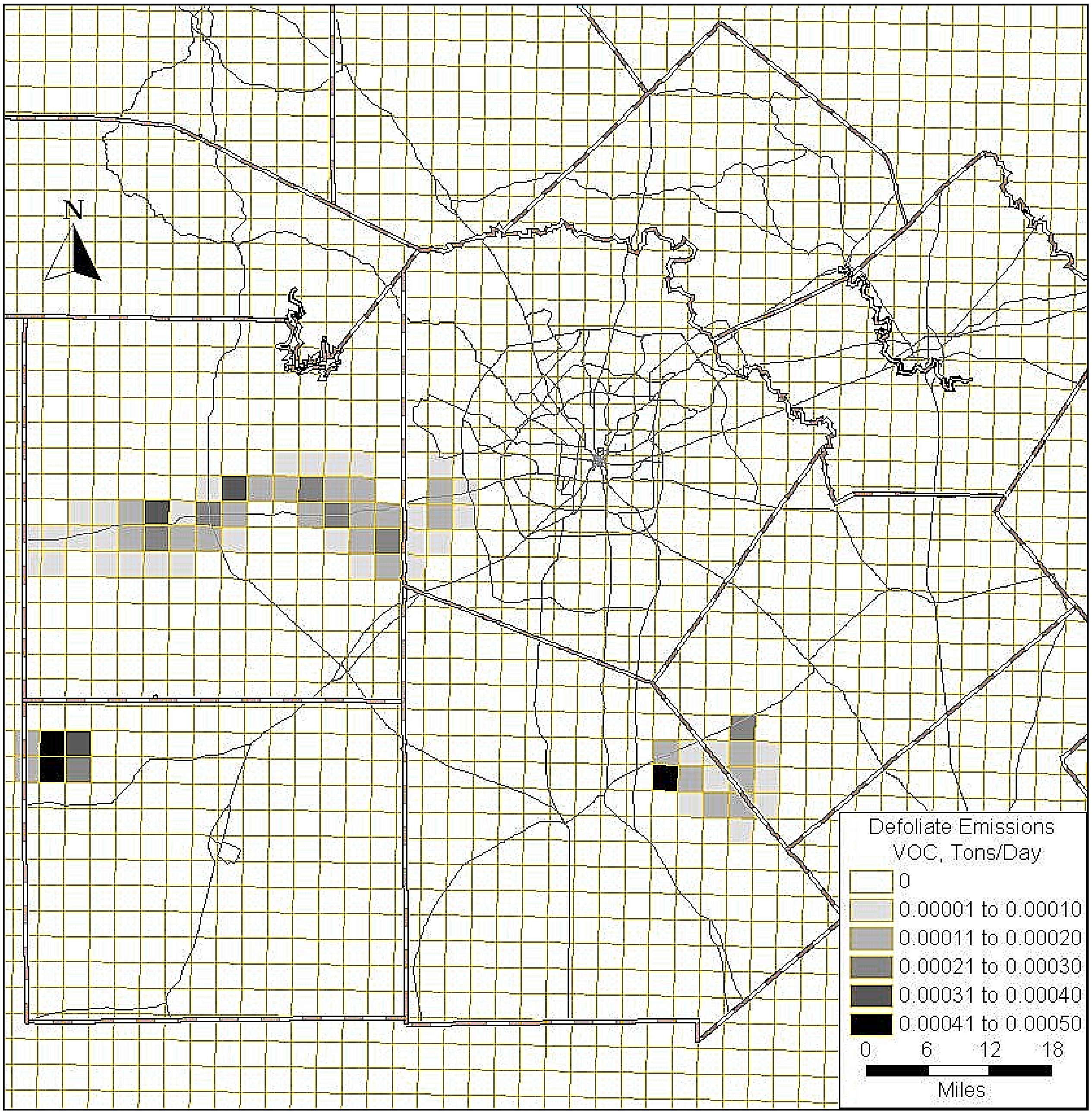
Where,
DE = Daily VOC emissions (tons/day)
AE = Annual VOC emissions (tons/yr), Equation (5)
PER = Percent of activity that occurs during the ozone season (100%)
DAY = Days during the ozone season (210 days/yr)

The daily VOC emissions for desiccants applied to 2,200 acres of cotton crops in Atascosa County:

DE = 0.209 tons/yr X 1.00 / 210 days/yr
= 0.001 tons/day

Spatial Distribution
Emissions are allocated on the 4km grid based on the location of cotton crop acres (Figure 4-1). Only Atascosa, Bexar, Frio, Karnes, Medina, and Wilson County's had desiccant emissions geo-coded because they were the only counties with cotton crops in 2005.

Figure 4-1. VOC Emissions from Desiccants, 2005



Plot Date: June 5, 2007
Map Compilation: June 5, 2007
Source: Surveys

Agricultural Fertilizer

Fertilizers are used to supply essential plant nutrients to improve crop production. The fertilizer predominately used in the AACOG region is ammonium sulfate $(NH_4)_2SO_4$ applied in a solid form.

Methodology
The application time(s) and rate are dependent upon specific soil type, the crop to be grown, weather at the application time, and equipment available to the individual farmer. Crop-acreage was obtained from the Texas Field Office of U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (Table 4-3).[10] The "typical" application rates and times for the dry application of ammonium sulfate fertilizer in this region are illustrated in Table 4-4 along with the EPA test results for latent EFs for the fertilizer applications in the AACOG region.[11]

Table 4-3. Acres Harvested by Crop for Each County, 2004

FIPS	County	Corn	Sorghum	Small Grains	Cotton	Hay	Peanuts
48013	Atascosa	2,700	1,700	3,900	2,200	34,911	5,600
48019	Bandera	0	0	100	0	5,988	0
48029	Bexar	9,000	8,000	11,300	1,300	34,334	0
48091	Comal	1,300	800	100	0	9,176	0
48163	Frio	3,800	7,700	7,900	3,900	15,612	14,700
48171	Gillespie	1,500	1,600	8,800	0	21,005	0
48187	Guadalupe	17,300	17,800	18,000	0	41,992	0
48255	Karnes	9,900	2,900	6,900	3,600	32,147	0
48259	Kendall	0	0	600	0	9,442	0
48265	Kerr	0	0	100	0	9,337	0
48325	Medina	25,500	16,100	25,200	11,000	29,323	0
48493	Wilson	8,700	9,900	6,000	1,900	45,114	3,400
12 County Total	AACOG	79,700	66,500	88,900	23,900	288,381	23,700

Fertilizers are applied at planting or just before planting of crops in the AACOG region. Most crops require roughly 2,100 lbs of ammonium sulfate fertilizer be applied to each acre of crop to achieve an effective application of 60 lbs of nitrogen/acre. A secondary side dressing of 700 lbs of ammonium nitrate is used to achieve an effective application rate of 20 lbs of nitrogen per acre, indicated as side dressing. Side dressing activities only occur for corn, cotton, and sorghum. Hay is fertilized with 2,100 lbs per acre in the early spring while peanuts are fertilized only at planting with approximately 1,000 lbs of fertilizer per acre.

[10] Texas Field Office of USDA: National Agricultural Statistics Service, July 2005. Texas Crop & Livestock County Estimates. Available online: http://www.nass.usda.gov/tx/mce.htm
11 U.S. Environmental Protection Agency, June 1998. Emission Factor Documentation for AP-42, Section 9.2.1: Fertilizer Application. (Draft Report) Research Triangle Park, North Carolina, p. 4-22.

Table 4-4. Crops, Application Schedule, and Emission Factors for Fertilizer

Crop	Month of Application	Ammonium Sulfate fertilizer Applied (lbs/acre)	Amount of Nitrogen (lbs/acre)	EF for Application of Nitrogen (NO) (lbs/ton)
Corn	March-April (Spring Planting)	2,100	60	138
	May (Side Dressing)	700	20	138
Cotton	March-April (Spring Planting)	2,100	60	138
	May (Side Dressing)	700	20	138
Small Grains	March-Apil (Spring Planting)	2,100	60	138
Sorghum	March-April (Spring Planting)	2,100	60	138
	May (Side Dressing)	700	20	138
Hay (Bermuda)	March-April (Spring Planting)	2,100	60	138
Peanuts	May-June (Spring Planting)	1,000	30	138

Daily emissions for the 2005 ozone season were determined by calculating a seasonal adjustment factor based on when the fertilizer is applied. Spring planting occurs during the months of March and April. Since the ozone season occurs during the months of April through October, half of spring planting application of fertilizer was used when calculating ozone season emissions. Side dressing activities occur during the summer months, which are during ozone season; therefore no seasonal adjustment factor was necessary.

The application of fertilizer is very dependent upon the prevailing weather conditions. Dry and anticipated dry conditions make fertilization harmful, as it will tend to burn crops. Sufficient moisture must be present to achieve the full rates shown in the approximations above. Additionally, the farmer will not spend the money to fertilize his crops if he anticipates substandard yield or market conditions that would make the expenditure of funds on fertilizer counter productive.

Sample Calculation

Equation (1)

Annual emissions for Spring Planting and Side dressing:

$$APE_A = (AC_A \times PAN_A \times PEF_A) + (AC_A \times SAN_A \times SEF_A)$$

Where,

APE_A = Annual emissions of NOx for crop A (tons /yr)

AC_A = Acres of crop A, Table 4-3

PAN_A = Amount of Nitrogen applied for planting for crop A (lbs/acre of crop A), Table 4-4

PEF_A = EF for application of NOx during planting for crop A (lbs/ton), Table 4-4

SAN_A = Amount of Nitrogen applied for side dressing for crop A (lbs/acre), Table 4-4

SEF_A = EF for application of NOx during side dressing for crop A (lbs /ton), Table 4-4

Annual emissions for Gillespie County, which has 1,600 acres of corn that is planted in March/April with a side dressing in May:

APE_A = [1,600 acres of corn x 60 lbs x (138 lbs / 2,000 lbs/ton)] + [1,600 acres of corn x 20 lbs x (138 lbs / 2,000 lbs/ton)]
= 4.42 tons/yr NOx for the planting of corn in Gillespie county

Equation (2)
Ozone season daily emissions for Spring Planting and Side dressing:

$$DPE_A = [(AC_A \times PAN_A \times PEF_A) / PSA_A] + [(AC_A \times SAN_A \times SEF_A) / SSA_A]$$

Where,

DPE_A = Ozone season daily emissions of NOx for crop A (tons /yr.)
AC_A = Acres of crop A
PAN_A = Amount of Nitrogen applied for planting of crop A in lbs/acre, Table 4-4
PEF_A = Emission factor for application of NOx during planting for crop A (lbs /ton), Table 4-4
PSA_A = Seasonal Adjustment for planting (0.5 based on March-April planting) / 214 days per year (7 month ozone season)
SAN_A = Amount of Nitrogen applied for side dressing for crop A in lbs/acre, Table 4-4
SEF_A = Emission factor for application of NOx during side dressing for crop A lbs/ton, Table 4-4
SA_A = Seasonal Adjustment for side dressing (1 / 214 days per year) (7 month ozone season)

Daily emissions for Gillespie County, which has 1,600 acres of corn that is planted in March/April with a side dressing in May:

DSE_A = [1,600 acres of corn x 60 lbs x (138 lbs / 2,000 lbs/ton) x 0.5 / 214] + [1,600 acres of corn x 20 lbs x (138 lbs / 2,000 lbs/ton) x 1.0 / 214]
= [15.48 lbs of emission / 2,000 lbs/ton] + [10.32 lbs of emission / 2,000 lbs/ton]
= 0.0129 tons/day NOx for the planting of corn in Gillespie county

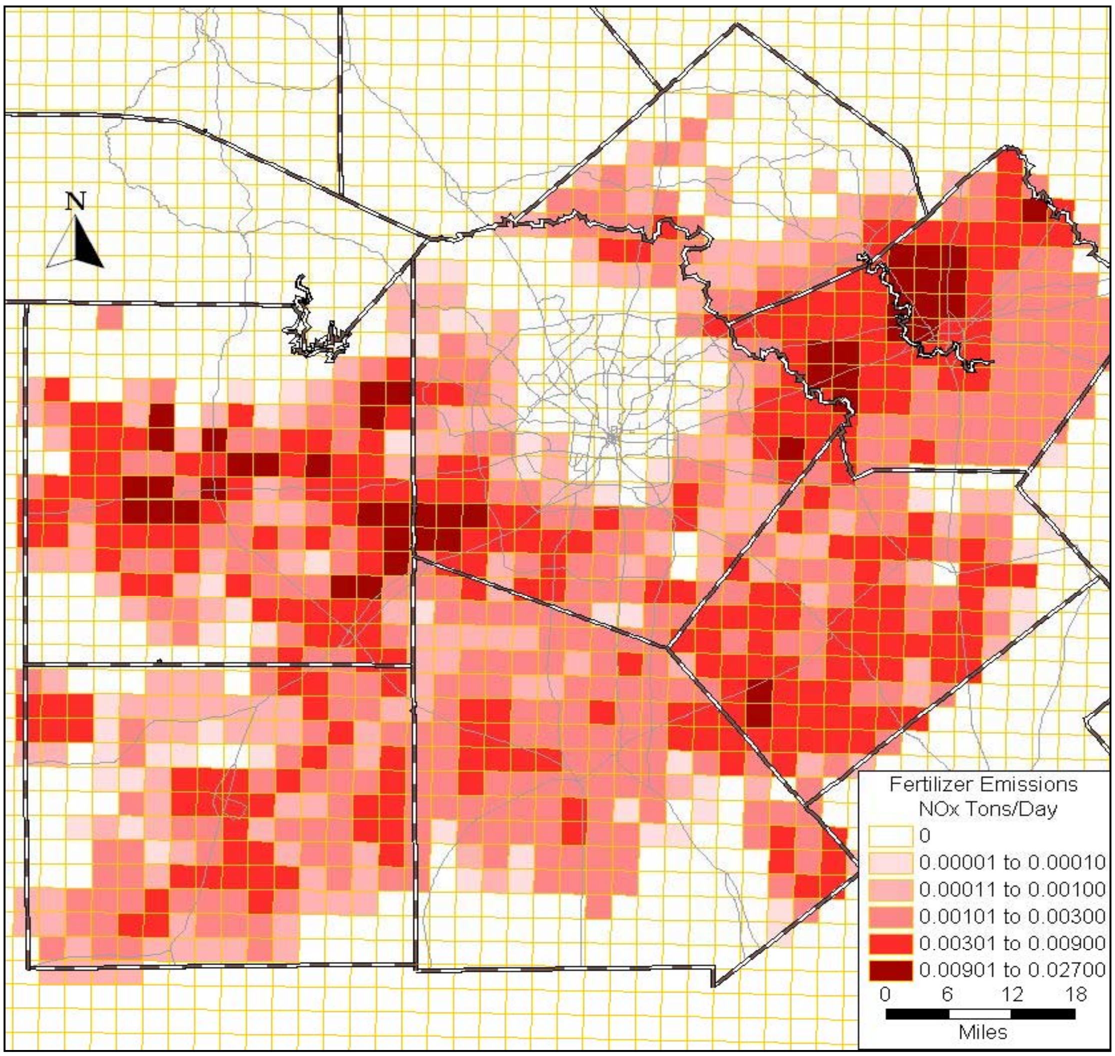
Spatial Distribution

Emissions are allocated on the 4km grid base on the location of the hay, corn, small grains, sorghum, corn, and cotton crops acres (Figure 4-2). Only Atascosa, Bexar, Comal, Frio, Guadalupe, Medina, and Wilson County's fertilizer emissions were geo-coded. The four northern counties had insignificant crops and the crop data did not exist for Karnes County. Table 4-5 is a snapshot taken from a spreadsheet used for agricultural data entry. For each grid cell in the AACOG domain there is a corresponding data entry cell as shown below. Entries are expressed in fraction of crops contained within each four-kilometer grid square.

Table 4-5. Sample Fertilizer Data Grid Cell

Cell Crop Type	Fraction of Crop	Acres of Crop
Range	0.86	3,934
Corn	0.10	393
Hay	N/A	N/A
Peanuts	0.02	79
Sorghum	N/A	N/A
Vegetables	N/A	N/A
Cotton	N/A	N/A
Small Grains	0.02	79
Urban	N/A	N/A
Water	N/A	N/A

Figure 4-2. NOx Emissions from Agricultural Fertilizer, 2005



Plot Date: February 26, 2007
Map Compilation: February 16, 2007
Source: Surveys

Agricultural Pesticide Applications

The definition of a Pesticide from the Title 7 U.S. Code 136 (FIFRA) Sec. 2 "The term "pesticide" means:

> (1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest,
> (2) any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant, and
> (3) any nitrogen stabilizer, except that the term "pesticide" shall not include any article that is a "new animal drug" …. The term "pesticide" does not include liquid chemical sterilant products (including any sterilant or subordinate disinfectant claims on such products) for use on a critical or semi-critical device."[12]

This section calculates emission estimates for agricultural pesticides. Every 3-5 years the chemicals and practices of pesticides allocation change, therefore it is important to keep up to date with the latest information. Pesticides used in the home and garden are included as part of the consumer/commercial solvent use category.

Methodology

The EPA Emission Inventory Improvement Program (EIIP) prescribes the preferred methodology for calculating emissions from agricultural pesticide applications by using the percentage of active ingredient in the pesticide, emission factor based on vapor pressure of active ingredient, fraction VOC in the formulation (method of allocating the pesticide), and the application rate of the pesticide. These factors were multiplied with the number of acres of each crop to estimate total emissions of pesticides by crop for each county.[13] The main harvested crops in the AACOG Region are:

- Corn
- Peanuts
- Sorghum
- Cotton
- Small Grains

The types of pesticides commonly used for these crops were obtained the Bexar County office of the Texas Cooperative Extension was contacted for assistance.[14] The Extension service was able to provide the pesticides used in the AACOG region and the times of the year the pesticide is used (Table 4-6).

To determine the composition of each pesticide, the county extension office recommended the Clemson University Cooperative Extension website.[15] The website contains a "Pest Management Handbook" that lists and describes various pesticides used for a multitude of crops. For a few cases, the Pest Management Handbook did not have the formulations for selected pesticides. In these cases other sources used to determine formulation including State

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[12] Title 7, Chapter 6, Subchapter II § 136. Definitions. Available online: http://straylight.law.cornell.edu/uscode/html/uscode07/usc_sec_07_00000136----000-.html

[13] U.S. Environmental Protection Agency, June 2001. Emissions Inventory Improvement Program: Volume 3, Chapter 9 – Pesticides – Agricultural and Nonagricultural. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii09_jun2001.pdf

[14] August 2004. The Texas Cooperative Extension, Bexar County office. Available online: http://bexar-tx.tamu.edu

[15] Clemson University Cooperative Extension. August 2004. Clemson University. Available online: http://www.clemson.edu/extension/

of West Virginia "Pesticide Registration Search"[16] and The University of Georgia "Georgia Pest Management Handbook."[17]

Table 4-6. Types of Pesticide Used and Seasonal Adjustment[18]

Crop Type	Pesticide	Monthly Usage		
		After crops are planted	Pegging	Spray at heading
Corn	Aztec	March	N/A	N/A
	Counter 15	March	N/A	N/A
	Counter 20	March	N/A	N/A
Sorghum	Karate Z 2.08 CS	N/A	N/A	June-July
Peanuts	Lorsban 15 G	June/July	N/A	N/A
	Temik 15 G	May	June/July	N/A
Cotton	Bidrin 8 EC	May/June	N/A	N/A
	Orthene 97 PE	May/June	N/A	N/A
	Temik 15 G	June	N/A	N/A
Small Grains	Lorsban 4E	March/April	N/A	N/A
Hay	none	N/A	N/A	N/A

It is important to note that many "pesticides are applied as a band over the row and not the total area. For example, a herbicide may be sprayed in a 10 inch band on rows planted 40 inches apart - so the actual herbicide use would by 10/40 or about 25% of the planted acreage."[19] Once the application rates were calculated, an average application rate was obtained per pesticide per acre. Practically none of the 7.2 million acres of small grain crops that Texas plants receive pesticide treatments. According to Doug Stevenson Ph.D. from the Texas Cooperative Extension at Texas A&M University,

> "Texas plants about 7.2 million acres of small grains every year. About 6.9 million are fall grain, and about 300,000 are spring grain. About 6.7 million of those acres are wheat. All small grains planted in Texas are grazed to some extent. According to USDA Ag Statistics Service, only 2.8 to 3.4 million acres are harvested for grain. The rest are either grazed off completely or cut for hay. Grazing also eliminates problems with the key pests of small grains, such as greenbug (Schizaphis graminum), bird-oat-cherry aphd (Rhopalosiphum padi), corn leaf aphid (Rhopalosiphum maidis), Russian wheat aphid (Diuraphis noxia) and English grain aphid (Macrosiphum avenae). Grazing also eliminates problems from occasional pests, such as chinch bugs (Blissus leucopterus), brown wheat mite (Petrobia latens) and winter grain mite (Penthaleus major), armyworms (Pseudaletia unipuncta, Spodoptera eridania, Spodoptera frugiperda, Spodoptera ornithogalli), and grasshoppers. Resistant varieties are used to eliminate Hessian fly and the wheat rusts. Seed certification eliminates smuts. Grazing replaces virtually all insecticide and fungicide treatments of the crop.

[16] State of West Virginia, June 29, 2005. Pesticide Registration Search. Available online: http://www.kellysolutions.com/wv/

[17] Paul Guillebeau, 2005. Georgia Pest Management Handbook. The University of Georgia Entomology. Available online: http://www.ent.uga.edu/pmh/Agronomic/Agronomic_Crops.htm

[18] Jerry W Warren. Sept. 4, 2005. E-mail "Agricultural Pesticides".

[19] Smith, Dudley, July 26, 2005 e-mail, "Ag practices Pesticides", Soil and Crop Sciences, Texas A&M University.

Texas plants about 2.5 to 3.5 million acres of sorghum. About half is grazed and harvested for hay, with less than 10% receiving pesticide applications. About 1.5 to 2 million acres are harvested for grain. These are grown in rotation with other crops. Between half and three-fourths of the grain sorghum requires minimum weed control, usually achievable by cultivation; weed control in the previous crop suppresses most weeds. Between 25 and 50 percent of grain sorghum crops receive herbicide treatments. Serious insect pests, such as greenbug and sorghum midge are controlled with resistant varieties or cultural practices. Late planted fields in South Texas may require pesticide treatment, but these account for only about 5% of the total acres in Texas. Taking herbicide and insecticide application figures into account, slightly more than 600,000 acres are treated with pesticide.

Some estimates of treated crops refer to the large proportion of treated seed planted. About 85% of the crops planted in the United States use commercial seed. The other 15% comes from farmers who save their seed for replanting. Virtually 100% of commercial seed receives treatment by fungicides and about half is treated with additional insecticide. The average treatment usually applies about 100 grams of active ingredient per 100 kilograms of treated seed (1g/kg). Since the average seeding rate for most crops is about 5 to 16 kilograms (12.5 to 40 lb) of seed per acre, the amount of any particular seed treatment pesticide entering the environment is about 0.005 to 0.016 kg. (0.01 to 0.02 lb) per acre."[20]

Emission factors per acre were calculated for both active and inert ingredient by crop type. The emission factor per acre for active ingredient is based on pounds of pesticide used per acre multiplied by the fraction of active ingredient and emission factor per pound of active ingredient. The emission factor for inert ingredient per acre is based on the same calculation. The emissions per acre for active ingredient are added to the emissions per acre for inert ingredient to get total emissions by acre for each crop. Table 4-8 lists the emission factors by crop and pesticide for both active and inert ingredients.

The emissions for each pesticide was summed by crop type[21] and multiplied by the number of acres for each crop in each county and the percentage of area the pesticide is applied to for each acre to estimate county emissions. Crop-acreage was obtained from the Texas Field Office of U.S. Department of Agriculture (USDA) National Agricultural Statistics Service.[22]

[20] Doug Stevenson, Ph.D. Sept. 2, 2005 E-mail "Agricultural Pesticides" Extension Associate - Ag Chem, Texas Cooperative Extension, TAMU, College Station, TX.

[21] Smith, Dudley and Anisco, Juan, August 2000. "Crop Brief on Production, Pests, & Pesticides", The Agricultural Program, Texas A&M University. Available online: http://aggie-horticulture.tamu.edu/extension/cropbriefs/

[22] Texas Field Office of USDA's National Agricultural Statistics Service, July 2005. Texas Crop & Livestock County Estimates. Available online: http://www.nass.usda.gov/tx/mce.htm

Table 4-7. Acre Percentage for Pesticide Application and Usage Rate

Crop	Pesticide	% of Crop that use each pesticide	Usage Rate	Number of Applications
Corn	AZTEC	85%	0.0125 - 0.0400 lbs	1
	COUNTER 15 G	85%	0.0125 - 0.0400 lbs	1
	COUNTER 20 CR	85%	0.0125 - 0.0400 lbs	1
Sorghum	KARATE Z 2.08 CS	25%	0.96-1.28 oz/ac	1
Peanuts	LORSBAN 15 G	1%	13.3 lbs/ac	1
	TEMIK 15 G	3%	4-7 lbs/ac	2
Cotton	BIDRIN 8 EC	85%	0.0125 - 0.0400 lbs	1
	ORTHENE 97 PE	85%	0.0125 - 0.0400 lbs	1
	TEMIK 15 G	85%	0.0125 - 0.0400 lbs	1
Small Grains	LORSBAN 4E	0.1%	16 oz/ac	1
Hay	None	0%	N/A	0

Sample Calculation

Clemson University Cooperative Extension provided data for the pesticide Lorsban that was used to calculate the emissions factor (EF) for each type of crop. The percentage of active ingredients in Lorsban is 44.9%. Lorsban active ingredient is chlorpyrifos and has a vapor pressure of 1.75×10^{-5}. Since the vapor pressure is less then 1×10^{-4}, the emission factor is 700 lbs/ton or 0.35.[23] Lorsban is applied in emulsifiable concentrate formulation that has a fraction of VOC of 0.56 for the inert ingredients.[24]

Equation (1)

Active Ingredient emission factor per acre:

$$AEF_A = AR_A \times FA_A \times VEF_A$$

Where,

AEF_A = Active ingredient emission factor for Pesticide A

AR_A = Average application rate for Pesticide A (lbs/acre), Table 4-7

FA_A = Fraction of active ingredient for Pesticide A, Table 4-7

VEF_A = Active ingredient emission factor in lbs/ton of Pesticide for Pesticide A (lbs/ton), Table 4-8

[23] U.S. Environmental Protection Agency, June 2001. Emissions Inventory Improvement Program: Volume 3, Chapter 9 – Pesticides – Agricultural and Nonagricultural. Research Triangle Park, North Carolina, p. 9.4-22. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii09_jun2001.pdf

[24] *Ibid*. p. 9.4-21 - 22

Table 4-8. Pesticide Use and Emission Factors by Crop

Crop	Pesticide	Application Rate (lbs/acre)	Active Ingredient					Inert Ingredient			Total EF per acre (Inert + Active) (lbs/ton)
			Active Ingredient	Percentage of Active ingredient	Vapor Pressure	EF of Active Ingredient (lbs/ton)	Active EF per acre	Inert Formulation Type	EF of Inert Ingredient	Inert EF per acre (lbs/ton)	
Corn	AZTEC	3.93	Cyfluthrin	0.1%	2.1E-08	0.35	0.029	Granule/flake	0.25	0.96	0.99
			Tebupirimphos	2.0%	not established						
	COUNTER 15 G	0.09	terbufos	90.0%	3.2E-04	0.58	0.048	Granule/flake	0.25	0.00	0.05
	COUNTER 20 CR	0.09	terbufos	90.0%	3.2E-04	0.58	0.048	Granule/flake	0.25	0.00	0.05
	TOTAL FOR CORN										1.09
Sorghum	KARATE Z 2.08 CS	0.10	lambda cyhalothrin	22.8%	1.5E-09	0.35	0.008	Pressurized sprays	0.39	0.03	0.04
	TOTAL FOR SORGHUM										0.04
Peanuts	LORSBAN 15 G	13.3	chlorpyrifos	15.0%	1.7E-05	0.35	0.029	Granule/flake	0.25	0.12	0.15
	TEMIK 15 G	5.5	aldicarb	15.0%	3.0E-05	0.35	0.029	Granule/flake	0.25	0.12	0.15
	TOTAL FOR PEANUTS										0.29
Cotton	BIDRIN 8 EC	0.10	dicrotophos	82.0%	1.6E-04	0.58	0.048	Emulsifiable Concentrate	0.56	0.01	0.06
	ORTHENE 97 PE	0.09	acephate	97.0%	1.7E-06	0.35	0.029	Pellet/Tablet	0.27	0.00	0.03
	TEMIK 15 G	0.55	aldicarb	15.0%	3.0E-05	0.35	0.029	Granule/flake	0.25	0.12	0.15
	TOTAL FOR COTTON										0.23
Small Grains	LORSBAN 4E	1.00	chlorpyrifos	44.9%	1.7E-05	0.35	0.16	Emulsifiable Concentrate	0.56	0.31	0.47
	TOTAL FOR SMALL GRAINS										0.47

Active ingredient emission factor for Lorsban 4E per acre for Small Grains:

EF_A = 16 oz/acre / 16 oz/lbs x 0.449 x 0.35 lbs/ton
= 0.16 lbs/acre

Equation (2)
Inert Ingredient emission factor:

IEF_A = AR_A x FI_A x VEF_A

Where,
IEF_A = Inert ingredient emission factor for Pesticide A
AR_A = Average application rate for Pesticide A (lbs/acre), Table 4-7
FI_A = Fraction of inert ingredient for Pesticide A, Table 4-8
VEF_A = Inert ingredient emission factor in lbs/ton of Pesticide for Pesticide A (lbs/ton), Table 4-8

Inert ingredient emission factor for Lorsban 4E per acre for Small Grains:

EF_I = 16 oz/acre / 16 oz/lbs x 0.551 x 0.56 lbs/ton
= 0.31 lbs/acre

Equation (3)
Total emission factor for each pesticide:

TEF_A = AEF_A + IEF_A

Where,
TEF_A = Total emission factor per acre for Pesticide A (lbs/acre)
AEF_A = Active ingredient emission factor for Pesticide A (lbs/acre), Table 4-8
IEF_A = Inert ingredient emission factor for Pesticide A (lbs/acre), Table 4-8

Total EF emission factor for Lorsban 4E per acre for Small Grains:

TEF = 0.16 lbs/acre + 0.31 lbs/acre
= 0.47 lbs/acre

Atascosa County has 3,900 acres of small grain cropland. Approximately 0.1 percent of the acres had pesticide applied to them.

Equation (4)
AE_A = Σ (ACRE x TEF_A x NUM_A x PER_A / 2000 lbs/ton)

AE_A = Annual emissions for Pesticide A (VOC tons/year)
ACRE = Crops Acres
TEF_A = Total emission factor per acre for Pesticide A (lbs/acre), Table 4-8
NUM_A = Number of Applications for Pesticide A, Table 4-7
PER_A = Fraction of acres with pesticides, Table 4-7

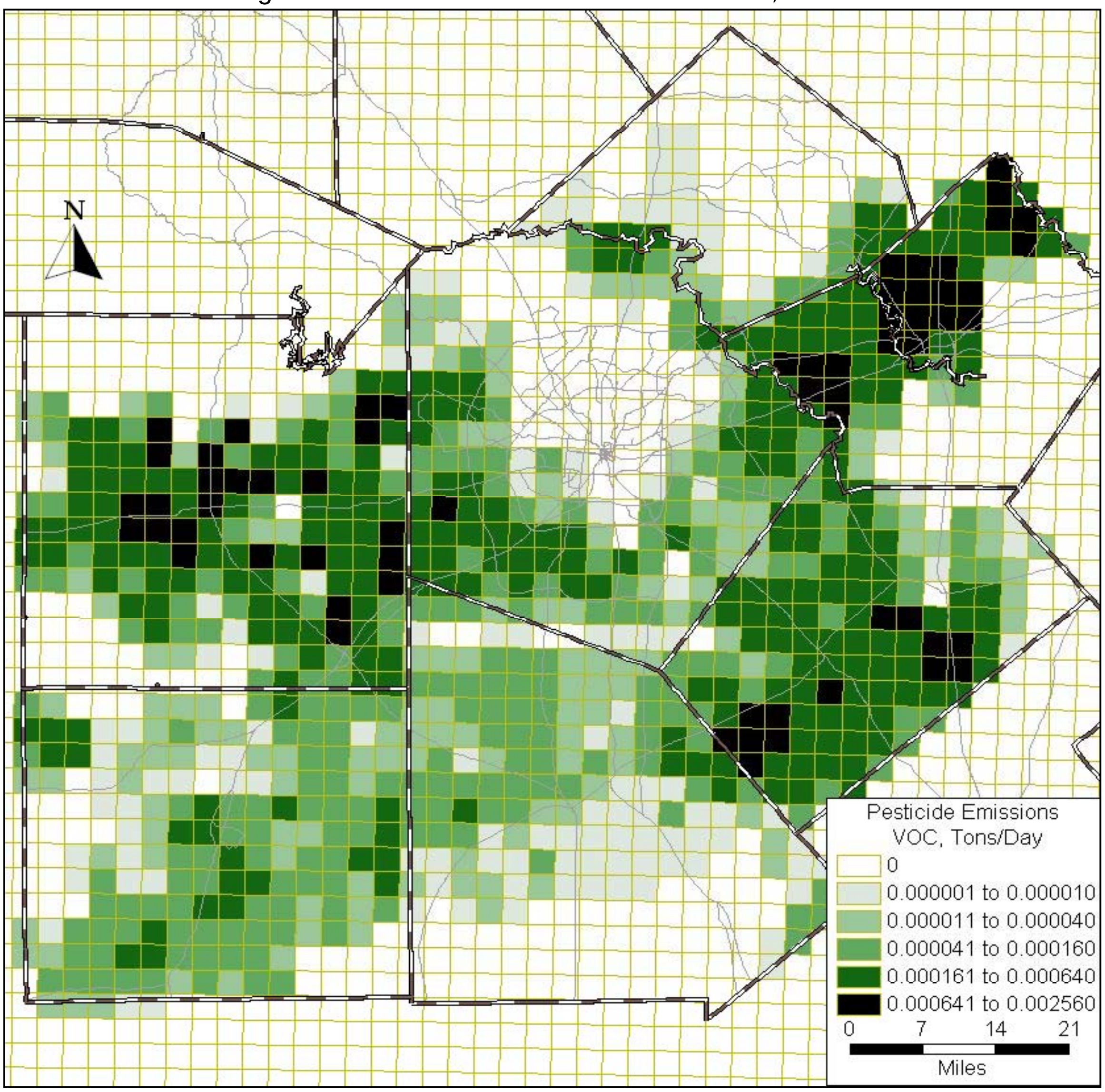
Annual emissions from Lorsban 4E pesticide for small grains in Atascosa County:

AE_A = 3,900 x 0.47 x 1 x 0.001 / 2000 lbs/ton
= 0.00091 tons/yr.

Seasonal Adjustment
The seasonal adjustment factor is based on Table 4-6 and an annual activity rate of 6 days per week to yield tons per day.

Spatial Distribution
Emissions are allocated on the 4km grid based on the location of the corn, small grains, sorghum, corn, and cotton crops acres (Figure 4-3). Only Atascosa, Bexar, Comal, Frio, Guadalupe, Medina, and Wilson County's pesticide emissions were geo-coded. The four northern counties had insignificant crops and the crop data did not exist for Karnes County.

Figure 4-3: VOC Emissions from Pesticides, 2005



Plot Date: February 23, 2007
Map Compilation: February 16, 2007
Source: Surveys

Architectural Surface Coatings

Volatile Organic Compound (VOC) emissions are released through the application and drying of paint, primer, varnish, and lacquer to the surface of stationary structures and portable buildings. The majority of surface coatings are applied to domestic, industrial, institutional, and governmental structures. The architectural coatings EI also includes emissions from solvents used as thinners, additives, or as solutions for cleanup.

Coatings are used for a variety of applications besides those included in the architectural coatings subcategory of area sources. These include coatings used for such activities as pavement and curb markings, manufacturing, and industrial maintenance. However, the emissions from these applications were determined using different methodologies than the approach used to estimate VOC emissions from architectural coatings. Therefore, the methodologies used to estimate emissions from industrial, pavement, and other types of coatings are described in separate sections of the 2005 AACOG EI.

Methodology

Emissions from architectural coatings were estimated based on a methodology used by ENVIRON to develop an area and mobile source EI for the State of Texas.[25] The ENVIRON methodology combined steps listed in volume III of the EPA's EIIP report, with information from the California Air Resource Board (CARB) study, to develop population-based usage and emission factors. ENVIRON methodology is based on an alternative EIIP methodology, that uses data from the US Census Bureau for national coatings sales and population estimates, to develop usage factors for two categories of coatings: solvent-based (SB) and water-based (WB) paints.

ENVIRON refined the EPA's methodology by using 1999 US Census Bureau data in conjunction with results from a 1998 architectural coatings survey conducted by CARB.[26] This methodology created 10 SCC categories of architectural coatings, each containing a solvent and water-based component, and thus allowing ENVIRON to develop more individualized usage factors for coatings. AACOG developed usage factors for the same 10 categories of coatings, but used more recent US Census Bureau data (2005) for coating sales,[27] national population,[28] and CARB's 2005 updated coatings survey.[29] Usage rates for each category were divided into solvent and water components based on gallons sold in the CARB study.

Usage estimates (in gal./year), for the individual SB and WB sales of each category, were calculated by multiplying the usage rates by national coatings sales data (in gallons) obtained from the US Census *2005 Paint and Allied Products Data*. The 2005 national sales data for the thinning, additives, and cleanup category were obtained by multiplying the appropriate 2005 US

[25] ENVIRON, August 31, 2001. Area and Mobile Source Emissions Inventory Technical Support Project: 1990-2010 Emission Inventory Trends and Projections. Prepared for the Texas Natural Resources Conservation Commission, Austin, Texas. TNRCC Umbrella Contract No. 582-0-34745, Work Order No. 34745-03 and TNRCC Umbrella Contract No. 582—0-34744, Work Order No. 34745-02.
26 California Air Resources Board, September 1999. 1998 Architectural Coatings Survey Results, Final report. Available online: http://www.arb.ca.gov/coatings/arch/Survey/results/FReport.pdf
[27] US Census Bureau, June 2006. Paint and Allied Products: 2005, MA325F(05)-1. Available online: http://www.census.gov/industry/1/ma325f05.pdf
[28] US Census Bureau, July 2006, Population Estimates. Available online: http://www.census.gov/popest/states/tables/NST-EST2005-01.xls
[29] California Air Resources Board, September 2006. 2005 Architectural Coatings Survey Results, Draft report. Available online: http://www.arb.ca.gov/coatings/arch/survey/2005/draft_2005_survey_rpt.pdf

Census sales data for solvent and water based coatings, by the usage factors in the 2005 CARB report.

Emission factors (in lbs/capita-year) for each SCC category were obtained by using two calculations. First, the individual usage estimates for SB and WB coatings in each category were multiplied by their respective VOC sales weight content (in lbs/gal) to determine the VOC emission factor (in lbs/year). Federal regulation limiting the amount of VOC in AIM products was enacted in September 1999.[30] The federal regulation used the same VOC limits for both solvent and water-based products. These limits would be unreasonably high for many categories; therefore CARB survey results were used.[31] VOC emission factors for all categories are listed in Table 4-9.

To convert the emission factors from total lbs/year into lbs/capita-year, total U.S. VOC emissions (lbs/year) were divided by the national population estimate (Table 4-10). SB and WB emission factors were added together to obtain a single emission factor for each category. To calculate the annual VOC emissions from architectural coatings for each county in the AACOG region, the emission factor for each SCC category was multiplied by county population.[32]

Sample Calculation

Equation (1)

Emission factor for each type of paint:

$$EF_A = [(SCL \times SPER \times SSALE) / USPOP] + [(WCL \times WPER \times WSALE) / USPOP]$$

Where,

EF_A = Emission factor for architectural surface coatings type A (lbs /capita-year)

SCL_A = VOC Content Limitations for solvent-based architectural surface coatings type A, Table 4-9

$SPER_A$ = Usage percentage for solvent-based architectural surface coatings type A, Table 4-9

SSALE = national solvent-based architectural surface coatings sales (138,988,000 gallons)

USPOP = U.S. population (296,410,404 from US Census Bureau)

WCL_A = VOC Content Limitations for water-based architectural surface coatings type A, Table 4-9

$WPER_A$ = Usage percentage for water-based architectural surface coatings type A, Table 4-9

WSALE = national water-based architectural surface coatings sales (659,448,000 gallons)

[30] US Environmental Protection Agency, September 1998. National Volatile Organic Compound Emission Standards for Architectural Coatings, Final Rule,40 CFR Part 59, [AD-FRL-6149-7], RIN2060-AE55. Office of Air Quality Planning and Standards, Research Triangle Park, NC. Available online: http://www.epa.gov/ttnatw01/183e/aim/fr1191.txt

[31] California Air Resources Board, September 2006. 2005 Architectural Coatings Survey Results, Draft report. p. 4-4 to 4-5. Available online: http://www.arb.ca.gov/coatings/arch/survey/2005/draft_2005_survey_rpt.pdf

[32] US Census Bureau, July 2006, Annual Estimates of the Population for Counties of Texas: April 1, 2000 to July 1, 2005. Available online: http://www.census.gov/popest/counties/tables/CO-EST2005-01-48.xls

Table 4-9. VOC Content Limitations (lbs /gal) for Architectural Surface Coatings

SCC	Coating Category Description	Solvent-based		Water-based	
		2005 CARB Study (lbs /gal)	Usage %	2005 CARB Study (lbs /gal)	Usage %
2401001001	Flat Paints	2.75	0.06%	0.32	41.72%
2401001005	Nonflat Paints - Low Gloss	3.35	0.05%	0.48	13.47%
2401001005	Nonflat Paints - Medium Gloss	3.10	1.08%	0.50	22.44%
2401001006	Nonflat Paints - High Gloss	3.03	5.79%	0.61	1.86%
2401001010	Primers, Sealers, and Undercoats	3.02	3.66%	0.47	11.36%
2401001011	Quick Dry - Primers, Sealers, and Undercoats	3.41	3.17%	0.21	0.04%
2401001015	Stains - Semitransparent	2.97	20.45%	0.70	0.05%
2401001020	Quick Dry - Enamels	3.25	9.98%	1.07	0.06%
2401001025	Lacquers – Clear	2.62	13.21%	0.63	0.40%
2401001050	Bituminous Roof	1.99	3.16%	0.02	1.49%
2401001050	Bituminous Roof Primer	2.85	0.84%	0.71	0.01%
2401001050	Faux Finishing	3.27	0.06%	0.95	0.34%
2401001050	Floor	1.28	2.36%	0.38	1.37%
2401001050	Roof	1.97	0.04%	0.18	0.10%
2401001050	Spec. Primer, Sealer, and Undercoat	2.86	0.62%	0.42	1.54%
2401001050	Stains – Opaque	2.40	21.29%	0.38	0.56%
2401001050	Varnishes – Clear	3.81	0.29%	0.92	1.04%
2401001050	Varnishes - Semitransparent	3.66	9.76%	1.08	0.31%
2401001050	Waterproofing Sealers	2.19	1.21%	0.54	0.01%
2401001050	Waterproofing Concrete/Masonry Sealers	1.66	4.34%	0.57	1.47%
Total for Paints and coating		-	100.00%	-	100.00%
2401001060	Thinners	0.35	100.00%	-	-
2401001060	Additives	-	-	0.004	100.00%
2401001060	Cleaners	0.11	100.00%	0.11	-

Table 4-10. Emission Factors (lbs/capita-yr)

SCC	Coating Category Description	Solvent Base EF	Water Base EF	Total EF
2401001001	Flat Paints	0.0006	0.2970	0.2976
2401001005	Nonflat Paints - Low Gloss	0.0008	0.1438	0.1446
2401001005	Nonflat Paints - Medium Gloss	0.0163	0.2497	0.2659
2401001006	Nonflat Paints - High Gloss	0.1140	0.0253	0.1393
2401001010	Primers, Sealers, and Undercoats	0.0498	0.1188	0.1685
2401001011	Quick Dry - Primers, Sealers, and Undercoats	0.0565	0.0002	0.0567
2401001015	Stains – Semitransparent	0.4411	0.0007	0.4418
2401001020	Quick Dry – Enamels	0.1779	0.0013	0.1792
2401001025	Lacquers – Clear	0.0176	0.0001	0.0177
2401001050	All Other Architectural Categories*	1.0799	0.0737	1.1536
2401001060	Thinners, Additives, and Clean-up*	0.4735	0.0000	0.4735

*Thinning, additives, and clean-up have the same SCC and all the other architectural coatings also have the same SCC, therefore their emission factors (in lbs /capita-yr.) were calculated separately and then added together for combined totals for each SCC.

The emission factor for flat paints was calculated as:

EF = [(2.75 lbs/gal. x 0.000581 x 138,988,000 gal. / 296,410,404] + [(0.32 lbs/gal. x 0.417213 x 659,448,000 gal. / 296,410,404]
= 0.2976 lbs/capita-year

Equation (2)
Annual emissions from coatings were calculated using the formula:

$$AE_A = (CPOP \times EF_A) / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual VOC emissions per county for surface coating type A in tons/year
CPOP = County population (from Texas Water Development Board[33])
EF_A = Emission factor for architectural surface coatings type A (lbs /capita-year), Table 4-10

As an example of a county-level estimation, the annual emissions of VOCs from lacquers used in Kendall County in 2005 were calculated using the equation:

$$AE_A = (28{,}607) \times (0.0177 \text{ lbs VOC/capita-yr.}) / 2{,}000 \text{ lbs/ton}$$
$$= 0.25 \text{ tons /year}$$

[33] Texas Water Development Board, April, 17. 2006. 2006 Regional Water Plan: County Population Projections for 2000 – 2060. Available online: http://www.twdb.state.tx.us/data/popwaterdemand/2003Projections/Population%20Projections/STATE_REGION/County_Pop.htm

Seasonal Adjustment
For ozone season weekday calculations, seasonal adjustment factors were developed from the quantities of paint, varnish, lacquer and other coatings listed in the quarterly shipment tables of the Census Bureau's *Paint and Allied Products: 2005* report. The ozone season for the AACOG region is April 1 to October 31; therefore the seasonal adjustment factor was determined based on the 2nd and 3rd quarter sales of the "architectural coatings" category. The resulting adjustment factors were averaged and yielded a weighted seasonal adjustment of 1.12 for the 2005 ozone season. Architectural surface coatings are applied 7 days a week. Therefore the activity rate is 365 days/year.

Equation (3)
Ozone season weekday emissions were calculated using the formula:

$$OSE = (AE \times SAF) / AR$$

Where,

OSE = Ozone season weekday emissions
AE = Annual emissions in tons/year, Equation (2)
SAF = Seasonal adjustment factor (1.12)
AR = Activity rate in days/year (365 days)

The VOC emissions estimate, from the use of lacquers in Kendall County during the 2005 ozone season weekday, was calculated as follows:

$$E_{OSW} = (0.25 \text{ tons VOC/year} \times 1.12) / 365 \text{ days/year}$$
$$= 0.0008 \text{ tons VOC/day}$$

Asphalt Paving

Asphalt concrete is grouped into three categories: hot-mix, cutback, and emulsified. Emissions from asphalt paving operations occur when asphalt mixtures are applied and as they cure. Hot-mix asphalt is the most commonly used paving asphalt for surfaces 2 to 6 inches thick. Hot mix application emissions were not calculated for this inventory because the emissions are insignificant.[34] Hot mix asphalt is prepared at asphalt plants and emissions from these plants are in the point source section.

Cutback asphalt is used primarily in tack and seal operations and for priming roadbeds for hot-mix application. Cutback asphalt is prepared by diluting asphalt cement with petroleum distillates. Cutback asphalt has the highest diluent content of the three asphalt categories and emits the highest amount of VOCs per ton used. Adding water and an emulsifying agent, such as soap, produces emulsified asphalt, which usually has 0% to 12% solvents added. Emulsified asphalt is used in most of the same applications as cutback asphalt but is lower emitting, energy saving, and a safer alternative to cutback asphalt.[35]

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[34] U.S. Environmental Protection Agency, January 2001. Emission Inventory Improvement Program (EIIP) - Area Sources, Volume III: Chapter 17: Asphalt Paving. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii17_apr2001.pdf
[35] *Ibid*. p. 17.2-2 – 17.2-3.

Methodology
A survey was distributed to the AACOG county governments, city governments, and businesses that use asphalt for paving operations. The survey inquired about the types and amounts of asphalt used, cure rates, dilute percentage, density/specific gravity and the months during which the asphalt was applied. With this information, EPA AP-42 formulas were used to estimate emissions.

Two methodologies were employed in the calculation of emissions from asphalt paving. The preferred methodology is to use the survey to calculate emission factors. This methodology was utilized for responses in which all data on asphalt use was provided. In cases where only partial data was provided on the returned survey, default emissions factors (EF) were used. Table 4-11 contains the values of selected cure rate for cutback asphalt used in the calculations.[36]

Table 4-11. Cutback Asphalt Cure Rates

Cure Rate	Value (by wt. of diluents evaporate)
Slow*	25%
Medium	75%
Rapid	95%

*Note: Also used for emulsified asphalt

Sample Calculation – Method 1
Equation (1)
To calculate the emission factor, the following formula was used:

$$EF_A = (DEN_A \times DV_A \times CR_A) / 2{,}000 \text{ lbs/ton}$$

Where,
EF_A = Emission factor for asphalt type A (ton/gal.)
DEN_A = Density for asphalt type A, from survey
DV_A = Diluent volume percent for asphalt type A, from survey
CR_A = Cure rate percent for asphalt type A, Table 4-11

Wilson County Precinct 2 used 90 tons of slow set (25%) AE-P emulsified asphalt in 2005. The specific gravity was 0.959 (which is equivalent to a density of 8.00 lbs/gal.), and the dilute volume was 10%. The county used this asphalt during the months of January – December. Emission factor for slow set AE-P emulsified asphalt for Wilson County:

$$EF_A = (8.00 \text{ lbs/gal.} \times 10\% \times 25\%) / 2{,}000 \text{ lbs/ton}$$
$$= 0.0001 \text{ tons/gal.}$$

Equation (2)
Annual VOC Emissions:

$$AE_A = AMT_A \times EF_A$$

Where,
AE_A = Annual VOC emissions for asphalt type A (tons/yr.)
AMT_A = Amount of asphalt for asphalt type A (gallons), from survey
EF_A = Emission factor for asphalt type A (ton/gal), Equation (1)

[36] *Ibid*. p. 17.4-9.

Annual VOC emissions for slow set AE-P emulsified asphalt in Wilson County:

AE_A = (90 tons x 238.10 gal/ton) x 0.0001 tons/gal
= 2.14 tons VOC/yr

Equation (3)
Ozone Season Day VOC Emissions:

$$OSD_A = AE_A \times PER_A / OS$$

Where,

OSD_A = Daily ozone season emissions (tons/ozone season day)
AE_A = Annual VOC emissions of asphalt type A (tons/yr)
PER_A = Percentage of time asphalt type A was used during the ozone season, from survey
OS = Ozone season days (ozone season 214 days/yr.)

Daily ozone season emissions for Wilson County Precinct 2 AE-P emulsified asphalt used for 2005:

OSD = 2.14 tons/yr. x 0.58 / 214 ozone season days/yr.
= 0.0058 tons VOC/ozone season day

Sample Calculation – Method 2

Some survey responses were incomplete. In such instances, a volume based EF was used as illustrated in Table 4-12 from the EIIP, VIII, Ch. 17.[37]

Table 4-12. Asphalt Volume-Based Emission Factors

Asphalt Type	Volume Based* (lbs VOC / Barrel of Asphalt)
Cutback Asphalt	88
Emulsified Asphalt	9.2

*Note: The average density of asphalt is similar to that of water, 8.34 lbs/gal or 1 barrel (42 gallons) of asphalt weighs 350 lbs.

Equation (4)
Annual VOC Emissions formula:

$$AE_A = AMT_A \times EF_A / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual VOC emissions for asphalt type A (tons/yr.)
AMT_A = Amount of asphalt for asphalt type A, from survey
EF_A = Emission factor for asphalt type A (lbs VOC/barrel), Table 4-12

Annual VOC Emissions for 130 gallons of cutback asphalt the City of Bandera used from March - October in 2005:

AE_A = (130 gallons / 42 gal./barrel) x 88 lbs VOC/barrel / 2,000 lbs/ton
= 0.1362 tons VOC /yr.

[37] *Ibid*. p. 17.5-8.

Equation (5)
Ozone Season Day VOC Emissions:

$$OSD_A = AE_A \times PER_A / OS$$

Where,

OSD_A = Daily ozone season emissions (tons/ozone season day)
AE_A = Annual VOC emissions of asphalt type A (tons/yr), Equation (4)
PER_A = Percentage of time asphalt type A was used during the ozone season, from survey
OS = Ozone season days (ozone season 214 days/yr.)

Daily ozone season emissions for City of Bandera for asphalt applied March to October:

OSD = 0.1362 tons VOC /yr. x 0.875 / 214 days/yr.
= 000557 tons VOC/ozone season day

Sample Survey

December 8, 2008

«Company»

«Address», «State» «Zip»

ATTENTION: OPERATIONS MANAGER

The Alamo Area Council of Governments (AACOG) requests your assistance in completion of the 2005 Air Quality Emissions Inventory Asphalt Paving survey. The survey information will be used to assess and quantify emissions from asphalt paving within the AACOG 12-County region. Survey responses are required to obtain accurate local data. The San Antonio region currently risks being declared in non-attainment of federal air quality standards (NAAQS); thus this inventory is a significant part of the emissions management process.

The purpose of this survey is to provide better information and services to the region, as well as help minimize additional regulations on the community. Your response is vital to this process and will enable a more precise emissions inventory for 2005.

To increase the accuracy of this information we ask that you review the attached survey and input the necessary data. You can return it to us in the addressed envelope or fax to (210) 225-5937 attention Donna Hessong, Natural Resources / Transportation Specialist, Alamo Area Council of Governments. Please submit your response by January 20, 2004.

Thank you for your time and participation. If you have any questions or comments please feel free to contact Steven Smeltzer, Environmental Manager, Alamo Area Council of Governments at (210) 362-5266.

Regionally Yours,

Al J. Notzon III
Executive Director

Enclosures (1)

Asphalt Paving Emissions Inventory Survey

Name of Municipality or DOT: ____

Mailing Address: ____

City/ Zip: ________________________ County: ____________________________

Contact Person/Phone Number: ____

The purpose of this survey is to collect information about the amounts and types of asphalt used for paving so those estimates of air pollution from paving operations can be made. Please enter the following information on the attached forms.

List the asphalt types used in the calendar year 2005. Note that Table 1 is for cutback asphalt; Table 2 is for emulsified asphalt. Information about hot-mix asphalt is not needed.

Provide the cure or set rate for each asphalt type.

Provide the amount, in tons, of each asphalt type used. If your agency used subcontractors, please photocopy the survey questionnaire and list the information for each subcontractor. This will help us to avoid double counting the amount and location of asphalt used.

Provide the specific gravity for each asphalt type.

Provide the volume percent of diluents in each asphalt type.

List the specific months during the year that each asphalt type is used (For example April to June).

Asphalt Paving 2005 Emissions Inventory Survey

Identification # or Name	Set Rate*	Amount Used tons	Specific Gravity	Diluent Content Volume %	Months of the Year Used

* Rapid, medium, slow

Asphalt Roofing

Asphalt roofing is the nation's most popular choice for the roofing of industrial, commercial, and residential buildings. Asphalt roofing can be found in four products: shingles, residential roll roofing, built-up roofing, and modified bitumen membranes. Emissions are released during manufacturing as well as the application of these materials in roof construction.[38] For this section, only the application of asphalt roof in construction was analyzed in assessing emissions.

Methodology

The methodology for determining the usage of asphalt roofing in the AACOG region was based on the methodology used by Sonoma Technology Inc (STI) for California Air Resource Board.[39] Figures of asphalt usage for the state of Texas were based on Energy Information Administration (EIA) "Petroleum Supply Annual.[40] EIA reports asphalt and road oil usage in thousand of barrels by Petroleum Administration for Defense Districts (PADD). The 2005 usage of Asphalt and Road Oil in PADD 3 was 34,908,000 barrels asphalt and road oil for the states of Texas, Alabama, Arkansas, Louisiana, Mississippi, and New Mexico. Asphalt and Road Oil use for PADD 3 was allocated to each state based on the value of construction work for remodeled homes, residential construction, and commercial building construction from the 2002 Economic Census (Figure 4-13).[41] Texas accounted for 67.5% of total value of construction work in PADD 3, or 23,576,036 barrels of asphalt and road oil.

Asphalt and Road Oil was split between asphalt use is for road paving (80%) and roofing (20%) based on the Tasker estimations.[42] This is similar to results found by Usmani *et. al*. (16.7%)[43] and a literature reviewed by Hardison *et. al*. (15.3% to 19.7%).[44] Using the 20 percent factor, the amount of asphalt used for roofing in Texas is 4,715,207 barrels.

After the amount of roofing asphalt used in Texas was determined, usage rates per county were calculated (Table 4-16). The estimated apportionment factor (0.0895) for roofing asphalt usage within the Alamo Area Council of Governments (AACOG) region was determined using 2004 County Business Patterns, Construction of Buildings employment (NAICS 236).[45] Of the 4,715,207 barrels of roofing asphalt used in Texas, 421,829 barrels were used in the AACOG

[38] Arma Online. Asphalt Roofing Manufacturers Association. July. 12, 2004. Roofing Basics. Available online: http://www.asphaltroofing.org/
[39] Sonoma Technology Inc., March 7, 2003. Attachment C: Asphalt Paving and Roofing. California Air Resource Board, Sacramento, California. Available online: http://www.arb.ca.gov/ei/areasrc/ccosmethods.html
[40] Energy Information Administration, October 10, 2006. Petroleum Supply Annual 2005, Volume 1 Released: Table 7. PAD District 3 -- Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, 2005. U.S. Department of Energy, Washington, DC. Available online: http://www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/psa_volume1.html
[41] U.S. Census Bureau, 2004. 2002 Economic Census Industry Series Reports, Construction: General Statistics for Establishments by State: 2002 Value of Construction Work. Economic Census. Available online: http://www.census.gov/econ/census02/guide/INDRPT23.HTM
[42] Tasker, Nasreen P. 1996. What do the cards hold for the asphalt industry?. Presentation at the joint meeting of the International Slurry Surfacing Association and the Asphalt Emulsion Manufacturers Association, Phoenix, Arizona. Available online: http://www.srv.net/~whone/ia/iagen.html
[43] Usmani, A. M., Gorman, W. B., March 1995. American Chemical Society Meeting. Rubber Division, Philadelphia, PA
[44] Hardison, Karla and John C. Gott. 2000. Emission Calculations For Asphalt Roofing. TCEQ.
[45] U.S. Census Bureau, July 14, 2006. County Business Patterns 2004, Construction of Buildings (NAICS 236). Available online: http://www.census.gov/epcd/cbp/view/cbpview.html

region. This is similar to the method proposed by Funk *et. al.* in the report "Development of gridded spatial allocation factors for the state of California."[46] Funk *et. al.* states that socioeconomic surrogates, such as construction activity, can be use to apportioned asphalt roofing emissions by county.

Table 4-13. Construction Work Values (Million US Dollars) by State, 2002

Type of Construction	Texas	Alabama	Arkansas	Louisiana	Mississippi	New Mexico	Total
Remodeled	2,118,938	3,065	1,425	2,467	947	1,830	2,128,672
Operative Builders	15,081,415	1,110,839	222,740	513,084	366,804	682,726	17,977,608
Single Family Housing	3,338,048	621,596	252,772	367,627	202,437	440,864	5,223,344
MultiFamily Housing	891,559	1,684,500	-	-	-	-	2,576,059
Commercial and Institutional	17,571,231	4,087,391	1,763,211	2,902,362	2,017,236	1,111,735	29,453,166
Industrial Building	1,130,143	931,709	-	-	-	-	2,061,852
Total	40,131,334	8,439,100	2,240,148	3,785,540	2,587,424	2,237,155	59,420,701
Percentage of Total	67.5%	14.2%	3.8%	6.4%	4.4%	3.8%	100.0%

Other apportion factors for roofing asphalt by 2004 employment in "roofing, sliding, & sheet metal contractors" - NAICS 238160 (0.1082)[47], 2005 annual new private-owned residential building permits by number of units (0.1219)[48], and 2005 annual new private-owned residential building permits by construction cost (0.1178)[49] were calculated. All four methodologies for apportionment yielded similar results in the AACOG region. It was determined that using employment for the construction of buildings from 2004 County Business Patterns was the most complete and accurate method because every county was included and commercial building construction is taken into account.

An average emission factor of 4 lbs per ton of asphalt was used to calculate both hot and cold application emissions. The factor was published in Hardison, Karla and John C. Gott's 2000 study on "Emission Calculations For Asphalt Roofing".[50] The Emission Inventory Improvement Program (EIIP) estimated a higher emission factor of 6.2 pounds VOC/ton of asphalt melted[51]

[46] Funk T.H., Stiefer P.S., and Chinkin L.R., July 2001. Development of Gridded Spatial Allocation Factors for the State of California. Technical memorandum prepared for California Air Resources Board, Sacramento, CA by Sonoma Technology, Inc., Petaluma, CA, STI-900201/999542-2092-TM. Available online: http://www.arb.ca.gov/airways/CCOS/docs/I4_0024_Jul01_tm.pdf

[47] Texas Workforce Commission, 2005, Employment Data for 3rd quarter 2004. Austin, Texas.

[48] U.S. Census Bureau, 2006. Manufacturing, Mining, and Construction Statistics: Building Permits. Available online: http://www.census.gov/const/www/permitsindex.html

[49] *Ibid.*

[50] Hardison, Karla and John C. Gott. 2000. Emission Calculations For Asphalt Roofing. TCEQ.

[51] Emission Inventory Improvement Program, Sept. 2000. Area Source Category Method Abstract – Asphalt Roofing Kettles. Environmental Protection Agency. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/asphalt.pdf

and an emission factor of 6 pounds VOC/ton of asphalt melted was reported by Kariher, *et. al*.[52] However, Hardison, Karla and John C. Gott determined the 6.2 and 6 pounds emission factors were too high.

Table 4-14. Building Construction Employees (NAICS 236) and Roofing Asphalt Apportionment Factor for 2004 and 2005 Roofing Asphalt (Barrels) by County

County	FIPS	Building Const. Employees	Apportionment Factor	Roofing Asphalt, 2005
Atascosa	48013	135	0.0014	6,673
Bandera	48019	49	0.0005	2,422
Bexar	48029	6,455	0.0677	319,066
Comal	48091	529	0.0055	26,148
Frio	48163	26	0.0003	1,285
Gillespie	48171	151	0.0016	7,464
Guadalupe	48187	385	0.0040	19,030
Karnes	48255	14	0.0001	692
Kendall	48259	116	0.0012	5,734
Kerr	48265	536	0.0056	26,494
Medina	48325	76	0.0008	3,757
Wilson	48493	62	0.0006	3,065
AACOG		8,534	0.0895	421,829
Texas	48000	95,393	1.0000	4,715,207

Sample Calculation
Equation (1)
Calculate the amount of asphalt used in the state:

TAR = PADD x (TCO / PCO)

Where,

TAR = Amount of asphalt barrels used in Texas
PADD = Amount of Asphalt and Road Oil used in PADD district 4 (34,908,000 barrels)
TCO = Value of construction work in the state, Table 4-15
PCO = Value of construction work in PADD, Table 4-15

Amount of asphalt used in Texas, which is in PADD3 (34,908,000 barrels):

TAR = 34,908,000 barrels x ($40,131,334,000 / $59,420,701,000)
= 23,576,036 barrels of asphalt

Equation (2)
Amount of roofing asphalt used by each county:

$CARA_A$ = TAR x ROOF x (EMP_A / TEMP)

[52] Kariher, P. et al. 1991. Evaluation of VOC Emissions from Heated Roofing Asphalt. EPA-600/2-91-061 (NTIS PB92-115286). US EPA, Research Triangle Park, NC.

Where,

$CARA_A$ = Amount of roofing asphalt used for county A
TAR = Amount of asphalt and road oil used in Texas, Equation (1)
ROOF = Percentage of roofing asphalt (0.20)
EMP_A = Employment in the construction of buildings for county A, Table 4-16
TEMP = Employment in the construction of buildings for Texas, Table 4-16

The amount of asphalt and road oil used in Texas is 23,576,036 barrels. The amount of roofing asphalt used in Bandera County in 2005:

$CARA_A$ = 23,576,036 barrels x 0.20 x (49 / 95,393)
= 2,422 barrels

Equation (3)
Annual VOC emissions from asphalt:

AE_A = $CARA_A$ x BAR x (GAL / 2,000 lbs/ton) x (EF / 2,000 lbs/ton)

Where,

AE_A = Annual VOC emissions for county A from asphalt
$CARA_A$ = Amount of asphalt roofing used for county A, Table 4-16
BAR = Gallons of asphalt per barrel (42 gal./barrel)
GAL = Pounds of asphalt per gallon (8.34 lb./gal)
EF = Emission Factor for roofing asphalt (4 lbs per ton of asphalt)

The following equation was used To calculate asphalt roofing emissions in Bandera County:

AE_A = 2,422 barrels/yr. x 42 gal./barrel x (8.34 lbs/gal / 2,000 lbs/ton) x (4 lbs VOC/tons asphalt / 2,000 lbs/ton)
= 0.85 tons VOC/yr.

Seasonal Adjustment
The seasonal adjustment factor is 1. Asphalt Roofing operations have a daily adjustment factor of 261 days per year (5 days a week).

Automobile Body Incineration

According to the EPA AP-42 guidelines, automobile body incineration "is rarely practiced today." Rather than being destroyed in an incinerator, vehicles are much more likely to be shredded or crushed and used for scrap metal. A SIC code search of the 2004 Texas Workforce Commission files was conducted to determine if incineration activities occurred in the AACOG region. In addition, an on-line search of the TCEQ-permitted facilities was conducted. Of the few disposal/incinerator sites identified using these search methods, none were listed as automobile incinerators. Consequently, no emissions were calculated for this category.

Auto Body Refinishing

Automobile refinishing shops are business establishments that perform replacement, repair, or refinishing of vehicles, which must be regulated for VOC emissions. These emissions can be most accurately calculated via the material balance method. Since the emissions come from solvents in automotive paint, calculating the emissions from the amount of paint consumed by the shops is accurate methodology to estimate emissions. Each shop records the amount of paint used and the amount of solvent in the paint. With this information, a precise estimate of emissions released into the air can be generated. Shop emissions based upon average paint sales for auto body shops categorized by annual sales is the objective of this effort to characterize emissions typical from these shops.

Methodology
Emission calculations from auto body repair shops in the AACOG 12-county region were performed utilizing employment numbers provided by the Texas Workforce Commission[53], US Census County Business Patterns[54], and emission factors provided by ENVIRON.[55] The number of employees for each county is contained in Table 4-17. Since Texas Workforce Commission employment database sometimes misses employment from business that do not report, employment figures were compared to the County Business Patterns database. The bolded value for each county, which is the highest known value, was the value used in the calculation.

Table 4-15. Automobile Refinishing Shops Employment by County

County	FIPS	2004 Texas Workforce Employment	2003 County Business Patterns Employment
Atascosa	48013	32	**53**
Bandera	48019	**9**	0-19
Bexar	48029	1,319	**1,564**
Comal	48091	**175**	58
Frio	48163	0	**0**
Gillespie	48171	**18**	0-19
Guadalupe	48187	82	**99**
Karnes	48255	**4**	0-19
Kendall	48259	**22**	20-99
Kerr	48265	**50**	20-99
Medina	48325	**9**	0-19
Wilson	48493	**15**	12

Emissions factors were calculated based on total revenue for each auto body shop. Revenue for each facility was determined by estimating that each employee generated $100,000 of revenue. For the twelve AACOG counties, revenue for each body shop was determined by multiplying employment numbers by $100,000. The emission factors were then allocated per auto body shop based on annual revenue and size of the shop. Table 4-18 lists the emission factors used for estimating auto body repair emissions. Once the auto body shops' facility size and emission factors were determined, the number of shops were grouped according to facility size and multiplied by their respective emission factor. The following equation details how VOC emissions were calculated.

[53] Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.
[54] U.S. Census Bureau, September 16 2005. County Business Patterns, 2003. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html
[55] ENVIRON, Aug. 2001. Austin Emission Inventory - Chapter 2.0: 1999 Area Sources Methodology. Novato, CA.

Table 4-16. Auto Refinishing / Coating Emission Factors

Facility Size Classes	Very Small	Small	Medium	Large	Very Large	Mega Size
Annual Revenue(s)	<$200k	$200-400k	$400-600k	$600-1,000k	$1.0 - 2.4M	$2.5 - 4.9M
Total Employee	1	2-3	4-6	7-9	10-24	> 24
EF (lbs VOC/year)	610	1,360	2,025	3,530	7,501	16,326

Sample Calculation
Equation (1)
Revenue determination:

$$AR_A = NE_A \times RPE$$

Where,

AR_A = Annual revenue for Autobody Shop A
NE_A = Number of employees for Autobody Shop A
RPE = Revenue per employee ($100,000)

Annual revenue for an auto body shop in Bexar County that had 15 employees in 2005:

AR = 15 x $100,000
= $1,500,000

Based on Table 4-18, facilities with annual revenue of $1,500,000 are classified as "Very Large". Therefore, the emissions from this facility are 7,501 lbs of VOC per year.

Equation (2)
Annual VOC emissions:[56]

$$EA = \sum [(FAC_{IAS} \times EF / 2{,}000 \text{ lbs/ton}) - E_{PSS}] \times [(1-(CE \times RP \times RE)]$$

Where,

EA = Annual emissions for the inventory area (tons VOC/yr.)
FAC_{IAS} = Number of facilities by size class within the inventory area
EF = Facility size-specific emission factor (lbs/facility-yr.), Table 4-18
E_{PSS} = Annual uncontrolled emissions of point sources in the inventory area for facility size class of interest (tons VOC /yr.)
CE = Control effectiveness (fraction) of applicable rules
RP = Rule penetration (fractions) of applicable rules
RE = Rule effectiveness (fraction) of applicable rules

Annual VOC emissions for Atascosa County, which could have 1 "very large" autobody shop, 1 "large" autobody shop, 2 "medium" autobody shops, and 1 "very small" autobody shop:

[56] ENVIRON International Corporation, E.H. Pechan & Associates, Inc., Pollution Solutions, and Starcrest Consulting, August 2001, 31. Area and Mobile Source Emissions Inventory Technical Support Project: 1990-2010 Emission Inventory Trends and Projections. Novato, CA. p. 2-27. Available online: http://www.tceq.state.tx.us/assets/public/implementation/air/am/contracts/reports/ei/ei_trends_1990_2010-environ.pdf

EA = ({[(1 x 610) / 2,000] - 0} x [1 - (0 x 0 x 0)]) + ({[(2 x 2,025) / 2,000] – 0} x [1 – (0 x 0 x 0)]) + ({[(1 x 3,530) / 2,000] – 0} x [1 – (0 x 0 x 0)]) + ({[(1 x 7,501) / 2,000] – 0} x [1 – (0 x 0 x 0)])
= 7.85 tons VOC/yr.

To assure the quality of the emission estimation, minor point sources were cross-referenced with area sources to ensure no double counting.

Seasonal Adjustment
Once the amount of VOC in tons per year was determined, emissions were seasonally adjusted to reflect typical ozone season day. The seasonal adjustment factor is 1.072 and the activity rate is 250 days.[57] The number of days was used to account for a 5-day week for 50 weeks of the year.

Equation (3)
Daily ozone season emissions (tons/day):

ED = (EA x SAF) /AR

Where,

ED = Ozone season day emissions (tons/day)
EA = Annual area source emissions (tons VOC/yr)
SAF = Seasonal adjustment factor (1.072)
AR = Activity rate (250 days/yr)

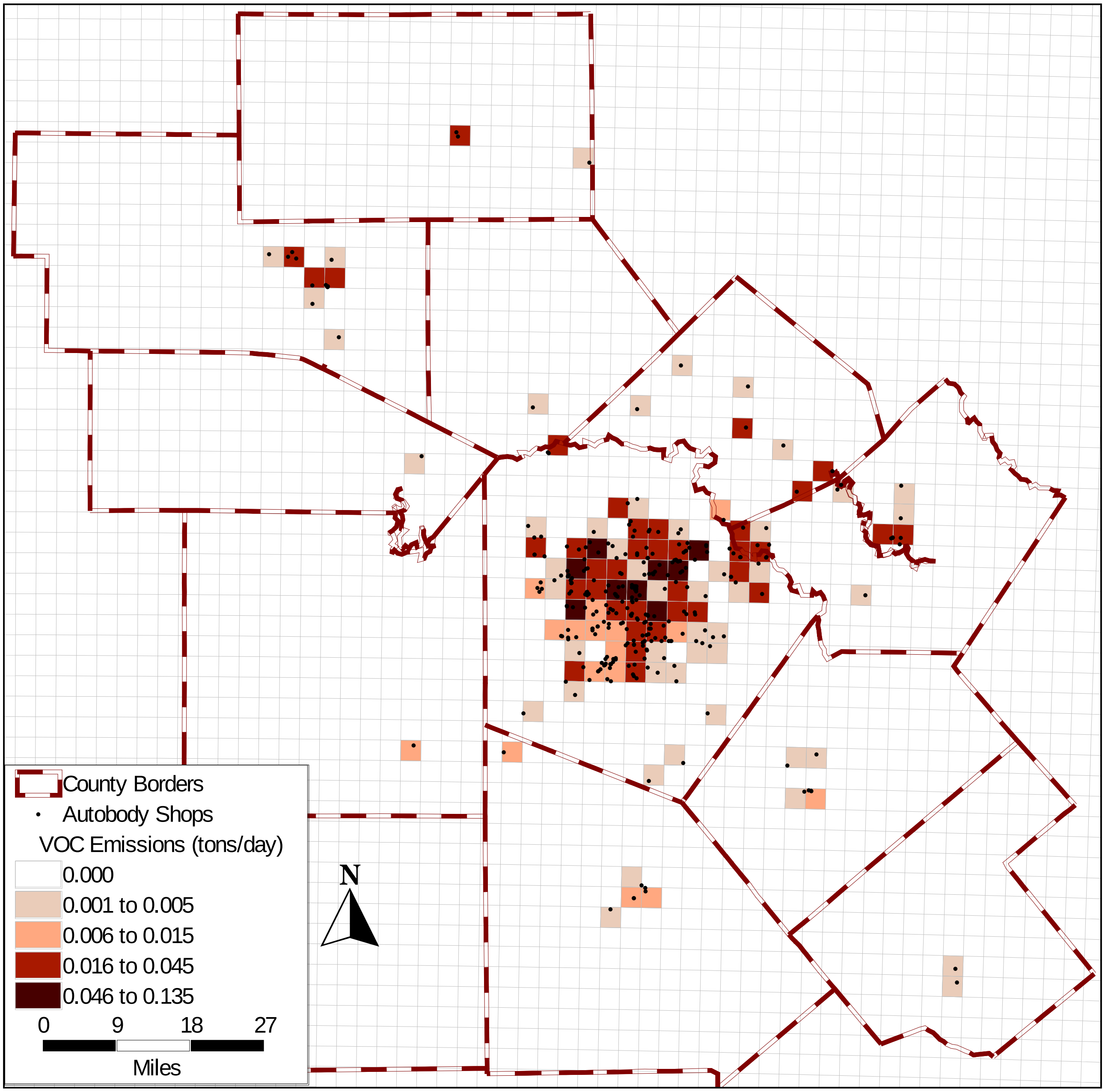
Daily ozone season emissions for Atascosa County:

ED = (7.85 tons VOC/yr. x 1.072) / (250 days/yr)
= 0.03364 tons VOC/day

Spatial Distribution
Emissions are allocated on the 4km grid by the location of the auto body shops (Figure 4-4).

[57] _Ibid_., p. 2-26.

Figure 4-4. VOC Emissions From Auto Body Shops, 2005



Plot Date: February 9, 2006
Map Compilation: February 9, 2005
Source: Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.

Bakeries

The primary VOC emitted from bakeries is ethanol, which is formed from yeast leavening of baked goods at commercial and retail bakeries. Bakery products that are yeast leavened include bread, bread-type rolls, pretzels, and sweet yeast goods such as doughnuts. There are two basic types of yeast dough mixing processes used in bakeries: sponge-dough and straight dough. During straight-dough leavening (used less by commercial bakers) ingredients are mixed, the yeast is allowed to ferment, and then the bread is baked. The sponge-dough process uses a larger amount of yeast to start the bread, but a smaller portion of other ingredients until baking.[58]

To calculate area source emissions for bakeries, per employee EF method was employed. The businesses using yeast products were identified for each county using SIC codes 2051 (commercial) and 5461 (retail) in table 4-19. Grocery stores with bakeries located inside were also included in the area source emissions (SIC code 5411). Texas Workforce Commission[59] and US Census County Business Patterns[60] provided data on the number of employees by SIC codes for each category. Bakery point sources were subtracted from the employment to prevent any overlapping.

Table 4-17. Bakery SIC and NAICS Codes

Type of Bakery	SIC	NAICS
Commercial bakeries	2051	311812
Retail bakeries	5461	311811, 445291
Grocery stores	5411	445110, 452910

Methodology – Commercial Bakery Emissions

For SIC codes 2051 and 5461, the total number of employees for each bakery were added and used to estimate the emissions for each county. The number of employees in each county is multiplied by per employee emission factor of 0.11 tons of VOC.

Sample Calculation

Equation (1)

Annual VOC emissions for bakeries in county A:

$$AE_{COM.} = EMP_A \times EF$$

Where,

$AE_{COM.}$ = Annual emissions from commercial bakeries for county A (tons VOC /yr.)

EMP_A = Total number of bakery employees for county A

EF = Per employee VOC emission factor (0.11 tons VOC/emp.)

Annual VOC emissions for commercial bakeries in Gillespie County:

$$AE_{COM.} = 25 \text{ employees} \times 0.11 \text{ tons VOC/emp.}$$

[58] Adams, Lucy. April 1992. VOC Emissions from Bakeries. Radian Corporation, Memorandum to USEPA. Research Triangle Park, N.C.

[59] Texas Workforce Commission, 2005, Employment Data for 3rd quarter 2004. Austin, Texas.

[60] U.S. Census Bureau, September 16 2005, County Business Patterns, 2003. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.

$= 2.75$ tons of VOC/yr.

Methodology – Grocery Store Bakery Emissions

For grocery store (SIC 5411), major grocery store chains were contacted to determine the number of employees working in the bakery section of each store. The number of employees provided was compared to the total amount of employees in each store using the Texas Workforce Commission database. An average percentage of bakery employees was calculated from the telephone survey and used for all remaining grocery stores. Based on this method, 5.4% of the grocery store employees are in the bakery section. The number of grocery store employees was multiplied by 5.4% and by the 0.11 tons of VOC/person/year emission factor to calculate bakery emissions.

Sample Calculation

Equation (2)

Annual tons of VOC emitted from grocery store bakeries in county A:

$$AE_{GROC} = GEMP_{A} \times EF \times PBE$$

Where,

$AE_{GROC.}$ = Annual emissions from grocery store bakeries for county A (tons VOC /yr.)
$GEMP_{A}$ = Total number of grocery store employees in county A
EF = Per employee VOC emission factor (0.11 tons VOC/emp.)
PBE = 5.4% of grocery store employees are in the bakery section, from survey

Gillespie County has 249 grocery store employees:

$$AE_{GROC.} = 249 \times 0.054 \times 0.11 \text{ tons VOC/employee/yr.}$$
$$= 1.48 \text{ tons VOC/yr.}$$

Methodology – Total Bakery Emissions

Emissions for the commercial and grocery store bakeries were added together to determine total emissions by county.

Sample Calculation

Equation (3)

Total annual VOC emissions for county A:

$$TAE = AE_{COM.} + AE_{GROC.}$$

Where,

TAE = Total annual emissions for bakeries in county A (tons VOC/yr)
$AE_{COM.}$ = Annual emissions from commercial bakeries for county A (tons VOC /yr)
$AE_{GROC.}$ = Annual emissions from grocery store bakeries for county A (tons VOC /yr)

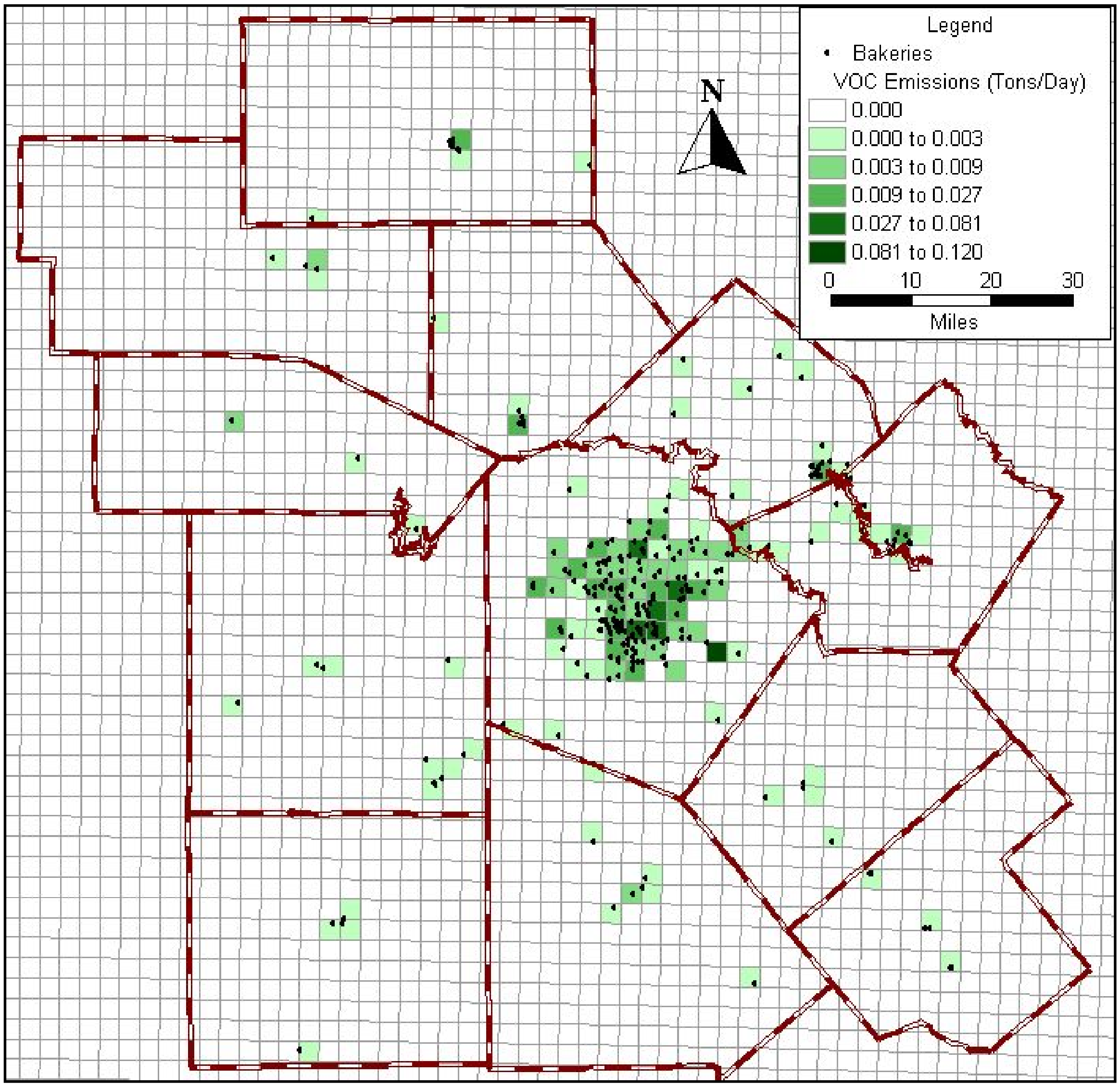
Total VOC emissions from all bakeries in Gillespie County for 2005:

$$TAE = 2.75 \text{ tons VOC/yr.} + 1.48 \text{ tons VOC/yr.}$$
$$= 4.23 \text{ tons VOC/yr.}$$

Seasonal Adjustment
The seasonal adjustment factor is 1. Bakeries have a weekly adjustment factor of 365 days per year (open 7 days a week).

Spatial Distribution
Emissions are allocated on the 4km grid by the location of the bakeries (Figure 4-5).

Figure 4-5: VOC Emissions from Bakeries, 2005



Plot Date: July 26, 2006
Map Compilation: July 26, 2006
Source: Bakeries locations were provided by Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.

Breweries

Breweries are emitters of VOC's (including ethanol, acetate, myrcene, etc.) due to the various steps utilized in the manufacturing of beer.

Methodology
Emission factors are based on brewery size: 4.17 lbs VOC / 1000 barrels for "large" breweries >60,000 barrels per year and 56.8 lbs VOC / 1000 barrels for "small and micro" <60,000 barrels per year.[61] To determine VOC emitted per year, production levels were multiplied by the suitable emission factors. Brewery productions were obtained from a number of sources and are listed in table 4-20. When production figures were not accessible, best estimates were used based on the whether it was considered a brewpub (~ 250 barrels / year)[62] or microbrewery (~ 2,000 barrels / year).

Sample Calculation
Equation (1)
Annual VOC emissions from breweries in County A:

$$AE_A = \sum PA \times EF / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual VOC emissions from breweries for County A (tons VOC/yr)
PA = Production amounts per brewery (barrels/yr), Table 4-20
EF = Emission factor by brewery size (56.8 lbs VOC/1000 barrels or 4.17 lbs VOC/1000 barrels depending on the size of the brewery)

Annual emissions for breweries in Gillespie County:

$$AE_A = [(1{,}000 \text{ barrels/yr.}) \times 56.8 \text{ lbs} / 1{,}000 \text{ barrels} / (2{,}000 \text{ lbs/ton})] + [(250 \text{ barrels/yr.}) \times 56.8 \text{ lbs} / 1{,}000 \text{ barrels} / (2{,}000 \text{ lbs/ton})] = 0.04 \text{ tons VOC/yr.}$$

Equation (2)
Daily VOC emissions for County A based on 365 activity days per year:

$$DE_A = AE_A / DAY$$

Where,

DE_A = Daily VOC emissions for breweries in County A (tons VOC/day)
AE_A = Annual VOC emissions from breweries for County A (tons VOC/yr), Equation (1)
DAY = Number of Activity days per year (365 days/yr)

Daily VOC emissions for breweries in Gillespie County:

$$DE_A = 0.04 \text{ tons VOC/yr} / 365 \text{ days/yr} = 0.0001 \text{ tons VOC/day}$$

[61] Radian Corporation.1992. VOC Emissions from Breweries, (EPA contract No. 68-D0-0125). Office of Air Quality Planning and Standards. U.S. Environmental Protection Agency. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/ttn/chief/old/memos/ef/brew_feb1992.pdf
[62] Sound Brewing System, Inc. 2007. Industry Info., Standards, Statistics, and Conversion Factors. Available online: http://www.soundbrew.com/standards.html

Table 4-18. Annual Production of Breweries in the AACOG Region, 2005

Brewery	County	Production Amount (barrels/yr)
Blue Star Brewery[63]	Bexar	2,000
Dodging Duck Brewhaus[64]	Kendall	200
Faust Brewing[65]	Comal	1,000
Fredericksburg Brewing Co. Inc.[66]	Gillespie	1,000
Furstenbrau Brewing Co	Bexar	2,000
Lindigs Restaurant & Bar	Gillespie	250
Pabst Brewing Company[67]	Bexar	1,468
Pete's Brewing Co. Inc. (Gambrinus Co.)	Bexar	2,000
Broadway Brew Haus	Bexar	250
Cementville Laboratory & Café*[68]	Bexar	250
Anheuser Busch (Sea World)[69]	Bexar	2

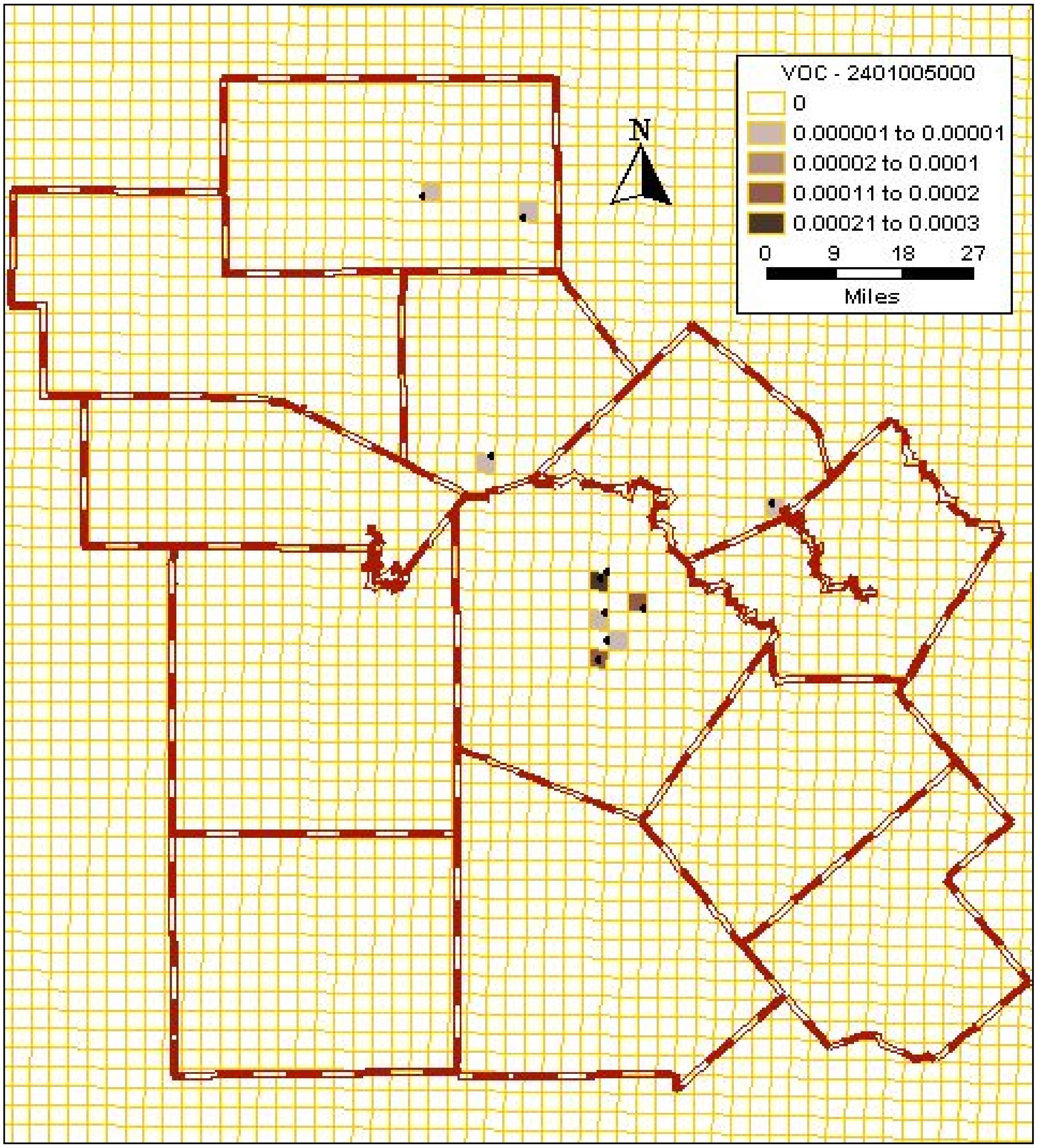
*Note: Production level was not published, but Cementville Laboratory & Café is a brewpub.

Seasonal Adjustment
The seasonal adjustment factor is 1.

Spatial Distribution
Emissions are allocated on the 4km grid by the location of breweries (Figure 4-6).

[63] Beer Expedition. Texas Breweries. Available online: http://beerexpedition.com/tx/b_00455.shtml
[64] Beer Me. March 2007. Breweries in Texas: Dodging Duck Brewhaus. Available online: http://www.beerme.com/breweries/us/tx/4698.shtml
[65] The Faust Hotel. Faust Brewing Co. Inc. Available online: http://www.fausthotel.com/brewcompany.html
[66] Beer Me. October 2005. Breweries in Texas: Fredericksburg Brewing Co. Inc. Available online: http://www.beerme.com/breweries/us/tx/index.shtml
[67] Beer Me. January 2007. Breweries in Texas: Pabst Brewing Co. Inc. Available online: http://www.beerme.com/breweries/us/tx/index.shtml
[68] Beer Expedition. Texas Breweries. Available online: http://beerexpedition.com/tx/b_02473.shtml
[69] Texas Alcoholic Beverage Commission. Phone Communication. Austin, Texas.

Figure 4-6. VOC Emissions from Breweries, 2005



Plot Date:	May 07, 2007
Map Compilation:	May 07, 2007
Source:	Texas Alcoholic Beverage Commission, 2005

Catastrophic Spills and Accidental Releases

Accidental spills and releases of petroleum products or other chemicals can come from sources such as tanker trucks, refueling stations, railroad accidents, or ruptured pipelines. Factors affecting emissions include the type of fuel, petroleum product, or chemical spilled and the amount spilled.

Methodology
Information on spills in the region was acquired through the National Response Center.[70] Spills were categorized by several different factors, such as date, material, amount, and the county where the spill occurred. The materials were sometimes labeled as unknown or the amount as zero, making it difficult to estimate the amount of substances actually spilled. No emissions were calculated for materials that were listed as unknown or zero.

Emission estimates are based on the density of the material spilled in Table 4-21 and the percent that will evaporate. Estimates are that 10% of crude lost will evaporate, 20% of gas well liquid (condensate) and diesel will evaporate, and 100% of gasoline.[71] Evaporation amounts (in gallons) were obtained by multiplying the amount of the substance spilled by the percentage that would evaporate into the atmosphere.

The total emissions released for each accident was obtained by multiplying the amount of the substance spilled (in gallons), by the evaporation percent, and by the density of the material (lbs /gal.).[72] The total emission in tons per year for each county was obtained by taking the sum of all the individual accidental releases that occurred in that county. The ozone season emissions in tons per day for each county were calculated by dividing the total tons spilled from April 1 to October 31, 2005 for each county by 214 days (the number of days in the ozone season).

Sample Calculation
Equation (1)
Emissions released per year:

$$EA = (GS \times EP \times D) / 2{,}000 \text{ lbs/ton}$$

Where,

EA = Total emissions released per accident (tons)
GS = Gallons spilled (from the National Response Center)
EP = Percent evaporated (10% for crude, 20% for gas well liquid, 100% for petroleum products)
D = Density of material (lbs/gal), Table 4-21

[70] National Response Center, August 7, 2006. Download NRC Data. Available online: http://www.nrc.uscg.mil/foia.html
[71] Pollution Solutions, December 1998. Tyler/Longview/Marshall Flexible Attainment Region Emissions Inventory Ozone Precursors, VOC, NOx and CO 1996 Emissions. Cedar Park, Texas, p. 28.
[72] *Ibid.*

Table 4-19. Density of Materials Spilled in the AACOG Region

Material Spilled	Specific Gravity	Density (lbs/gal)
*Acetone[73]	0.79	6.6
Aviation Fuel[74]	-	5.9
*Gasoline: Automotive (Unleaded)[75]	0.72	6.0
Jet Fuel: JP-8[76]	-	5.5
*MC 50 Road Sealer[77]	1.18	9.8
*Nitric Oxide[78]	1.04	8.7
Oil: Diesel[79]	-	6.6
Oil, Misc.: Fuel: 2-D[80]	-	6.1
Oil, Misc.: Hydraulic[81]	-	7.1
*Oil, Misc.: Motor[82]	0.88	7.3
Oil, Misc.: Transformer[83]	-	7.4
*Propane[84]	0.51	4.9

*Indicates that the density was calculated from the specific gravity.

[73] Mallinckrodt Baker Inc., May 20, 2004. Material Safety Data Sheet for Acetone (MSDS No. A0446. Phillipsburg, New Jersey. Available online: http://www. jtbaker.com/msds/englishhtml/A0446.htm

[74] Chevron U.S.A. Inc., 2005. Aviation Fuels Technical Review ,(FTR-3). Global Aviation Headquarters, Houston, Texas, p. 3. Available online: http://www.chevron.com/products/prodserv/fuels/bulletin/aviationfuel/2_at_fuel_perf.shtm

[75] CHS Inc., January 3, 2007. Material Safety Data Sheet for Regular, Midgrade, & Premium Unleaded Gasoline (MSDS No. 0147-M6A0-Rev. G). St. Paul, Minnesota, p. 4. Available online: http://www.cenex.com /%5CLinkedContent%5CPDF%5CRF%5CMSDS%5CUNLEADED-GASOLINE.pdf

[76] Chevron U.S.A. Inc., 2006. Material Safety Data Sheet: JP 8. Global Aviation Headquarters, Houston, Texas. Available online: http://www.chevronglobalaviation.com/docs/jp8.doc

[77] Henry Co., July 25, 2006. Material Safety Data Sheet – OSHA 174 for HE200 Driveway Asphalt Sealer. El Segundo, California, p. 1. Available Online: http://www.henry.com/fileadmin/pdf/msds/HE200_msds.pdf

[78] CFC StarTec, July 3, 2004. “Nitric Oxide Profile”. Available online: http://www.c-f-c.com/specgas_products/nitric_oxide.htm

[79] ExxonMobil Oil Corporation, September 30, 2001. Material Safety Data Bulletin for N9000 Diesel Engine Oil. Environmental Health and Safety Dept., Clinton, Virginia, p. 4. Available online: http://www.host1.exxonmobil.com/psims/AlternateFormat.aspx?DocumentID=83718&DocumentFormat=RTF

[80] ExxonMobil Oil Corporation, April 3, 2005. Material Safety Data Bulletin for Diesel #2 On-road (Low Sulfur). Environmental Health and Safety Dept., Clinton, Virginia, p. 5. Available online: http://www.host1.exxonmobil.com/psims/AlternateFormat.aspx?DocumentID=82412&DocumentFormat=RTF

[81] Exxon Mobil Corp., 2001. Mobil SHC 500 Series: Hydraulic Oils. Houston, Texas, p.3. Available online: http://www.mobil.com/USA-English/Lubes/PDS/glxxenindmombil_shc_500.pdf

[82] ChevronTexaco Global Lubricants, November 17, 2005. Material Safety Data Sheet for ChevronDelo 100 Motor Oil (MSDS No. 7329). ChevronTexaco Energy Research & Technology Company, Richmond, California. Available online: http://www.chevrondelo.com

[83] Conoco Phillips Company, April 2005. Transformer Oil. Houston, Texas, p. 2. Available online: http://www.phillips66lubricants.com/NR/rdonlyres/76E8776D-5CA-4F27-89DD-6B6FA657F93F/0/66_Transformer_Oil.pdf

[84] Praxair Inc., September 2004. Praxair Material Safety Data Sheet for Propane (MSDS No. P-4646-F). Danbury, Connecticut, p. 4. Available online: http://www.praxair.com/praxair.nsf/AllContent/E503213220BB051585256A860081E838/$File/p4646f.pdf

Bexar County, February 13, 2005, Jet Fueled: 165 gallons of JP-8 Spilled:

EA = (165 gallons x 100% x 5.5 lbs/gal.) / 2,000 lbs
= 0.45 tons VOC/year

Equation (2)
Emissions released per day:

ED = ES / OSD.

Where,

ED = Emission released per day
ES = Total emissions released per accident (tons) from April 1 to October 31, 2005 (from the National Response Center)
OSD = Number of Days in the Ozone season (214 days/year)

Bexar County September 28, 2005, Oil Fuel: 7200 gallons of No. 2-D spilled:

ED = (4.32 tons/yr.) / 214 ozone season days/yr.
= 0.020 tons VOC/ozone season day

Commercial Cooking

Commercial cooking activities can produce criteria pollutants (such as VOC and CO). Based on tests conducted by the EPA and other environmental agencies, the major source for most commercial cooking emissions is from the cooking of meat. The type of equipment used to cook also plays a large factor in the amount of emissions released by restaurants. The commercial cooking EI includes five types of restaurants: ethnic cuisine, fast food, family, seafood, and steak houses and bar-b-que restaurants. These types of restaurants were chosen because they often use emission emitting cooking equipment and represent most of the restaurants in the region.

Methodology

Commercial cooking emissions were estimated for five equipment types: chain-driven (conveyorized) charbroilers (SCC 2302002100), under-fired charbroilers (SCC 2302002200), deep-fat fryers (SCC 2302003000), flat griddles (SCC 2302003100), and clamshell griddles (SCC 2302003200). The emissions for each equipment type are based on the amount and type of meat cooked. Emissions for deep-fat frying of french fries were also estimated. The methodology used to calculate commercial cooking operations emissions is based on E.H. Pechan and Associates report[85] completed for the U.S. Environmental Protection Agency (EPA).

Local restaurants were located through the yellow pages and sorted into the five types of restaurants (Table 4-22). To calculate emissions from cooking of meat, the number of restaurants was multiplied by the percentage of restaurants that have each cooking equipment type (provided in Table 4-23). Some of these restaurants have more then one piece of each

[85] E.H. Pechan and Associates, Inc., December 2003. Methods for Developing an Emissions Inventory for Commercial Cooking Processes: Technical Memorandum. Prepared for U.S. Environmental Protection Agency.

equipment type; therefore, the average number of cooking equipment pieces per restaurant (Table 4-24) was multiplied by the number of restaurants.

The total pounds per week of each type of meat cooked were calculated by multiplying the total number of each type of cooking equipment by the average pounds per week of each type of meat cooked by equipment type (Table 4-25). Annual VOC and CO emissions for commercial cooking were calculated by multiplying the tons of meat cooked per week by 52 weeks per year and the emission factor for each equipment type (Table 4-27).

Table 4-20. AACOG Region Restaurants by County and Type

Type	FIPS	BBQ & Steak	Ethnic	Family	Fast Food	Seafood
Atascosa	48013	6	27	23	10	0
Bandera	48019	6	5	7	3	0
Bexar	48029	142	962	578	391	92
Comal	48091	22	48	50	20	4
Frio	48163	4	10	4	5	0
Gillespie	48171	21	13	27	4	5
Guadalupe	48187	17	37	27	23	1
Karnes	48255	4	11	9	7	0
Kendall	48259	15	21	16	9	0
Kerr	48265	6	10	26	8	5
Medina	48325	7	19	16	11	1
Wilson	48493	6	16	16	7	0

Table 4-21. Percent of Restaurants Owning Each Type of Cooking Equipment [86]

Restaurant Category	Chain-Driven Charbroilers	Underfired Charbroilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
Ethnic	3.5	47.5	81.9	62.7	4.0
Family	10.1	60.9	91.4	82.9	1.4
Fast Food	18.6	30.8	96.8	51.9	14.7
Seafood	0.0	52.6	100.0	36.8	10.5
Steak & BBQ	6.9	55.2	82.8	89.7	0.0

Activity data for deep fat frying was based on the mass of frozen potato products sold in 2004 from the U.S. Department of Agriculture.[87] In the U.S., the mass of frozen potatoes sold was 10,834,395,000 pounds, of which about 91 percent[88] (9,859,299,450 lbs) are french fries sold by fast food restaurants. The remaining 975,095,550 pounds of frozen potatoes are french fries sold by other restaurants.

[86] *Ibid.*
[87] U.S. Department of Agriculture, 2004. U.S. Pack of Frozen Potato Products, American Frozen Food Institute. Available online: http://www.affi.com/2004PackBook.pdf
[88] E.H. Pechan and Associates, Inc., December 2003. Methods for Developing an Emissions Inventory for Commercial Cooking Processes: Technical Memorandum. Prepared for U.S. Environmental Protection Agency.

Table 4-22. Average Equipment Population by Restaurant Type[89]

Restaurant Category	Chain-Driven Charbroilers	Underfired Charbroilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
Ethnic	1.62	1.54	1.63	1.88	1.80
Family	1.71	1.29	2.34	2.03	-
Fast Food	1.07	1.58	3.10	1.43	2.09
Seafood	-	1.10	2.47	1.11	1.50
Steak & BBQ	-	1.63	2.42	1.35	-

Table 4-23. Average Weekly Pounds of Meat Cooked by Equipment Type[90]

Type of Meat	Chain-Driven Charbroilers	Underfired Charbroilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
Steak	236	180	181	166	94
Hamburger	798	270	274	362	1,314
Poultry, with skin	147	144	365	88	113
Poultry, without skin	266	179	208	111	108
Pork	57.6	148	58.6	112	118
Seafood	119	143	159	92.1	632
Other	-	41.5	274	57.5	-

The total mass of frozen potatoes was multiplied by the percentage of AACOG's population (1,988,187) in the U.S. (296,410,404).[91] Then, the amount of frozen potatoes for fast food restaurants was divided by the number of fast food restaurants or other frozen potatoes was divided by the number or non-fast food restaurants to determine the amount of frozen potatoes per restaurant. Total amount of frozen potatoes by county is provided in Table 4-26. The tons of frozen potatoes cooked per week were multiplied by 52 weeks and by the deep fat fryers emission factor for VOC.

[89] *Ibid*.
[90] *Ibid*.
[91] US Census Bureau, July 2006. Population Estimates. Available online: http://www.census.gov/popest/states/tables/NST-EST2005-01.xls

Table 4-24. Frozen Potato Consumption by County, 2005

County	Annual tons for fast food restaurants	Annual tons for all other restaurants	Total annual tons
Atascosa	664	78	742
Bandera	199	25	224
Bexar	25,961	2,477	28,438
Comal	1,328	173	1,501
Frio	332	25	357
Gillespie	266	92	358
Guadalupe	1,527	115	1,642
Karnes	465	34	498
Kendall	598	73	670
Kerr	531	66	597
Medina	730	60	790
Wilson	465	53	518

Table 4-25. Emission Factors for Commercial Cooking Equipment[92]

Pollutant	Chain-Driven Charbroilers	Underfired Charbroilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
VOC (lbs/ton)	4.00	3.92	0.13	0.36	0.04
CO (lbs/ton)	13.36	12.82	-	0.73	-

Sample Calculation – Meat Cooking

Equation (1)

Number of cooking equipment for each restaurant type:

$TRE_A = NR \times PRE_A \times NE_A$

Where,

TRE_A = Number of cooking equipment type A for each restaurant type
NR = Number of restaurants by type, Table 4-22
PRE_A = Percent of restaurants with equipment type A of cooking equipment, Table 4-23
NE_A = Average number of equipment type A by restaurant type, Table 4-24

Number of fast food restaurants with underfired charbroilers in Bexar County:

TRE_A = 391 x 0.308 x 1.58 underfired charbroilers per restaurant
= 190 underfired charbroilers at fast food restaurants in Bexar County

Equation (2)

Tons of type A meat cooked on each equipment type for all restaurants:

$TM_A = (\sum TRE_A) \times M_A / 2{,}000$ lbs/ton

[92] E.H. Pechan and Associates, Inc., December 2003. Methods for Developing an Emissions Inventory for Commercial Cooking Processes: Technical Memorandum. Prepared for U.S. Environmental Protection Agency.

Where,

TM_A = Total tons per week of each type of meat cooked on cooking equipment type A

TRE_A = Total number of equipment type A for each restaurant type, Equation (1)

M_A = Average weekly pounds of meat cooked by equipment type A, Table 4-25

Total tons per week of steak cooked on underfired charbroilers in Bexar County:

TM_A = (190 underfired charbroilers at fast food + 127 underfired charbroilers at BBQ and Steak + 704 underfired charbroilers at Ethnic + 454 underfired charbroilers at family + 53 underfired charbroilers at Seafood) x 180 lbs / 2,000 lbs/ton

= 137.62 tons/week for steak cooked on underfired charbroilers in Bexar County

Equation (3)
Annual tons of VOC or CO emissions per type of cooking equipment:

$$AE_A = \left(\sum TM_A\right) \times EF \times WK / 2000 \text{ lbs/ton}$$

Where,

AE_A = Annual tons of VOC or CO emissions for cooking equipment type A

TM_A = Total tons per week of each type of meat cooked on each type of cooking equipment (tons) (from equation (2))

EF = Emission factor for VOC or CO by equipment type (lbs VOC or CO /yr.) (from Table 4-27)

WK = weeks per year (52)

Annual tons of VOC per year from underfired charbroilers in Bexar County:

ATM_A = (137.62 tons of steak /yr. + 206.42 tons of hamburger /yr. + 110.09 tons of poultry w/ skin /yr. + 136.9 tons of poultry w/out skin /yr. + 113.15 tons of pork /yr. + 109.33 tons of seafood /yr. + 31.73 tons of other meat /yr.) x 3.92 x 52 weeks /yr. / 2000 lbs/ton

= 86.10 tons VOC/yr. from underfired charbroilers in Bexar County:

Sample Calculation – Deep-fat Frying of Potato Fries:

Equation (4)
Total tons of frozen potatoes used by restaurants in the AACOG region:

TFP = (LPOP / NPOP) x FPOT / 2,000 lbs/ton

Where,

TFP = Total tons of frozen potatoes used by restaurants in the AACOG region

LPOP = Population of the AACOG region (1,988,187)

NPOP = Population of the U.S. (296,410,404)

FPOT = Amount of frozen potatoes sold nationally in 2004 (10,834,395 lbs)

Total tons of frozen potatoes used by restaurants in the AACOG region:

$$TFP = (1,988,187 / 296,410,404) \times 10,834,395,000 / 2,000 \text{ lbs/ton}$$
$$= 36,336.11 \text{ tons/yr.}$$

Equation (5)
Tons of frozen potatoes used per restaurant type A:

$$FP_A = TFP / ARES_A \times PER_A$$

Where,

FP_A = Tons of frozen potatoes used for restaurant type A
TFP = Total tons of frozen potatoes used by restaurants in the AACOG region, Equation (4)
$ARES_A$ = Total number of restaurants in the AACOG region for restaurant type A, Table 4-22
PER_A = Percent of frozen potatoes sold nationally to restaurant type A (fast food 91%, non-fast food 9%)

Tons of frozen potatoes used per fast food restaurant:

$$FP_A = 36,336.11 \text{ tons /yr.} / 485 \text{ restaurants} \times 0.91$$
$$= 66.40 \text{ tons of frozen potatoes /yr. /fast food restaurant}$$

Equation (6)
Tons of french fries deep-fat fried annually for each county:

$$TF = \sum (FP_A \times CRES_A)$$

Where,

TF = Tons of frozen potatoes deep-fat fried annually for each county (tons/yr)
FP_A = Tons of frozen potatoes used by restaurant type A, Equation (5)
$CRES_A$ = Total number of restaurants type A for each county, Table 4-22

Tons of frozen french fries deep-fat fried annually by restaurants in Bexar County:

TF = (66.40 tons/yr / fast food restaurant x 391 fast food restaurants) + (1.40 tons/yr / other restaurants x 1,774 other restaurants)
= 28,438.47 tons of deep-fat fried french fries/yr in Bexar County

Equation (7)
Annual tons of VOC emissions for deep-fat fryers

$$AE = TF \times EF / 2,000 \text{ lbs/ton}$$

Where,

AE = Annual tons of VOC emissions
TF = Tons of frozen potatoes deep-fat fried annually type for each AACOG county (tons/yr), Equation (6) and Table 4-26
EF = Emission factor for VOC from deep-fat fryers (lbs/yr), Table 4-27

Annual tons of VOC emissions for deep-fat fryers in Bexar County:

AE = 28,438.47 tons of french fries/yr x 0.13 lbs/yr / 2000 lbs/ton

= 1.83 tons VOC/yr

Seasonal Adjustment
The seasonal adjustment factor for commercial cooking is 1 and the activity is 365 days a year.

Consumer and Commercial Solvents

Commercial or consumer solvent-containing products include personal care products, household products, automotive aftermarket products, adhesives and sealants, household pesticides, coatings, and other miscellaneous commercial or consumer products that emit VOC. The primary solvents used in the formulation of these products are generally ethanol and isopropanol.

Personal care products include hair products, deodorants and antiperspirants, perfumes, colognes, and nail care products. Household products primarily consist of cleaning products for hard surfaces, clothing, carpet, dishes, waxes, polishes, air fresheners, and charcoal fluids. Automotive consumer products are divided into two categories: (1) detailing products, and (2) maintenance and repair products. Detailing products include those used for cleaning, polishing, and waxing. Maintenance and repair products include engine and parts cleaners, carburetor/fuel injection cleaners, lubricants, antifreeze, radiator cleaners, and brake fluids. Adhesives include cements, glues, and pastes. Pesticides include substances or mixtures that are used to prevent, destroy, repel, or mitigate pests in urban areas and, finally, the coatings section includes aerosol spray paints and related products such as paint removers.

Solvents contained in these types of products are primarily released during product use. However, residual amounts of solvent may also remain in discarded product packaging, enter the municipal solid waste streams, and be disposed of in landfills. The VOC EFs presented in this inventory section have been adjusted to account for biodegradation of VOCs that enter the wastewater stream, but not those that enter landfills. Landfill emissions are covered in the landfill emissions section of the EI.

Methodology
The methodology employed to calculate emissions from consumer and commercial products uses per capita emission factors for the product categories of interest. The per capita emission factors[93] in table 4-28 were multiplied by population data[94] to obtain total VOC emissions. Once the calculation was completed, a rate of progress control factor (0.8) was applied to account for additional emission reductions due to improved techniques and/or implementation of new regulations.[95]

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[93] Texas Commission on Environmental Quality (TCEQ), 1999. Derivation of 1999 Consumer and Commercial Product Per Capita Emission Factors for the State of Texas. Austin, Texas.
[94] Texas Water Development Board, July 2004. 2006 Regional Water Plan: County Population Projections for 2000 – 2060. Available online: http://www.twdb.state.tx.us/data/popwaterdemand/2003Projections/Population%20Projections/STATE_REGION/County_Pop.htm
[95] ENVIRON International Corporation, 2001. Future-Year Ozone Modeling of the Austin, Texas Region: Draft Final Report. Novato, Ca.

Table 4-26. VOC Emission Factors for Commercial Solvents

Product Category	Per Capita EF (lbs VOC/person)[96]
Personal Care Products	1.66
Household Products	1.10
Automotive Aftermarket Products	0.71
Adhesives and Sealants	1.87
FIFRA-Regulated Products	0.28
Coatings and Related Products	0.51
Miscellaneous Products	0.60
Total for All Consumer and Commercial Products	6.73

Sample Calculation
Equation (1)
Annual VOC emissions for category A:

$$AE_A = POP \times EF_A \times R / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual VOC emissions for category A (tons VOC/yr)
POP = County population
EF_A = Per capita emission factor for category A (lbs VOC/ person), Table 4-28
R = Rate of progress control factor (0.8)

The annual VOC emissions for Bexar County (1,512,433) from consumer and commercial personal care products are:

$$AE_A = 1{,}512{,}433 \text{ persons} \times 1.66 \text{ lbs VOC/person/yr} \times 0.8 / 2{,}000 \text{ lbs/ton}$$
$$= 1{,}004.26 \text{ tons VOC/yr}$$

Seasonal Adjustment
The seasonal adjustment factor for commercial cooking is 1 and the activity is 365 days a year.

Degreasing

Solvent degreasing (or solvent cleaning) is the physical process of using organic solvents or solvent vapor to remove grease, fats, oils, wax or soil from items made of metal, glass or plastic. The equipment used for degreasing is batch cold cleaning machines, batch vapor cleaning machines batch, and in-line cleaning machines. Non-aqueous solvents used in the process include distillates, chlorinated hydrocarbons, ketones, and alcohol. Industries that use solvent degreasing include automotive, electronics, plumbing, aircraft, refrigeration, and business machine industries. The printing, chemical, plastics, rubber, textiles, glass, paper, and electric power industries also use solvent degreasing operations.

[96] State of California, Air Resources Board (CARB), 1999. Consumer and Commercial Products Survey summary of Sales and Emissions (as of 3/21/2000). Sacramento, California. Available online: http://www.arb.ca.gov/consprod/regact/ccps/SUMMARY.WB2

Methodology

VOC emissions from degreasing operations were calculated using EPA-approved emission factors (EF).[97] These factors were developed for degreasing based on equipment type and employment by SIC code as illustrated in Table 4-29. By multiplying the EF by the number of people employed[98] within each applicable SIC code, the total emissions for each degreasing category were determined.

Table 4-27. SIC Codes and EFs for Degreasing Equipment [99]

Subcategory	SIC	Per Employee Factor (lbs VOC/yr./employee)
Solvent Cleaning		
Solvent Cleaning	25, 33-39, 417, 423, 551, 552, 554-556, 753	87
Cold Cleaning		
Automobile Repair	417, 423, 551, 552, 554-556, 753	270
Manufacturing	25, 33-39	24
Vapor and In-Line Cleaning		
Electronics and Electrical	36	29
Other	25, 33-39, 417, 423, 551, 552, 554-556, 753	9.8

To calculating degreasing emissions, the methodology takes into account Chapter 106 of the Texas Administration Code.[100] Chapter 106 requires all Texas counties to implement equipment controls, as stipulated by Chapter 115, on degreasing units that will reduce emissions from the degreasing process by 85%.[101] Chapter 115, requires that 100% of the degreasing equipment population in Bexar, Comal, Guadalupe, and Wilson counties be Chapter 106 compliant. A Texas-based company that provides various environmental services supplies approximately 50% of degreasing units in the San Antonio area and their units are Chapter 106 compliant. This factor was utilized to provide a more accurate estimate of emission reductions for the remaining AACOG counties of Atascosa, Bandera, Frio, Gillespie, Karnes, Kendall, Kerr, and Medina.

Sample Calculation

Equation (1)

Uncontrolled emissions released for each degreasing category:

$$E_A = (EF_A \times EP_A) / 2{,}000 \text{ lbs/ton}$$

Where,

E_A = Total emissions released for degreasing category A (tons VOC/yr)

EF_A = Per employee emission factor for degreasing category A (lbs VOC/yr / employee), Table 4-29

[97] U.S. Environmental Protection Agency, September 1997. Emission Inventory Improvement Program Volume III: Chapter 6 Solvent Cleaning. Research Triangle Park, North Carolina.

[98] Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.

[99] U.S. Environmental Protection Agency, September 1997. Emission Inventory Improvement Program Volume III: Chapter 6 Solvent Cleaning. Research Triangle Park, North Carolina.

[100] TCEQ, 2001. Permit By Rule, 30 T.A.C. §106.454. Available online: http://www.tceq.state.tx.us/permitting/air/permitbyrule/subchapter-t/degrease_units.html

[101] TCEQ, 1999. Control of Air Pollution from Volatile Organic Compounds, 30 T.A.C. §115.412-419. Available online: http://www.tceq.state.tx.us/permitting/air/rules/state/115/412/r5412hp.html

TE_A = Total employment for degreasing category A

The annual uncontrolled emissions from cold cleaning from the automotive repair industry in Gillespie County were calculated as follows:

E_A = (270 lbs VOC/yr. / employee X 128 employees) / 2,000 lbs/ton
= 17.28 tons VOC/yr

Equation (2)
Once annual emissions for each degreasing category were calculated, Chapter 106 emission reductions were applied. This was accomplished by taking into account that 100% of the degreasing equipment population for Bexar, Comal, Guadalupe, and Wilson counties is Chapter 106 compliant. For the other AACOG counties of Atascosa, Bandera, Frio, Gillespie, Karnes, Kendall, Kerr, and Medina, approximately half of the degreasing equipment is Chapter 106 compliant.

$$AE = \sum (E_A) \times [1 - (ER / PERC)]$$

Where,
AE = Annual emissions released (tons VOC/yr.)
E_A = Total emissions for degreasing category A (tons VOC/yr), Equation (1)
ER = 85 percent emission reduction
PERC = Percent of equipment compliant with Chapter 115/106 (100% for Bexar, Comal, Guadalupe, and Wilson counties; 50% for other AACOG counties)

Annual emissions for Gillespie County:

AE = (9.70 tons VOC/yr. + 17.28 tons VOC/yr. + 1.14 tons/yr. + 0.00 tons VOC/yr. + 1.09 tons VOC/yr.) x [1 - (0.85 x 0.5)]
= 16.80 tons VOC/yr.

Annual emissions for Bexar County:

AE = (900.89 tons VOC/yr. + 1,638.09 tons VOC/yr. + 102.91 tons/yr. + 12.70 tons VOC/yr. + 101.48 tons VOC/yr.) x [1 - (0.85 x 1.0)]
= 413.41 tons VOC/yr.

Equation (3)
Emissions released per year per ozone season day:

DE = (AE) / OSD

Where,
DE = Daily amount of emissions released (tons VOC/yr.)
AE = Annual amount of emissions released (tons VOC/yr.), Equation (2)
OSD = Based on a six day work week per year (312 days)

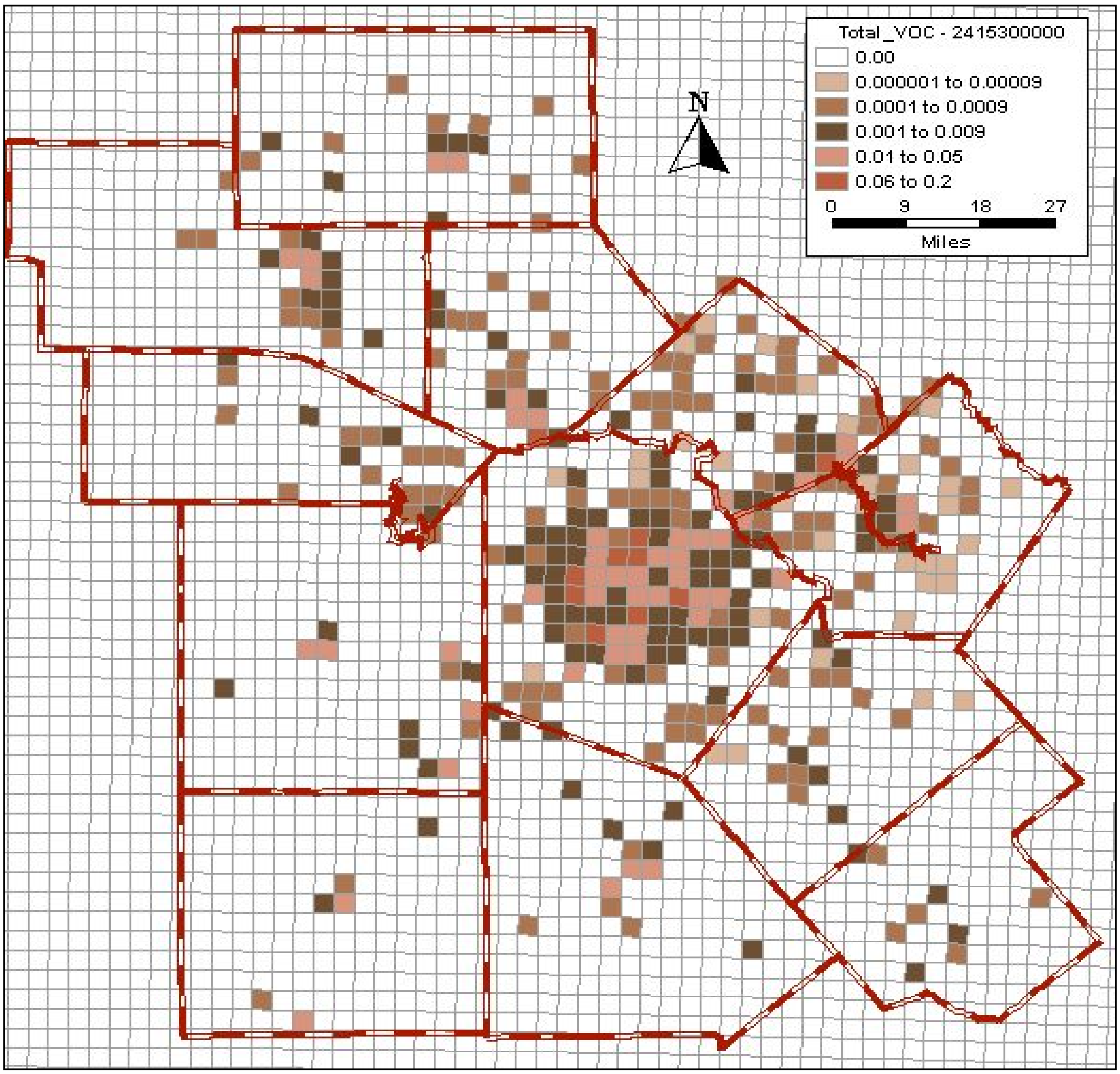
Emissions released per year per ozone season day for Gillespie County:

DE = (16.80 tons VOC/yr.) / (312 days/yr.)
= 0.0538 tons VOC/day

Seasonal Adjustment
Emission Inventory Improvement Program guidance suggests uniform activity throughout the year (no seasonal adjustment) and a six-day workweek when facility-specific information is unavailable.

Spatial Distribution
Emissions are allocated on the 4km grid by the location of businesses that perform degreasing operations (Figure 4-7).

Figure 4-7. VOC Emissions from Degreasing Operations, 2005



Plot Date:	April 18, 2007
Map Compilation:	April 18, 2007
Source:	Location of businesses that perform degreasing operations was obtained from the Texas Workforce Commission, 2005. Employment Data for 3rd Quarter 2004. Austin, Texas.

Diesel Truck Idling

(See Appendix A)

Dry Cleaners

VOC emitted by dry cleaners are from the solvents used in the dry cleaning process. Dry cleaning operations typically use synthetic halogenated or petroleum distillate organic solvents for cleaning purposes. VOC may be emitted in the dry cleaning process or during solvent reclamation processes. Petroleum solvents most commonly used in the dry cleaning process are Stoddard solvent (mineral spirits) and 140-F. Synthetic solvents used in the dry cleaning process include PERC (Perchloroethane), TCA (Trichloroethane), and CFC-113 (Chlorofluorocarbons).

There are three types of dry cleaning operations: coin operated, commercial, and industrial. Two of these dry cleaning types, coin-operated (SIC code 7215, NAICS code 812310) and commercial (SIC code 7216, NAICS code 812320) dry cleaners, are significant sources of emissions. Coin-operated dry cleaning units are self-service machines that are usually found in laundromats. Commercial dry cleaners are small businesses that offer cleaning services to the public. Some commercial sites may not be emission sources because they are only for drop-off and pick-up of clothes. Industrial launders (SIC 7218, NAICS code 812332) usually use soap and detergent when cleaning, but may also use large-capacity dry cleaning units that should be monitored for emissions. Industrial launders that use dry cleaning solvents are usually part of a business operation that generates soiled fabrics or are large businesses that provide uniform and rental services to its clients.

Methodology
There is a very small number of coin-operated and industrial dry cleaning facilities located within the AACOG region. Since there are few operations and industrial launders typically use soap and detergent, emissions from these two categories are minimal and not calculated. The methodology used in calculating emissions for commercial dry cleaning facilities is based on local survey. The methodology involves:

1) Conducting a mailed survey requesting the type of solvent used in the dry cleaning process, usage amounts, waste amounts, and activity data.
2) Using information from the returned surveys was used to formulate per employee emission factors, usage, waste, and activity data.
3) Conducting a second telephone survey requesting information about the type of solvent used and whether dry cleaning activities are performed at the location.
4) Allocating average amount and activity data to dry cleaning facilities contacted by phone that performed dry cleaning processes.
5) Spatially allocating emissions to 4km photochemical modeling grids with TransCAD 4.8 GIS software

For commercial dry cleaners the preferred methodology for calculating emissions involves sending out surveys to local commercial dry cleaning facilities and using the information gathered to develop local per employee emission factors.[102] The survey inquired about the type of solvent used, the number of gallons used in the last 12 months, the number of gallons of waste solvent, the solvent density, the number of employees directly involved with dry cleaning,

[102] *Ibid.*

the days of operation per week, and the number of dry cleaning machines by type of machine. Twenty-two dry cleaners, out of a total of 142 contacted, responded to the mail survey.

Information obtained from the survey was used to calculate local emission factors for each type of solvent. For each solvent type, total gallons of solvent waste were subtracted from the total gallons of solvent used: the difference was then multiplied by the appropriate solvent density factor (lbs/gal.). The calculated emissions of each type of solvent were divided by the total employment[103] for dry cleaning facilities that used that type of solvent, then multiplied by the total organic gases (TOG) to VOC conversion factor of 1.03;[104] yielding local per employee emission factors for each type of solvent used (Table 4-30).

Table 4-30. Dry Cleaning Emission Factors by Solvent

Type of Solvent	Density (TOG lbs/gal)	Emission Factor (lbs VOC/ employee/yr)
Petroleum (Stoddard Solvent)[105]	6.8	632.6
PERC (Perchloroethylene)[106]	13.47	55.4
DF-2000 (Exxon)[107]	6.4	63.4
EcoSolv (Chevron-Phillips)[108]	8.51	173.6
Dri-rite[109]	8.55	508.6

The PERC emission factor is lower than the other solvent emission factors, despite its higher density, because dry cleaners tend to use less PERC per employee. One of the key factors that account for the lower usage is the higher price of PERC solvent compared to petroleum solvents leading to higher recovery and reuse rates of PERC from dry cleaning machines.[110] Another factor in the lower usage amounts, are the stricter regulations by the EPA on PERC emissions, requiring such controls as upgrading equipment, limiting the number of dry cleaning machines, and contributing money to waste clean-up funds for contaminated dry cleaning sites.[111]

After calculating the emission factor per employee for each solvent, a telephone survey of dry cleaners in the AACOG region was conducted. The survey inquired about whether the location was for drop-off only and, if it performed dry cleaning activities, what type of solvent did they use. The survey helped to establish the total number of dry cleaners in the AACOG region that perform dry cleaning operations. Average activity data that was calculated from the mailed

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103 Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.
104 U.S. Environmental Protection Agency (EPA), April 2003. Emissions Modeling Clearinghouse Speciation: VOC/ROG to TOG Conversion Ratios File. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/ttn/chief/emch/speciation/voc-togconversions_apr_23_2003.xls
105 State Coalition for Remediation of Drycleaners, January 2002. Solvent Data Table. Office of Superfund Remediation and Technology Innovation of the Environmental Protection Agency, Washington D.C. Available online: www.drycleaningcoalition.org/download/solvent_table.xls
106 *Ibid.*
107 *Ibid.*
108 Chevron Phillips Chemical Company LP, September 2002. Materials Safety Data Sheet: EcoSolv Dry Cleaning Fluid. The Woodlands, Texas. Available online: www.whitakeroil.com/MSDS/Ecosolv%20msds.pdf
109 Provided on returned survey to AACOG, 2004.
110 Radian Corporation, 1996. Dry Cleaning: Final Report. Area Sources Committee Emission Inventory Improvement Program, Vol. III: Chapter 4. p. 4.2-2 to 4.2-3.
111 *Ibid.*

surveys was allocated to the telephone survey results based on type of solvent used and number of employees.[112].

Table 4-29. Telephone Survey Results for Local Dry Cleaners

Activity data	Number of dry cleaners
No response	4
Drop-off only	40
Petroleum solvent	47
PERC solvent	25
DF-2000 solvent (Exxon)	20
EcoSolv (Chevron-Phillips)	4
Dri-rite solvent	1
Water-based solvent (no emissions)	1
Total	142

Emissions were calculated by multiplying the per employee emission factor for each type of solvent by employment for each dry cleaning facilities that used that type of solvent. To determine daily emissions, average number of activity days per year was calculated from the survey results (275.41 days/year). The total emissions per year for each type of solvent were divided by the average number of activity days per year to obtain the emissions released per day.

Sample Calculation

Equation (1)

Emission factor per employee:

$$EF_A = [(SU_A - SW_A) \times DEN_A / TE_A] \times CON$$

Where,

EF_A = Emission factor for solvent A (lbs VOC/Emp./yr)
SU_A = Total amount of solvent A used (gal /yr)
SW_A = Total amount of solvent A waste (gal /yr)
DEN_A = Density of solvent A (lbs/gal), Table 4-30
TE_A = Total employment for all dry cleaners surveyed using solvent A
CON = Conversion factor to convert TOG to VOC (1.03)

Emission factor for petroleum:

$$EF_A = [(11{,}226.9 \text{ gal} - 754.8 \text{ gal}) \times (6.8 \text{ lbs/gal.}) / 116 \text{ Emp.}] \times 1.03$$
$$= 632.6 \text{ lbs VOC /Emp./yr}$$

Equation (2)

Emissions released per solvent per year:

$$AE_A = (TE_A \times EF_A) / 2{,}000 \text{ lbs/ton}$$

[112] Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.

Where,

AE_A = VOC emissions per solvent A (tons /yr)
TE_A = Total employment for dry cleaners using solvent A, Table 4-31
EF_A = Emission factor for solvent A (lbs VOC/Emp./yr), Equation (1) and Table 4-30

Bexar county emissions per year from petroleum solvent:

AE_A = (717.76 Emp. x 632.6 lbs VOC/Emp./yr) / 2,000 lbs/ton
= 227.03 tons VOC/ yr

Equation (3)
Emissions released per solvent per day:

DE_A = (AE_A / OSD)

Where,

DE_A = Daily emissions released per solvent A (tons VOC /day)
AE_A = Annual VOC emissions per solvent A (tons VOC /yr)
OSD = Average activity days per year for dry cleaning facilities from surveys – (275.41 days /yr)

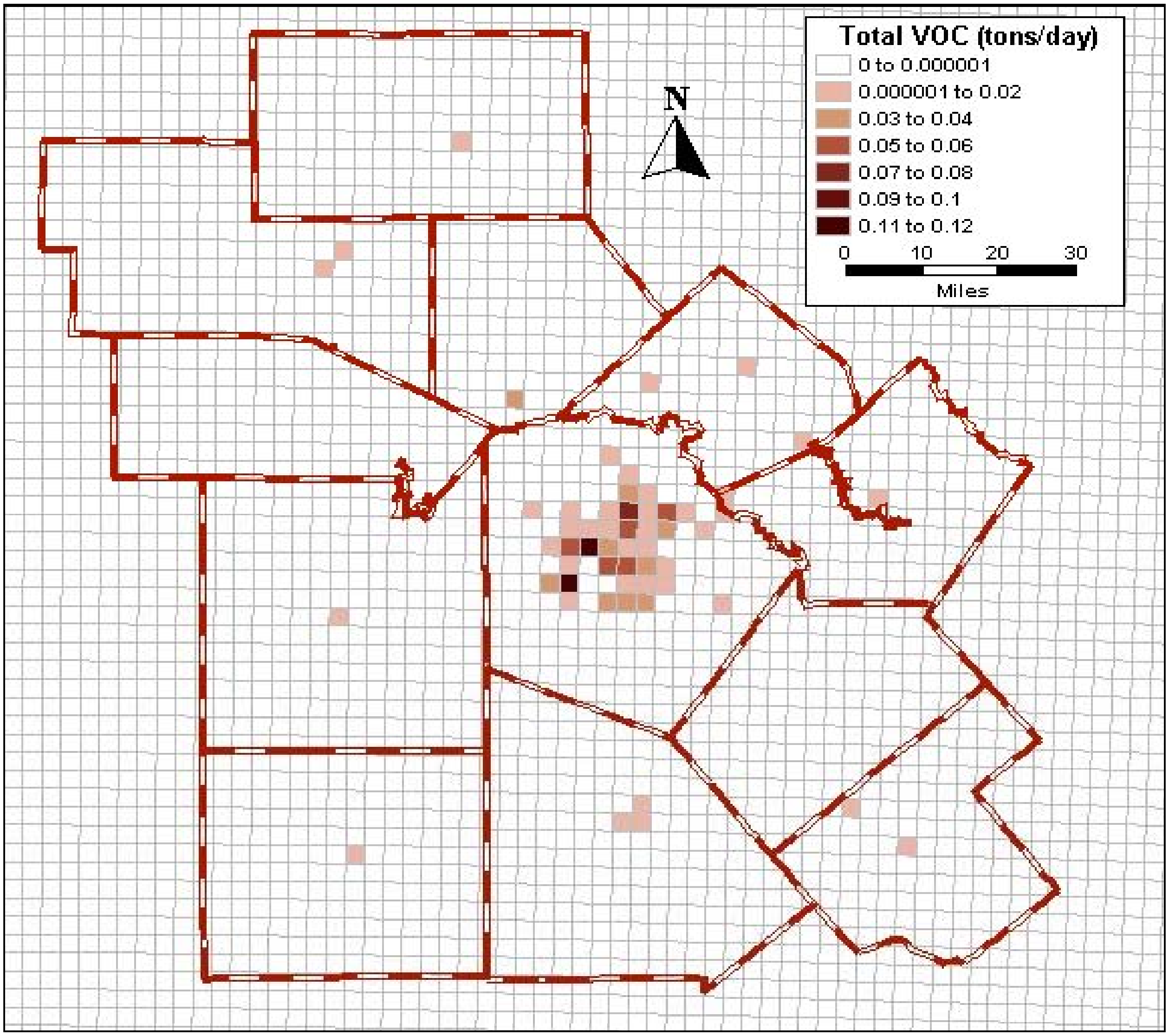
Bexar county emissions per day from petroleum solvent:

DE_A = (227.03 tons VOC/ yr) / (275.41 days /yr)
= 0.82 tons VOC /day

Seasonal Adjustment
The seasonal adjustment factor is 1.

Spatial Distribution
Emissions are allocated on the 4km grid by the location of dry cleaning facilities (Figure 4-8).

Figure 4-8. VOC Emissions from Dry Cleaning Facilities, 2005



Plot Date:	March 28, 2007
Map Compilation:	March 28, 2007
Source:	Location of dry cleaning facilities came from the Texas Workforce Commission, 2005. Employment Data for 3rd Quarter 2004. Austin, Texas.

Sample Survey

April 20, 2007
«Company»
«Address», «State» «Zip»

ATTENTION: OPERATIONS MANAGER

The Alamo Area Council of Governments (AACOG) requests your assistance in completion of the Dry Cleaners 2005 Emissions Inventory survey. The survey information will be used to assess and quantify emissions from dry cleaning operations within the AACOG 12-county region. Information on local dry cleaning activities is obtained through survey responses. This inventory is a significant part of the emissions management process because the San Antonio region was declared in non-attainment deferred of the National Ambient Air Quality Standards (NAAQS).

The purpose of this survey is to provide better information and services to the region, as well as help minimize additional regulations on the community. Your response is vital to this process and will enable a more precise emissions inventory for 2005.

To increase the accuracy of this information we ask that you review the attached survey and input the necessary data. You can return it to us in the self-addressed envelope or fax at (210) 225-5937 attention Steven Smeltzer, Environmental Manager, Alamo Area Council of Governments. Please submit your response by June 03, 2004.

Thank you for your time and participation. If you have any questions or comments please feel free to contact Steven Smeltzer, Environmental Manager, Alamo Area Council of Governments at (210) 362-5266.

Regionally Yours,

Al J. Notzon III

Executive Director
Enclosures (1)

8700 Tesoro, Suite 700•San Antonio, Texas 78217•362-5200•Fax: (210) 225-5937•website: www.aacog.com•E-mail: mail@aacog.com

Dry Cleaning Emissions Survey

The purpose of this survey is to collect information about the amounts and types of chemical used by dry cleaners in the San Antonio region. Completed surveys will allow a more accurate depiction of emissions per facility, thus allowing better analysis of San Antonio's air quality. Therefore, please enter as much of the following information as possible.

Please fill the appropriate box

SOLVENT	GALLONS USED IN LAST 12 MONTHS	GALLONS OF SOLVENTS PICKED UP BY WASTE HAULER	SOLVENT DENSITY (LBS/GAL OF VOC)*
PERC (Perchloroethylene)			
Petroleum (Stoddard Solvent)			
CFC-113 (Trichlorfluroethane)			
TCA (1,1,1-Trichloroethane)			
Carbon Dioxide (CO_2)			
Other Petroleum Solvents (please specify): ________________________			
Other (please specify): ________________________			

*If available, VOC density may be found by studying the Material Data Sheets (MSDSs).

Please provide the number of employees, number of operating days, and number of machines at your facility.

Please fill the appropriate box

Facility Information	
1) Number of employees directly involved with dry cleaning activities	
2) Days of operation per week	
3) Number of dry to dry machines	
4) Number of transfer machines	
5) Number of coin-operated dry cleaning machines	
6) Number of other dry cleaning machines	

Explosives Detonation

Explosives are chemical compounds/mixtures that experience rapid burning/decomposition and generate large amounts of gas and heat with a subsequent production of sudden pressure effects.[113] While CO is the primary pollutant produced by the detonation of explosives, NOx is also formed, but only very limited data is available on these emissions. Most of these emissions are from the detonation of industrial explosives and firing of weapons. Explosive detonation can be broken into three categories:

- Explosive use in mining operations,
- Private citizens using small arms, and
- Military use of explosives and small arms firing.

Some quarrying operations in the AACOG region use explosives to mine limestone, but the emissions would be insignificant and there is a lack of data. Also, there is lack of information regarding the firing of small arms by private citizens and the emissions would be insignificant. There are detailed records on the munitions used by the army at the main training facility in Bexar County: Camp Bullis.[114] In 2002, operations at CAMP Bullis fired 5,251,426 rounds, however the emissions are insignificant (less then 0.5 tons/year of NOx).

Fires

Fires are a source of pollutants that have the potential to produce large amounts of emissions over a short period. The fire category is broken into the following nine sub-categories:

- Structure (residential and commercial),
- Vehicle,
- Open burning of solid waste,
- Open burning of yard waste,
- Agricultural field burning,
- Slash management burning,
- Prescribed burning for forest management,
- Prescribed burning of Rangeland, and
- Orchard heaters.

Emissions for the categories of agricultural field burning, slash management burning, prescribed burning for forest management, and prescribed burning of Rangeland were based on David Allen and Ann Dennis' report "Inventory of Air Pollutant Emissions Associated with Forest, Grassland, and Agricultural Burning in Texas".**[115]** The emission calculations for the other 5

[113] Encarta Encyclopedia, July 2001. Explosives. Available online: http//encarta.msn.com/find/Concise.asp?z=1&pg=2 &ti=7615778751

[114] Katherine Von Stackleberg, Craig Amos, C. Butler, Thomas Smith, J. Famely, M. McArdle, B. Southworth, and Jeffrey Steevens, October 2006. Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species. U.S. Army Engineer Research and Development Center (ERDC), Construction Engineering Research Laboratory (CERL). Champaign, IL. Available online: http://www.cecer.army.mil/techreports/ERDC_TR-06-11/ERDC_TR-06-11.pdf

[115] David Allen and Ann Dennis, February 2000. Inventory of Air Pollutant Emissions Associated with Forest, Grassland, and Agricultural Burning in Texas. Center for Energy and Environmental Resources.

categories are listed below.

Structural Fires
Structures are classified as either residential or commercial: both categories will be covered in this section. Data on the number of fires by county in the AACOG region (Table 4-32) was obtained from the State Fire Marshall, Texas Dept. of Insurance.[116] Emission factors of 11 lbs for VOC, 1.4 lbs for NOx, and 60 lbs for CO was used per ton of material burned in structures.[117]

Table 4-30. Structural and Vehicle Fires in the AACOG Region, 2005

County	FIPS	Number of Fire Department	Structural Fires	Vehicle Fires
Atascosa	48013	2	11	16
Bandera	48019	4	19	9
Bexar	48029	25	1,093	1,139
Comal	48091	5	108	75
Frio	48163	2	15	30
Gillespie	48171	4	22	17
Guadalupe	48187	8	73	60
Karnes	48255	1	4	8
Kendall	48259	3	21	22
Kerr	48265	4	19	13
Medina	48325	6	23	26
Wilson	48493	5	13	9
Total		69	1,421	1,424

Fuel loading estimates are necessary to convert number of fires into a value that can be multiplied by appropriate emission factors, which are based upon the total weight of material burned. Since there is a lack of data pertaining to square footage for both structures in general and structures involved in fires, the EPA default value of residential size, 1350 square feet, was used to determine the fuel-loading factor for all buildings. A fuel-loading factor for combustible structural mass and combustible building contents is 1.15 tons per structure fire.[118]

Sample Calculation
Equation (1)
Annual tons of emissions from structural fires:

$$AE_S = (EF \times STF \times FL) / 2{,}000 \text{ lbs/ton}$$

Where,

AE_S = Annual structural fire emissions (tons/yr.)

The University of Texas, Austin, Texas. Available online: http://www.tceq.state.tx.us/implementation/air/areasource/binary/detail_area_2002_by_region_736258.pdf
[116] State Fire Marshall, Texas Department of Insurance, October 2006. Fires in Texas; Texas Fire Incident Reporting System. Austin, Texas. Available online: http://www.tdi.state.tx.us/fire/fmtexfir.html
[117] Eastern Research Group, Inc. Jan. 2001. Volume III: Chapter 18, Structure Fires. Emission Inventory Improvement Program, EPA. Revised Final, p. 18.4-5. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii18_apr2001.pdf
[118] *Ibid*., p. 18.4-4

EF = Emission factor (11 lbs VOC/ton, 1.4 lbs NOx/ton, and 60 lbs CO/ton)
STF = Number of structural fires, Table 4-21
FL = Fuel loading factor (1.15 tons/fire)

Annual tons of VOC emissions from structural fires in Bexar County in 2005:

AE_S = (11 lbs/ton x 1,093 fires x 1.15 tons/fire) / (2,000 lbs/ton)
= 6.91 tons VOC /yr.

Seasonal Adjustment
Fires by month for the AACOG region were analyzed and there was no statistically significant difference between the ozone season and the rest of the year (-0.4% difference during the ozone season). Therefore, the seasonal adjustment factor is 1. Also, there was no significant difference by day of the week (-2.4% difference during the weekdays), thus the weekly adjustment factor of 365 days per year (7 days a week) was used. However, there was an hourly difference for fires in the AACOG region. Most of the fires occurred during the daytime and the fewest fires occurred between 4 and 6 a.m. (Figure 4-9).[119] The hourly adjustments were applied to residential structure, commercial structural, and vehicle fire emission categories.

Vehicle Fires
Data on vehicle fires in the AACOG area was obtained from the Texas State Fire Marshall's Office (Table 4-21). To determine fuel loading, an estimate must be made on how much material burns in a vehicle fire. The estimate used for this parameter is that each vehicle contains approximately 500 pounds (0.25 tons) of material that burns in a fire, based on the average weight of a vehicle being about 3,700 pounds. The emission factors of 32 lbs for Nonmethane TOC (VOC), 4 lbs for NOx, and 125 lbs for CO per ton of material burned was used for vehicle fires.[120]

Sample Calculation
Equation (2)
Annual tons of emissions from vehicle fires:

AE_V = (EF x VF x FL) / 2,000 lbs/ton

Where,

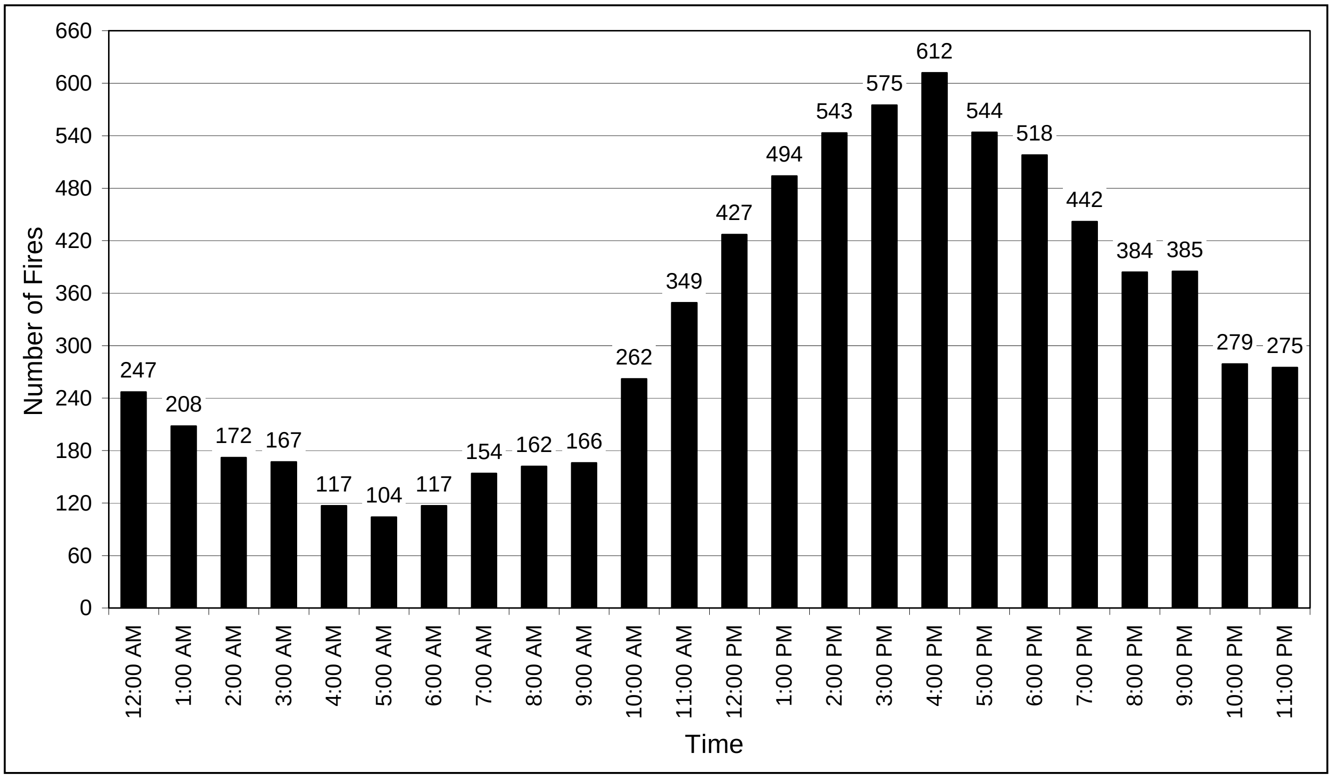
AE_V = Annual vehicle fire emissions (tons/yr.)
EF = Emission factor (32 lbs VOC/ton, 4 lbs NOx/ton, and 125 lbs CO/ton)
VF = Number of vehicle fires, Table 4-32
FL = Fuel loading factor (0.25 tons/fire)

Annual tons of NOx emitted from vehicle fires in Bexar county in 2005:

AE_V = (4 lbs/ton x 1,139 fires x 0.25 tons/fire) / (2,000 lbs/ton)
= 0.57 tons NOx /yr.

[119] State Fire Marshall, Texas Department of Insurance, October 2006. Fires in Texas; Texas Fire Incident Reporting System. Austin, Texas. Available online: http://www.tdi.state.tx.us/fire/fmtexfir.html
[120] May 2000. Volume III Area Source Method Abstracts: Vehicle Fires. EPA. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/vehclf13.pdf

Figure 4-9. 2005 Structural and Vehicle Fires by Hour, AACOG Region



Open Burning of Solid Waste

Open burning refuse emissions where calculated in the AACOG Region for the year of 2005. According to current regulations, counties with a population less than 30,000 are not responsible for providing waste collection services. In these counties, residents must handle disposal of their waste by: transporting waste to regional landfills, contracting haulers individually, land filling waste on their property, or burning household waste on their property. "Outdoor burning is authorized for the following: domestic waste burning at a property designed for and used exclusively as a private residence, housing not more than three families, when collection of domestic waste is not provided or authorized by the local governmental entity having jurisdiction, and when the waste is generated only from that property."[121]

According to Atascosa, Frio, and Medina counties survey results, 28.6% of households did not landfill waste.[122] Generated waste was calculated based on 1.19 tons per person per year.[123] Only 50 percent of waste subject to burning is combustible.[124] The amount of residential waste burned was multiplied by the following emission factors: 30 lbs VOC/ton, 6 lbs NOx/ton, and 85

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[121] Title 30 Environmental Quality, Part 1 Texas Commission on Environmental Quality Chapter 111 Control of Air Pollution from Visible Emissions and Particulate Matter §111.209 Exception for Disposal Fires. Available online: http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=111&sch=B&rl=Y
122 AACOG, 1993. Solid Waste Management in the AACOG Region, 1990 – 2010. 1993 Update. financed by the Texas Natural Resource Conservation Commission. San Antonio, Texas.
[123] AACOG, 1998. Solid Waste Report. 1998 Update. San Antonio, Texas.
[124] Volume III, Chapter 16, Emissions Inventory Improvement Program, 1997. Evaluation of Emissions from the Open Burning of Household Waste in Barrels. Triangle Research Park, North Carolina.

lbs CO/ton to determine the pounds per pollutant emitted.[125]

Emission estimates were also calculated for unincorporated population in counties that had more then 30,000 people. According to the Texas Administrative Code, Rule §111.219, "burning must be outside the corporate limits of a city or town except where the incorporated city or town has enacted ordinances which permit burning consistent with the Texas Clean Air Act, Subchapter E, Authority of Local Governments.[126] Unincorporated population for each county in 2005 was developed using Census Population projections for 2005 (Table 4-33).[127] For Bexar County, the population for heavily urbanized unincorporated census block groups was removed from the unincorporated population.

Table 4-31. 2005 Population per AACOG County

FIPS	County	County 2005 Population	Unincorporated 2005 Population*
48013	Atascosa	43,226	21,433
48019	Bandera	19,988	
48029	Bexar	1,518,370	36,803
48091	Comal	96,018	43,478
48163	Frio	16,387	
48171	Gillespie	23,088	
48187	Guadalupe	103,032	41,703
48255	Karnes	15,351	
48259	Kendall	28,607	
48265	Kerr	46,496	22,648
48325	Medina	43,027	23,384
48493	Wilson	37,529	25,694

*Only calculated for counties with a population greater than 30,000

Sample Calculation
Equation (3)
Annual tons of emissions from open burning of solid waste:

$$AE_{SW} = (EF \times POP \times PP \times WP \times FL) / 2{,}000 \text{ lbs/ton}$$

Where,

AE_{SW} = Annual open burning emissions from solid waste (tons/yr)
EF = Emission factor (30 lbs VOC /ton, 6 lbs NOx /ton, and 85 lbs CO/ton)
POP = Population of counties with less then 30,000 people or unincorporated

[125] United States Environmental Protection Agency, Office of Air Quality Planning and Standards. Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 2.5 Open Burning. Research Triangle Park, NC. October 1992.
[126] Title 30 Environmental Quality, Part 1 Texas Commission on Environmental Quality Chapter 111 Control of Air Pollution from Visible Emissions and Particulate Matter §111.219 General Requirements for Allowable Outdoor Burning. Available online: http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=111&sch=B&rl=Y
[127] U.S. Census Bureau, Population Division, March 16, 2006. Population Estimates. Available online: http://www.census.gov/popest/estimates.php

population, Table 4-33
PP = Percent of unincorporated population not land filling residential waste (0.29)
WP = Percentage of waste subject to combustion (50 percent)
FL = Fuel loading factor (1.19 tons per person, per year)

Annual tons of CO emissions in Comal County resulting from open burning of solid waste:

AE_{SW} = (30 lbs/ton x 43,478 people x 0.29 x 0.5 x 1.19 tons/person/yr) / 2,000 lbs/ton
= 112.53 tons VOC /yr

Open Burning of Yard Waste

Open burning of vegetation occurs when residents burn yard waste including leaf and brush debris. According to E.H. Pechan & Associates, 0.54 lbs of yard waste is generated every day for each person in unincorporated areas. Since the AACOG region has between 10% and 50% of forested acres, an adjustment factor of 50% was applied to yard waste generated. Of this amount, 25 percent represents leaves, 25 percent represents brush, and 50 percent represents grass by weight. Only 28 percent of the leaves and brush are burned, while 0 percent of the grass is burned.[128]

Emission factors, of 28 lbs per ton for VOC and 112 lbs per ton for CO, were used of leaf waste burned. For brush, an emission factor of 19 lbs for VOC, and 140 lbs for CO was used.[129]

Sample Calculation

Equation (4)

Annual tons of emissions from open burning of yard waste:

AE_{YW} = [(LEF x POP x PP x FL x FA x LP x DAYS / 2000 lbs/ton) + (BEF x POP x PP x FL x FA x BP x DAYS / 2,000)] / 2,000

Where,

AE_{YW} = Annual emissions from open burning of yard waste (tons/yr)
LEF = Emission factor for leave burning (28 lbs VOC/ton and 112 lbs CO/ton)
POP = Unincorporated population, Table 4-33
PP = Percent of leaf and brush yard waste burned (0.28)
FL = Fuel loading factor (0.54 lbs. per person, per day)
FA = Adjustment for percent of forested acres (0.50)
LP = Percentage of yard waste composed of leaves (0.25)
BEF = Emission factor for brush burning (19 lbs VOC/ton and 140 lbs CO/ton)
BP = Percentage of yard waste composed of brush (0.25)
DAYS = Days per year activity rate (365)

Annual CO emissions in Comal County resulting from open burning of yard waste:

AE_{YW} = [(112 lbs/ton x 43,478 people x 0.28 x 0.54 x 365 x 0.50 x 0.25 / 2,000 lbs) + (140 lbs/ton x 43,478 people x 0.28 x 0.54 x 365 x 0.50 x 0.25 / 2,000 lbs/ton)] / 2,000 lbs/ton
= 18.90 tons CO/yr

[128] E.H. Pechan & Associates, Inc., July 2006. Documentation for the Final 2002 Nonpoint Sector (Feb 06 Version) National Emission Inventory for Criteria and Hazardous Air Pollutants. EPA68-D-02-063, Durham, NC, p. A118. Available online: http://www.epa.gov/ttn/chief/net/2002inventory.html

[129] *Ibid*., p. A119-120.

Orchard Heaters
Orchard heaters are used to prevent frost damage to fruit and fruit trees. The heaters are used to keep ambient temperatures within the accepted range of temperatures in which fruit production can be optimized. After attempting to contact the agricultural agents in the outlying counties of the AACOG region and getting no response, it is impossible to estimate the use (if any) of the orchard heaters. Orchard heaters are not needed in the summer time because the summer temperatures are high enough for local fruit trees. Therefore, these emissions are estimated to be insignificant and no emissions were calculated for this area.

Gas Cans

Portable fuel containers, more commonly known as gas cans, are fillable, spillable and permeable containers that can release VOC into the atmosphere. Since there is an average of 1.35 gas cans for each household and 10.5 gas cans for each lawn and garden company, emissions can be significant.[130] Vapors are released from gas cans in five ways:[131]

- Permeation
- Diurnal
- Transport Spillage
- Spillage
- Vapor Displacement

Methodology – Residential
The number of residential gas cans was calculated by multiplying the number of households by a percentage of households that have gas cans (70%) and by the average number of gas cans per household (1.35).[132] To calculate the number of households in 2005 for each county, a growth percentage was developed based on the increase in household population between 2000 and 2005 in Bexar, Comal, Guadalupe, and Wilson (Table 4-34). The calculated growth rate of 14.8% was applied to the other 8 counties shown in table 4-35.

Table 4-32. Total Number of Household by County, 2000 and 2005[133]

County	2000 Household	2005 Household
Bexar	488,942	556,760
Comal	29,066	37,335
Guadalupe	30,900	36,121
Wilson	11,038	12,519
Total	559,946	642,735

Sample Calculations
Equation (1)
Number of households for each rural county:

[130] Eastern Research Group, August 2002. Emissions from Portable Gasoline Containers in Texas, Final Report.
[131] California Environmental Protection Agency, Air Resources Board, September 1999. Gas Can Fact Sheet 1999. California.
[132] *Ibid*.
[133] AACOG, 2005. 2005 - 2030 AACOG Metropilus Forecast for the Four County Area. San Antonio, Texas.

$$NHH_A = (U2005 / U2000) \times R2000_A$$

Where,

NHH_A = Number of Households in Rural County A in 2005, Table 4-35
U2005 = Number of Households in Bexar, Comal, Guadalupe, and Wilson in 2005, Table 4-34
U2000 = Number of Households in Bexar, Comal, Guadalupe, and Wilson in 2000, Table 4-34
$R2000_A$ = Number of Households in Rural County A in 2000, Table 4-35

The number of households in Atascosa County, 2005

NHH_A = (642,735 / 559,946) × 12,816
= 14,711 households in Atascosa County

Table 4-33. Total Number of Household, 2000 and 2005 Rural Counties

County	2000 Households[134]	2005 Households
Atascosa	12,816	14,711
Bandera	7,010	8,046
Frio	4,743	5,444
Gillespie	8,521	9,781
Karnes	4,454	5,113
Kendall	8,613	9,886
Kerr	17,813	20,447
Medina	12,880	14,784

Equation (2)
Number of residential gas cans in each county:

$$RGC_A = NHH_A \times PHGC \times COUNT$$

Where,

RGC_A = Number of residential gas cans in County A
NHH_A = Number of household units in County A, Table 4-35
PHGC = Percentage of households with gas cans (70%)
COUNT = Average number of gas cans per household (1.35)

The number of residential gas cans in Bexar County:

RGC_A = 556,760 households × 70% × 1.35 gas cans/household
= 541,170.7 residential gas cans

Permeation

Permeation occurs when the gasoline stored within the gas can saturates the container and fittings. Emissions factors depend on whether the can is plastic (1.57 grams/gallon per day) or metal (0.06 grams/gallon per day). Within the category of residential gas cans, 81% are made

[134] U.S. Census Bureau, January 2002. 2000 Census. Available online: http://www.census.gov/main/www/cen2000.html

of plastic and 19% are metal. For gas cans in Texas, 70% contain fuel and are 29% full. Permeation emissions are only estimated for closed gas cans.[135]

Sample Calculations
Equation (3)
Amount of permeation emissions in tons of VOC per day:

PER_A = RGC × SF x TC x P × EF × SIZE × LEVEL x 0.002205 g/lbs / (2,000 lbs/ton)

Where,

PER_A	= Permeation VOC emissions for county A
RGC_A	= Number of residential gas cans for county A (from equation (2))
SF	= Percentage of gas cans stored with fuel (70%)
TC	= Percentage of residential gas cans that are closed (66%)
P	= Percentage of residential gas cans that are either plastic (81%) or metal (19%)
EF	= Emission factor (1.57 g/gal. per day for plastic and 0.06g/gal. per day for metal)
SIZE	= Average capacity of the residential gas can (2.34 gallons)
LEVEL	= Average amount of fuel within the gas cans (29%)

Total tons VOC per day for permeation emissions in Bexar County for residential plastic gas cans:

PER_A = 541,170.7 gas cans x 0.81 x 0.66 × 0.70 × 1.57 g/gal/day × 2.34 gal x 0.29 × 0.002205 g/lb / (2,000 lbs/ton)
= 0.24 tons VOC/day

Diurnal

Diurnal emissions are the result from fuel expansion vapor production during rising temperatures during the day. The amount of emissions depends on whether the gas can is closed (vents and spouts sealed) or open (spout of vent allows any vapors or liquids to escape). 34% of all gas cans (plastic, metal, residential and commercial) are stored open.[136] Within non-road lawn and garden equipment there is a category for diurnal emissions; however, this category pertains to the fuel expansion within the gas tank of the lawn and garden equipment and not within the gas cans.

Sample Calculations
Equation (4)
Diurnal emissions in tons VOC per day for residential gas cans:

DIU_A = RGC_A × P x TC x SF × EF × SIZE × LEVEL x 0.002205 g/lbs / (2,000 lbs/ton)

Where,

DUI_A = Diurnal emissions for each type of gas can both closed and open in County A (tons VOC /day)

[135] Eastern Research Group, August 2002. Emissions from Portable Gasoline Containers in Texas, Final Report.
[136] *Ibid*.

RGC_A = Number of residential gas cans for county A, Equation (2)
P = Percentage of residential gas cans that are either plastic (81%) or metal (19%)
TC = Percentage of residential gas cans that are open (34%) or closed (66%)
SF = Percentage of gas cans stored with fuel (70%)
EF = Emission factor (1.38 g/gal/day closed plastic, 0.44 g/gal/day closed metal, 21.8 g/gal/day open plastic and metal)
SIZE = Average capacity of the residential gas can (2.34 gallons)
LEVEL = Average amount of fuel within the gas cans (29%)

Total tons VOC per day for diurnal emissions in Bexar County for closed residential plastic gas cans:

$$DUI_A = 541{,}170.7 \text{ gas cans} \times 0.81 \times 0.66 \times 0.70 \times 1.38 \text{ g/gal/day} \times 2.34 \text{ gal} \times 0.29 \times 0.002205 \text{ g/lb} / (2{,}000 \text{ lbs/ton})$$
$$= 0.21 \text{ tons/day}$$

Equation (5)
Total diurnal emissions for all types of residential gas cans:

$$TDUI_A = \sum DUI_A$$

Where,
$TDUI_A$ = Total diurnal emissions for County A (tons VOC /day) in County A
DUI_A = Diurnal emissions for each type of gas can both closed and open for County A (tons VOC /day), Equation (4)

Total diurnal VOC emissions per day for Bexar County:

$$TDUI_A = 1.70 \text{ tons/day} + 0.40 \text{ tons/day} + 0.21 \text{ tons/day} + 0.02 \text{ tons/day}$$
$$= 2.33 \text{ tons VOC/day}$$

Transport Spillage
Transport spillage occurs when the gas can is refueled at the pump. Whether the gas can is open or closed is the only variable that impacts emissions. Emissions do not depend on the material of the gas can.

Sample Calculations
Equation (6)
Emissions from transport spillage in tons VOC per day for residential gas cans:

$$TRS_A = RGC_A \times P \times TC \times SF \times EF \times Refill \times 0.002205 \text{ g/lbs} / (2{,}000 \text{ lbs/ton})$$

Where,
TRS_A = Transport spillage emissions for county A (tons VOC /day)
RGC_A = Number of residential gas cans for county A, Equation (2)
P = Percentage of residential gas cans that are either plastic (81%) or metal (19%)
TC = Percentage of residential gas cans that are open (34%) or closed (66%)
SF = Percentage of gas cans stored with fuel (70%)
EF = Emission factor (23 g/gal/day closed, 32.5 g/gal/day open)

Refill = Frequency of daily refilling (0.0174)

Emissions from transport spillage for Bexar County Residential Closed Plastic Gas Cans:

TRS_A = 541,170.7 gas cans x 0.81 x 0.66 x 0.70 × 23 g/gal/day × 0.0174 gal x 0.002205 g/lb / (2,000 lbs/ton)
= 0.09 tons VOC/day

Equation (7)
Total transport spillage emissions for residential gas cans:

$$TTRS_A = \sum TRS_A$$

Where,

$TTRS_A$ = Total transport spillage emissions for County A (tons VOC /day)
TRS_A = Transport spillage emissions for each type of gas can both closed and open for County A (tons VOC /day), Equation (6)

Total transport spillage VOC emissions per day for Bexar County residential gas cans:

$TTRS_A$ = 0.07 tons/day + 0.015 tons/day + 0.09 tons/day + 0.02 tons/day
= 0.20 tons VOC/day

Refueling Spillage and Vapor Displacement
Refueling spillage occurs when the gas tanks of some non-road equipment, mainly lawn and garden equipment, are filled using a gas can. This filling also causes vapor displacement, displacing the gasoline vapor within the tank as the liquid gasoline enters the gas can. These emissions are accounted for in the non-road lawn and garden category and were removed from this section to avoid double counting.

Methodology – Commercial
Commercial gas cans differ from residential gas cans in two significant ways: commercial gas cans hold on average 5 gallons and the percentage of metal cans to plastic is higher. To determine how many commercial gas cans are used, the number of lawn and garden companies in the AACOG region were counted[137] and multiplied by the average number of gas cans (10.5) per company.[138]

Sample Calculations
Equation (1)
Number of commercial gas cans per county:

$$CGC_A = NC_A \times COUNT$$

Where,

CGC_A = Number of commercial gas cans in County A
NC_A = Number of lawn and garden companies in County A
COUNT = Average number of gas cans per company (10.5 cans)

[137] Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.
[138] Eastern Research Group, August 2002. Emissions from Portable Gasoline Containers in Texas, Final Report.

Number of commercial gas cans in Bexar County:

CGC_A = 113 lawn and garden companies × 10.5 gas cans per company
= 1,186.5 commercial gas cans

Permeation

Sample Calculation

Equation (2)

Daily VOC emissions from permeation from commercial gas cans:

PER_A = CGC_A × P x TC x SF × EF × SIZE × LEVEL x 0.002205 g/lbs / (2,000 lbs/ton)

Where,

PER_A = Permeation VOC in County A
CGC_A = Number of commercial gas cans in County A (from equation (1))
P = Percentage of commercial gas cans that are either plastic (77.6%) or metal (22.4%)
TC = Percentage of commercial gas cans that are closed (66%)
SF = Percentage of gas cans stored with fuel (70%)
EF = Emission factor (1.57 g/gal. per day for plastic and 0.06 g/gal per day for Metal)
SIZE = Average capacity of the residential gas can (3.52 gallons)
LEVEL = Average amount of fuel within the gas cans (29%)

Permeation emissions (tons VOC/day) for Bexar County from commercial plastic gas cans:

PER_A = 1,186.5 commercial gas cans × 0.776 x 0.66 x 0.70 × 1.57 g/gal/day × 3.52 gal × 0.29 × 0.002205 g/lb / (2,000 lbs/ton)
= 0.00075 tons VOC/day

Diurnal

Sample Calculation

Equation (3)

Diurnal emissions in tons VOC per day for commercial gas cans:

DIU_A = CGC × P x T x S × EF × SIZE × LEVEL x 0.002205 g/lbs / (2,000 lbs/ton)

Where,

DUI_A = Diurnal emissions for each type of gas can both closed and open in County A (tons VOC /day)
CGC_A = Number of commercial gas cans in County A, Equation (1)
P = Percentage of commercial gas cans that are either plastic (77.6%) or metal (22.4%)
T = Percentage of commercial gas cans that are closed (66%) and open (34%)
S = Percentage of gas cans stored with fuel (70%)
EF = Emission factor (1.38 g/gal/day closed plastic, 0.44 g/gal/day closed metal, 21.8 g/gal/day open plastic and metal)
SIZE = Average capacity of the residential gas can (3.52 gallons)
LEVEL = Average amount of fuel within the gas cans (29%)

Diurnal emissions (tons VOC /day) for Bexar County from closed commercial plastic gas cans:

DUI_A = 1,186.5 gas cans × 0.776 x 0.66 x 0.70 × 1.38 g/gal/day × 3.52 gal × 0.29 × 0.002205 g/lbs / (2,000 lbs/ton)
= 0.00066 tons VOC/day

Equation (4)
Total diurnal emissions for all types of commercial gas cans:

$$TDUI_A = \sum DUI_A$$

Where,

$TDUI_A$ = Total diurnal emissions in County A (tons VOC /day)
DUI_A = Diurnal emissions for each type of gas can both closed and open in County A (tons VOC /day)

Total diurnal VOC emissions per day for Bexar County for commercial gas cans:

$TDUI_A$ = 0.005376 tons VOC/day + 0.001552 tons VOC/day + 0.000661 tons VOC/day + 0.000608 tons VOC/day
= 0.008197 tons VOC/day

Transport Spillage
Transport spillage occurs when the gas can is refueled at the pump. Only whether the gas can is open or closed is of any relevance, not the material of the gas can.

Sample Calculation
Equation (5)
Emissions from transport spillage in tons VOC per day for commercial gas cans:

TRS_A = CGC_A × P x TC x SF × EF × Refill x 0.002205 g/lbs / (2,000 lbs/ton)

Where,

TRS_A = Transport spillage emissions in County A (tons VOC /day)
CGC_A = Number of commercial gas cans in County A, Equation (1)
P = Percentage of commercial gas cans that are either plastic (77.6%) or metal (22.4%)
TC = Percentage of commercial gas cans that are closed (66%) or open (34%)
SF = Percentage of gas cans stored with fuel (70%)
EF = Emission factor (23 g/gal/day closed, 32.5 g/gal/day open)
Refill = Frequency of daily refilling (0.9636)

Bexar County Commercial Plastic Closed Gas Cans:

TRS_A = 1,186.5 commercial gas cans × 0.776 x 0.66 × 0.70 × 23 g/gal/day × 0.9636 × 0.002205 g/lb / (2,000 lbs/day)
= 0.01039 tons VOC/day

Equation (6)
Total transport spillage emissions for commercial gas cans:

$$TTRS_A = \sum TRS_A$$

Where,

$TTRS_A$ = Total transport spillage emissions in County A (tons VOC /day)
TRS_A = Transport spillage emissions for each type of commercial gas can both closed and open in County A (tons VOC /day)

Total transport spillage VOC emissions per day for Bexar County for commercial gas cans:

$TTRS_A$ = 0.00757 tons VOC/day + 0.00218 tons VOC/day + 0.01039 tons VOC/day + 0.0030 tons VOC/day
= 0.02314 tons VOC/day

Gasoline Distribution

The gasoline distribution network for automobile gasoline in the United States is a complex system of retail and wholesale outlets. Gasoline distribution can include many sources of emissions. The emissions calculated in this section do not include marine vessel loading, gasoline bulk tanks, loading and unloading of railway tank cars, spillages, and pipeline emissions. In the AACOG region, there is no marine vessel loading and no data on loading and unloading of railway tank cars. Gasoline bulk tanks, spillages, and pipeline emissions are included in the other sections of the emission inventory. Emissions from diesel fuels distribution was not calculated because it has a higher boiling point than gasoline and the emissions are insignificant.

In order to calculate VOC emissions from gasoline distribution, this section is divided into four sub-categories, as described in the EPA "Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone."[139]

1. Trucks in Transit. These emissions are created by pressure in the truck tank, thermal effects, and leaking delivery trucks.
2. Tank Breathing Losses. Emissions are emitted by the storage of fuel in underground storage tanks at gas stations.
3. Tank Truck Unloading. The transfer of fuel from the tank truck to the service station creates emissions in this category.
4. Vehicle Refueling. The displacement of vapors from the vehicle fuel tank produces emissions.

Methodology

Emissions from refueling, service station tank truck unloading, tank breathing losses, tank trucks in transit, and other emissions were calculated based on the gallons of gasoline sold based on the motor fuels tax collected from each county. Gasoline motor fuels tax for Texas was

[139] U.S. Environmental Protection Agency, 1991. Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone. Volume 1, Gasoline Marketing (Stage I and Stage II). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina; Emission Inventory Improvement Program, (Volume III, Chapter 11). TRC Environmental Corporation. Available Online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii11_apr2001.pdf

obtained from the Texas State Comptroller and is only available at the state level.[140] "Diesel fuel and gasoline taxpayers are only required to report their sales on a statewide basis when they file their Texas Fuels Tax Report. This includes large companies such as Exxon-Mobil, Shell, B.P., and Citgo etc as well as medium and small suppliers."[141]

To calculate the amount of gallons of gasoline sold in each county, the motor fuels tax is multiplied by five to determine the number of gallons sold because the state gasoline motor fuels tax is 20 cents/gal. As recommended by the Texas State Comptroller,[142] gallons sold were allocated to each county based on population. In Texas, approximately 1% of on-road vehicles are exempt from paying gasoline motor fuels tax. Thus, gasoline sales were increased by 1% to account for these exempt vehicles.[143] Table 4-36 lists the each county population and gallons of gasoline sold.

Table 4-34. 2005 Gasoline Sales per AACOG County

County	Population*	Gallons Sold
Atascosa	42,066	21,644,370
Bandera	22,009	11,324,370
Bexar	1,512,433	778,197,594
Comal	93,120	47,913,369
Frio	17,206	8,853,065
Gillespie	22,452	11,552,051
Guadalupe	101,951	52,456,958
Karnes	16,224	8,347,536
Kendall	29,732	15,297,856
Kerr	46,452	23,900,857
Medina	42,990	22,119,542
Wilson	38,243	19,677,308

*Note: Population figures are from the Texas Water Development Board[144]

Sample Calculation

Equation (1)

Total Gallons of Gasoline Sold in County A in 2005:

$$GS_A = POP_A / SPOP \times GMFT \times GTAX \times EXEMPT$$

Where,

[140] Email communication, Doug Freer, Revenue Estimating, Texas State Comptroller, June, 26, 2006. Austin, Texas.

[141] *Ibid*.

[142] *Ibid*.

[143] U.S. Environmental Protection Agency, 1991. Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone. Volume 1, Gasoline Marketing (Stage I and Stage II). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina; Emission Inventory Improvement Program, (Volume III, Chapter 11). TRC Environmental Corporation. Available Online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii11_apr2001.pdf

[144] Texas Water Development Board, April, 17. 2006. 2006 Regional Water Plan: County Population Projections for 2000 – 2060. Available online: http://www.twdb.state.tx.us/data/popwaterdemand/2003Projections/Population%20Projections/STATE_REGION/County_Pop.htm

GS_A	= Gallons of gasoline sold in County A
POP_A	= Population of County A for inventory year (from table 4-36)
SPOP	= State population for inventory year (22,155,787)
GMFT	= State gasoline motor fuel tax revenue for inventory year ($2,257,405,264)
GTAX	= Five gallons per dollar of tax revenue (5/1)
EXEMPT	= 1% of on-road vehicles are exempt from paying gasoline motor fuels tax (1.01)

Total Gallons of Gasoline Sold in Bexar County 2005:

$$GS_A = 1{,}512{,}433 / 22{,}155{,}787 \times \$2{,}257{,}405{,}264 \times 5 \text{ gal}/\$1 \times 1.01$$
$$= 778{,}197{,}578 \text{ gal}$$

Seasonal adjustment factor (1.016) was calculated based on average gasoline sales for the months of April, May, June, July, August, September, and October compared to the annual total gasoline sales in 2005.

Stage 1 Vapor Recovery Systems

As a tank of volatile fuel such as gasoline is gradually emptied, the empty space will be occupied by vapors of the fuel, or by a mixture of air and vapors, if an inlet air vent is provided. When a tanker truck delivers fuel to a gas station, the new fuel entering the underground tank would force accumulated gasoline vapors out of the tank into the air. With the Stage I vapor recovery system, vapors are forced out of the underground storage tank into the tanker truck through a vapor recovery line and the vapor can be recycled.

Currently, Stage I systems are required in the San Antonio MSA for facilities that dispense 25,000 or more gallons of gasoline per month.[145] The effectiveness of the Stage I vapor recovery system strategy was measured by calculating the current release of hydrocarbon emissions due to tank unloading. Tanks that are Stage I equipped recapture 98-100% of emissions that would have traditionally been released into the atmosphere during tank filling. Table 4-37 lists the number of tanks at gasoline stations with stage 1 vapor recovery by county. The percentage of tanks equipped with Stage I in Bexar, Comal, Guadalupe and Wilson Counties was calculated using TCEQ underground tank registration files[146] and a survey perform by the City of San Antonio Health Department. Martha C. Glasgow, a Petroleum Storage Tank (PST) Registration & Self Certification Specialist for TCEQ, supplied the percentages for the other eight counties.

[145] Texas Administrative Code, Title 30, Part 1, Chapter 115, Subchapter C, Division 2, Rule 115.229.
[146] Texas Commission on Environmental Quality, November 2005. UST and AST Database files. Austin, TX.

Table 4-35. Number of Tanks at Gasoline Stations Equipped with Stage 1 Vapor Recovery

County	Number of Tanks at Gasoline Stations	Number of Tanks without stage 1	Percentage of Tanks without Stage 1	Percentage of Tanks with Stage 1
Atascosa	129	27	20.93%	79.07%
Bandera	46	13	28.26%	71.74%
Bexar	1,597	416	26.05%	73.95%
Comal	160	59	36.88%	63.12%
Frio	45	9	20.00%	80.00%
Gillespie	60	13	21.67%	78.33%
Guadalupe	145	53	36.55%	63.45%
Karnes	77	20	25.97%	74.03%
Kendall	52	9	17.31%	82.69%
Kerr	97	24	24.74%	75.26%
Medina	108	29	26.85%	73.15%
Wilson	48	33	68.75%	31.25%
AACOG Total	2,389	665	27.84%	72.16%

Emission Factors

Table 4-38 lists the emissions factors for the four subcategories within gasoline distribution. The factors for tank trucks in transit, tank truck unloading, and tank-breathing loss were provided by the EIIP.[147] For vehicle refueling, EPA MOBILE6.2 was used to calculate emission factors for both annual and ozone season day. MOBILE6.2 has improved predictive equations to calculate refueling emission factors, including sensitivity to temperature and Reid vapor pressure (RVP).[148] The RVP, Reid Vapor Pressure, used was 7.8. The average ozone season maximum temperature used within MOBLIE6.2 was 87.8° F and the minimum was 69.4° F. For the annual total emission, 79.3° F was the maximum and 58.5° F was the minimum.

Table 4-36. VOC Emission Factors for Gasoline Distribution, AACOG Region

Subcategory	Emission Factor (EF)	
Vehicle Refueling	Annual	3.62 lbs of VOC/1,000 gal
	Ozone Season	3.85 lbs of VOC/1,000 gal
Tank Trucks in Transit	Vapor Filled Truck (unloaded tank truck)	0.055 lbs/ 1,000 gal
	Gas Filled Truck (loaded tank truck)	0.005 lbs/ 1,000 gal
Tank Truck Unloading	Submerged Filling (no stage 1)	7.3 lbs/ 1,000 gal
	Bal. Submerged Filling (stage 1)	0.3 lbs/ 1,000 gal
Tank Breathing loss	1.0 lb. of VOC/1,000 gal.	

To calculate emissions per day for each county, the number of days per year that each activity would have taken place was required. Table 4-39 shows the days per week and the days per year that the four types of activities took place. By using the amount gasoline sold within the AACOG region, days in which the activities took place, and emission factors for vehicle refueling, storage tank breathing, trucks in transit, and fuel delivery to outlets, gasoline

[147] U.S. Environmental Protection Agency, January 2001. Emission Inventory Improvement Program (EIIP)/Area Source Committee Volume III: Chapter 11. Research Triangle Park, North Carolina.
[148] U.S. Environmental Protection Agency, August 2003. User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model. Available online: http://www.epa.gov/otaq/m6.htm

distribution emissions were calculated.

Table 4-37. Daily Allocation of Gasoline Distribution

Subcategory	Days per Week	Days per Year
Vehicle Refueling	7	365
Tank Trucks in Transit	6	312
Tank Truck Unloading	6	312
Tank Breathing loss	7	365

Vehicle Refueling Emissions

The EPA recommends that the MOBILE6.2 model be used to generate refueling (Stage II) emission factors for vehicle emission inventories. Refueling emissions have two mechanisms of introducing emissions to the environment: (1) vapor displacement from the vehicle fuel tank during refilling; and (2) gasoline spillage during refueling.[149]

Sample Calculation

Equation (2)

Ozone season vehicle refueling emissions for County A:

$$VRE_A = EF \times GS_A / 2{,}000 \text{ lbs/ton}$$

Where,

VRE_A = Annual vehicle refueling emissions for County A (tons VOC/yr)
EF = Ozone season emission factor for vehicle refueling (3.85 lbs/1,000 gal), Table 4-38
GS_A = Gallons of gasoline sold in County A, Table 4-36 and Equation (1)

Ozone season vehicle refueling emissions for Bexar County:

$$VRE_A = 3.85 \text{ lbs} / 1{,}000 \text{ gal} \times 778{,}197{,}594 \text{ gal} / 2{,}000 \text{ lbs/ton}$$
$$= 1{,}497.12 \text{ tons VOC/year}$$

Equation (3)

Daily vehicle refueling emissions for County A:

$$DVRE_A = VRE_A / DAY \times SF$$

Where,

$DVRE_A$ = Daily vehicle refueling emissions for County A (tons VOC/day)
VRE_A = Annual vehicle refueling emissions for County A (tons VOC/yr), Equation (2)
DAY = Number of activity days per year (365), Table 4-39
SF = Seasonal adjustment factor (1.016)

Daily vehicle refueling emissions for Bexar County:

$$DVRE_A = 1{,}497.12 \text{ tons/yr} / 365 \text{ days} \times 1.016$$
$$= 4.17 \text{ tons VOC/day}$$

[149] U.S. Environmental Protection Agency, January 2001. Emission Inventory Improvement Program (EIIP)/Area Source Committee Volume III: Chapter 11. Research Triangle Park, North Carolina.

Tank Trucks in Transit Emissions

There are leaking emissions when the tanker trucks are in transit distribute gasoline. To calculate the loss the amount of gasoline in gallons transported within the area was needed. The gasoline transportation adjustment (GTA) factor used was the national default of 1.25. The GTA is "based on an estimated overall historical national ratio of bulk plant throughput to total gasoline consumption."[150]

Sample Calculation

Equation (4)

Daily tank truck in transit emissions for County A:

$$TTE_A = ((GS_A \times LEF \times GTA) + (GS_A \times UEF \times GTA)) / 2{,}000 \text{ lbs/ton}$$

Where,

TTE_A = Total gasoline emissions from tank trucks in transit in County A (tons VOC/year)

GS_A = Gallons of gasoline sold in County A, Table 4-36 and Equation (1)

LEF = Loaded tank truck in-transit emission factor (0.005 lbs/1,000 gal), Table 4-37

GTA = Gasoline transportation adjustment factor (1.25)

UEF = Unloaded tank truck in-transit emission factor (0.055 lbs / 1,000 gal), Table 4-37)

Daily tank trucks in transit emissions for Bexar County:

$$TTE = ((778{,}197{,}594 \text{ gal} \times 0.005 \text{ lbs/1,000 gal} \times 1.25) + (778{,}197{,}594 \text{ gal} \times 0.055 \text{ lbs/1,000 gal} \times 1.25)) / 2{,}000 \text{ lbs}$$
$$= 29.182 \text{ tons VOC/year}$$

Tank Truck Unloading Emissions

The emissions factors for this category depend on the filling technology used. If Stage I vapor recapture is used, the emissions released are significantly reduced. The two types of technology used in the AACOG region are submerged filling (7.3 lbs/1,000 gal) and balanced submerged filling (0.3 lbs/1,000 gal). Balanced submerged filling is stage I tank filling.

Sample Calculation

Equation (5)

Annual VOC emissions for Balanced Submerged Filling (Stage 1):

$$ABE_A = PBFT \times GS_A \text{ x } EF / 2{,}000 \text{ lbs/ton}$$

Where,

ABE_A = Annual emissions from balanced submerged filling for County A (tons VOC/yr)

PBFT = Percent of filling technology that is balanced submerged filling, Table 4-37

GS_A = Gallons of gasoline sold in County A, Table 4-36 and Equation (1)

EF = Emission factor for tank truck unloading balanced submerged filling (0.3 lbs/1,000 gal), Table 4-38

[150] *Ibid*., p. 11.3-7.

Annual tank truck unloading balanced submerged filling emissions for Atascosa County:

ABE_A = 0.7907 × 21,644,370 gal x 0.3 lbs/1,000 gal / 2,000 lbs/ton
= 2.56 VOC tons/year

Equation (6)
Annual VOC emissions for Submerged Filling (no Stage 1):

$$AGE_A = PGFT \times GS_A \times EF / 2{,}000 \text{ lbs/ton}$$

Where,

AGE_A = Annual emissions from submerged filling (no Stage 1) for County A (tons VOC/yr)
PGFT = Percent of filling technology that is submerged filling (no Stage 1), Table 4-37
GS_A = Gallons of gasoline sold in County A, Table 4-36 and Equation (1)
EF = Emission factor for tank truck unloading submerged filling (no Stage 1) (7.3 lbs/1,000 gal), Table 4-38

Total gallons of gasoline filled by submerged filling for Atascosa County:

AGE_A = 0.2093 × 21,644,370 gallons x 7.3 lbs/1,000 gal. / 2,000 lbs/ton
= 16.54 VOC tons/year

Equation (7)
Total yearly tank truck unloading emissions for County A:

$$TDE_A = DBE_A + DGE_A$$

Where,

TDE_A = Total tank truck unloading emissions for County A (tons VOC/yr)
DBE_A = Emissions from balanced submerged filling for County A (tons VOC/yr)
DGE_A = Emissions from submerged filling (no Stage 1) for County A (tons VOC/yr)

Total daily tank truck unloading emissions for Atascosa County:

DGE_A = 2.56 VOC tons/year + 16.54 VOC tons/year
= 19.10 tons VOC/ year

<u>Tank Breathing Loss</u>
No storage tank is 100% sealed; there are spaces within the tank where the gasoline vapor can escape from the tank and into the atmosphere.

Sample Calculation
Equation (8)
Annual tank breathing loss emissions for County A:

$$ATBE_A = EF \times GS_A / 2{,}000 \text{ lbs/ton}$$

Where,

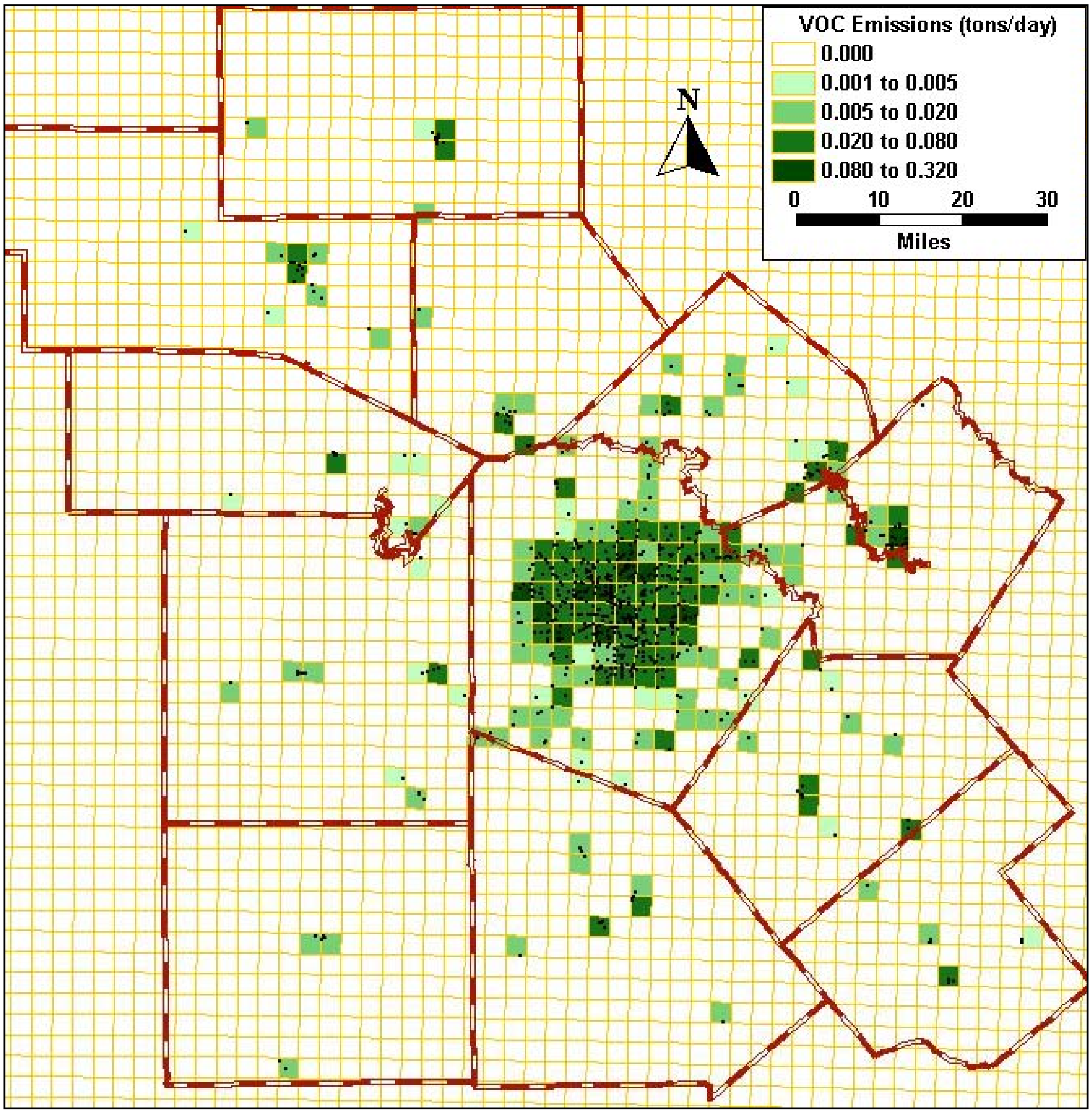
$ATBE_A$ = Annual tank breathing emissions (tons VOC/yr.)
EF = Emission factor for tank breathing (1.0 lbs/1,000 gal), Table 4-38
GS_A = Gallons of gasoline sold in County A, Table 4-36

Annual emissions from tank breathing loss for Bexar County:

$$ATBE_A = 1.0 \text{ lbs/1,000 gal} \times 778{,}197{,}594 \text{ gal} / 2{,}000 \text{ lbs/ton}$$
$$= 389.10 \text{ tons VOC/yr}$$

Spatial Distribution
Emissions are allocated on the 4km grid by employment of gasoline stations.

Figure 4-10. VOC Emissions from Vehicle Refueling, 2005



Plot Date: July 14, 2006
Map Compilation: July 13, 2006
Source: Texas Workforce Commission, 2005. Employment Data for 3rd Quarter 2004. Austin, Texas.

Stationary Diesel Generators

This category consists of emissions produced from stationary generators used for emergency, peak, and base-load situations.

> "Stationary diesel internal combustion (IC) engines constitute a significant component of the nation's electricity generating infrastructure… Historically, the vast majority of these engines has been used primarily or exclusively to provide back-up power in emergency (i.e. outage) situations and in some cases to reduce reliance on grid-supplied electricity during periods of peak demand. Consequently, most diesel generators have been operated infrequently and have not been subject to the kinds of environmental regulation applicable to large central station power plants."[151]

Methodology

The methodology used in producing emission estimates from generator within the AACOG region is based on local data, California Air Resource Board (CARB) report,[152] Northeast States for Coordinated Air Use Management (NESCAUM) report,[153] and the EPA AP42 Emission Factors.[154] The methodology follows these steps:

1. Determine MW capacity of generator for emergency, peak, and baseload operations
2. Determine population by kW ranges for generators in the AACOG region
3. Calculate emissions based on AP42 factors

Step 1: Determine MW Capacity of Generator for Emergency, Peak, and Baseload Operations

To calculate emissions, generators were designated as emergency, peak, or baseload capacity because of the wide range of hours used by different types of generators. Emergency generators are only used in case of a power interruption or for testing/maintenance of the generator. Peak generators are used to generate power during peak times to supplement existing power; while baseload generators are consistently operating when the facility needs power. Baseload generators are often utilized in areas were existing power supply is not available or cannot meet the demand.

Table 4-38 shows the generator allocation by county based on NESCAUM data. To calculate capacity by county, a population to generator ratio for the NESCAUM study was calculated by dividing the generator capacity for each category by the total population.[155] Then, the ratio was multiply by the population of each county for 2005 in the AACOG region.[156]

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[151] Northeast States for Coordinated Air Use Management (NESCAUM), June 2003. Stationary Diesel Engines in the Northeast: An Initial Assessment of the Regional Population, Control Technology Options and Air Quality Policy Issues. Boston, MA, p. ES 1.

[152] California Air Resource Board (CARB), September 2003. Staff Report: Initial Statement of Reasons for Proposed Rulemaking Airborne Toxic Control Measure for Stationary Compression-Ignition Engines. Available online: http://www.arb.ca.gov/regact/statde/isor.pdf

[153] NESCAUM, June 2003. Stationary Diesel Engines in the Northeast: An Initial Assessment of the Regional Population, Control Technology Options and Air Quality Policy Issues. Boston, MA.

[154] EPA, October 1996. AP 42. Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources: Chapter 3 Stationary Internal Combustion Sources. Available online: http://www.epa.gov/ttn/chief/ap42/ch03/index.html

[155] U.S. Census Bureau. Oct. 13, 2005. National and State Population Estimates - Table 1: Annual Estimates of the Population for the United States and States, and for Puerto Rico: April 1, 2000 to July 1, 2004. Available online: http://www.census.gov/popest/states/tables/NST-EST2004-01.pdf

[156] Texas Water Development Board, Oct. 13, 2005. 2006 Regional Water Plan: County Population Projections for 2000 – 2060. Available online: http://www.twdb.state.tx.us/data/popwaterdemand/2003Projections/Population%20Projections/STATE_REGION/County_Pop.htm

Table 4-38. Diesel Generators Capacity (MW) in AACOG, 2005

FIPS	Region	Emergency	Peak	Baseload	Total
	NESCAUM	8,756	2,805	211	11,772
48013	Atascosa	9	3	0	12
48019	Bandera	5	1	0	6
48029	Bexar	318	102	8	428
48091	Comal	20	6	0	26
48163	Frio	4	1	0	5
48171	Gillespie	5	2	0	6
48187	Guadalupe	21	7	1	29
48255	Karnes	3	1	0	5
48259	Kendall	6	2	0	8
48265	Kerr	10	3	0	13
48325	Medina	9	3	0	12
48493	Wilson	8	3	0	11
Total		417	134	10	561

Sample Calculation
Equation (1)
Estimated MW capacity of generators for County A:

$$EMWC_A = CPOP_A / NPOP \times CAP$$

Where,

$EMWC_A$ = Estimated MW capacity of generators by type (peak, emergency, or baseload) for County A
$CPOP_A$ = Population of County A for inventory year
NPOP = 2001 population of NESAUM region (41,638,170)
CAP = Capacity of generators (MW) for NESAUM region by type of generator, Table 4-40

Estimated capacity of peak generators for Bexar County:

$$EMWC_A = 1,512,433 / 41,638,170 \times 2,805 \text{ MW}$$
$$= 102 \text{ MW of Peak Generator Capacity}$$

When applying data from the California or the NESCAUM studies to the AACOG region, it should be done with caution because the power grid and economics in those regions of the U.S. are different than in Texas. Although these estimates may have inconsistencies for the AACOG region, they are the best data available without conducting a labor-intensive survey. In the past, this was a category that has not been accounted for in local emission inventory and these sources have not been cataloged. The only intensive study conducted in Texas was the Houston Advanced Research Center (HARC) report on "Estimates of Emissions for Small-Scale Diesel Engines."[157] Since this study produced unrealistic estimations of generator population and emissions, the population results could not be applied to the AACOG region.

[157] ENVIRON, December 22, 2003. Estimates of Emissions for Small-Scale Diesel Engines. Novato, CA. Available online: http://www.harc.edu/harc/Projects/AirQuality/Projects/ShowProject.aspx?projectID=22

Step 2: Determine population by kW ranges for generators in the AACOG region.
Generators were divided into kW ranges to calculate emissions. This division was necessary because the EPA AP42 provides a different emissions factor for engines above 600hp compared to smaller engines. Some of the larger generators were removed from the study because generators have to report "an account which meets the definition of a major facility/stationary source, as defined in §116.12 of this title (relating to Nonattainment Review Definitions), or any account in an ozone nonattainment area emitting a minimum of ten tons per year (tpy) volatile organic compounds (VOC), 25 tpy nitrogen oxides (NOx), or 100 tpy or more of any other contaminant subject to national ambient air quality standards (NAAQS)."[158] The San Antonio eight-hour ozone nonattainment area is Bexar, Comal, and Guadalupe counties.[159] According to Texas Administrative Code, "San Antonio eight-hour ozone nonattainment area (69 FR 23936)--Classified under the Federal Clean Air Act, Title I, Part D, Subpart 1 (42 United States Code, §7502), nonattainment deferred to September 30, 2005, or as extended by EPA."

An average 600 hp baseload generator (448 kW) emits approximately 31 tons of NOx year. These generators are covered under the point source database reporting requirements of 25 tons/day or more of NOx in the 3 non-attainment counties. Furthermore, large generators are often on the same site as other large sources of air pollutants that have to report under permitting regulations. Therefore, the removal of peak and baseload generators greater then 500kW from this study was necessary for the non-attainment counties.

However, emergency generators greater then 500kW were not removed from the calculations for the non-attainment counties because they are permitted by rule and do not have to report NOx/VOC emissions under the Texas Administrative Code. The Code states "Internal combustion engine and gas turbine driven compressors, electric generator sets, and water pumps, used only for portable, emergency, and/or standby services are permitted by rule, provided that the maximum annual operating hours shall not exceed 10% of the normal annual operating schedule."[160] Table 4-41 below lists estimated MW ranges for non-attainment counties, while Table 2-42 lists MW ranges for attainment counties. The breakdown of the MW capacity is based on the CARB study.[161] Generators less than 25 kW capacities were not included in this study because the emissions from these generators are insignificant, were not included in the CARB report, and most of them are covered under the commercial equipment section. To calculate capacity of generators in each kW bin, the total number of generators was multiplied by the percentage of generators in each bin.

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[158] Texas Administrative Code. Title 30, Part 1, Chapter 101, Subchapter A, Rule 101.10. Available online: http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC
[159] Title 40: Protection of Environment. PART 81 — Designation of Area for Air Quality Planning Purposes, Subpart C—Section 107 Attainment Status Designations. Available online: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=%2Findex.tpl
[160] Texas Administrative Code. Title 30, Part 1, Chapter 106, Subchapter W, Rule 511. Available online: http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC
[161] CARB, September 2003. Staff Report: Initial Statement of Reasons for Proposed Rulemaking Airborne Toxic Control Measure for Stationary Compression-Ignition Engines. Appendix D. p. D-28. Available online: http://www.arb.ca.gov/regact/statde/appd.pdf

Table 4-39. Generators by MW Capacity in Bexar, Comal, and Guadalupe Counties

Generator Size (kW)	Emergency	Peak	Baseload
25-150	28.6%	28.5%	28.5%
150-300	23.7%	23.7%	23.7%
300-500	23.2%	23.2%	23.2%
500-700	3.1%	0.0%	0.0%
700-1,200	9.9%	0.0%	0.0%
1,200+	11.5%	0.0%	0.0%
Total % of Generators	100.0%	75.4%	75.4%

Table 4-40. Generators by MW Capacity in Atascosa, Bandera, Frio, Gillespie, Karnes, Kendall, Kerr, Medina, and Wilson Counties

Generator Size (kW)	Emergency	Peak	Baseload
25-150	28.6%	28.5%	28.5%
150-300	23.7%	23.7%	23.7%
300-500	23.2%	23.2%	23.2%
500-700	3.1%	3.1%	3.1%
700-1,200	9.9%	9.9%	9.9%
1,200+	11.5%	11.6%	11.6%
Total % of Generators	100.0%	100.0%	100.0%

Sample Calculation
Equation (2)
Estimated capacity of kW of generators for each county:

$$MWC_A = EMWC_A \times PMWC$$

Where,

MWC_A = Estimated capacity of kW of generators for County A
$EMWC_A$ = Estimated MW capacity of generators by type (peak, emergency, or baseload) for County A, Table 4-40
PMWC = Percentage of generators by MW capacity, Table 4-41 or 4-42

Estimated Capacity of 25-150 kW of Peak Generators for Bexar County:

KWC_A = 102 MW x 0.285
= 29.07 MW of Peak Gen. Capacity (25-150 MW)

Step 3: Estimating Annual Emissions of Ozone Precursors

CARB estimated that the average hours usage for emergency diesel generators over 50 hp was 30 hours per year.[162] The same value was used in this study for generators from 25 kW (34hp) to 50 kW (67hp). For peak and baseload generators, the average hour used was taken from an

[162] *Ibid*.

study conducted by ENVIRON in Houston.[163] These hourly values are based on the ParkLink™ database.[164]

Table 4-41. Estimated Average Hour Usage for Diesel Generators (CARB/NESCAUM)

Range (kW)	Emergency (hrs/yr)	Peak (hrs/yr)	Baseload (hrs/yr)
25-150	30	350	2,880
150-300	30	420	4,240
300-500	30	460	4,460
500-700	30	460	4,460
700-1,200	30	540	4,530
1,200+	30	880	5,120

When relaying on the ParkLink database for peak and baseload generator hours, they must be used with caution. As the NESCAUM study states that:

> "While PSR's estimation methodology represents one of the few sources of information available on the total population of distributed generators, it is inherently inaccurate. Because multiple assumptions are involved in generating the estimates, it is difficult to know how much confidence can be placed in the results. Comparison with state permit records…reveals both that the discrepancies are significant and that there is no particular pattern to the variance between states permit data and PSR's population estimates for different engine size categories. This suggests either that the PSR estimates are highly inexact, or that available state permit records are incomplete, or some combination of both."[165]

The 953-hours used in the CARB study for baseload (prime) generators were unrealistic for the San Antonio area. Since there was no other information available on usage, the ParkLink™ data for Houston was applied to this study. The 0.74 load factor (LF) value was obtained from CARB.[166] The emission factors used (Table 4-43) was from the Sacramento Metropolitan Air Quality Management District (SMAQMD).[167] The SMAQMD emission factors are based on EPA AP-42 manual.

[163] ENVIRON, December 22, 2003. Estimations of Emissions for Small-scaled Diesel Engines: HARC Project H-10. Novato, CA. p. 12.
[164] Power Systems Research (PSR). ParkLink™: Engine & Equipment Population Database. Available online: http://www.powersys.com/dat_parts.html
[165] Northeast States for Coordinated Air Use Management (NESCAUM), June 2003. Stationary Diesel Engines in the Northeast: An Initial Assessment of the Regional Population, Control Technology Options and Air Quality Policy Issues. Boston, MA, p. 14.
[166] CARB. 2003. September. Staff Report: Initial Statement of Reasons for Proposed Rulemaking Airborne Toxic Control Measure for Stationary Compression-Ignition Engines. Appendix D. p. D-28. Available online: http://www.arb.ca.gov/regact/statde/appd.pdf
[167] Northeast States for Coordinated Air Use Management (NESCAUM), June 2003. Stationary Diesel Engines in the Northeast: An Initial Assessment of the Regional Population, Control Technology Options and Air Quality Policy Issues. Boston, MA, p. ES 6.

Table 4-42. Diesel Generators Emission Factors (lbs/MWh)

HP	kW	NOx		VOC		CO	
		g/hp-hr	lb/MWh	G/hp-hr	lb/MWh	g/hp-hr	lb/MWh
<600hp	<448	14.06	41.47	1.14	3.36	3.00	8.86
>600hp	>448	10.86	32.04	1.00	2.95	2.50	7.39

According to NESCAUM, "the generic efficiency assumed for stationary generator engines is 33%…1 MMBtu/hr = 100 kW = 0.1 MW = 134 hp."[168] A final step in the calculation was determining ozone season emissions by dividing the total average hourly usage by 365 days.

Sample Calculation
For generators, annual VOC, NOx, and CO emissions were calculated using the following formula:

Equation (3)
Annual VOC, CO, and NOx emissions (tons) for generators by size for County A:

$$AE_A = MWh \times HRS \times LF \times EF / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual emissions for generators for County A (tons/yr)
MWh_A = MWh produced by generators in each MWh bin for County A
HRS = Annual hours of use based on range (hrs/yr), Table 4-43
LF = Typical load factor (0.74)
EF = average emissions of pollutant per unit of use for Type A equipment (lbs/MWh), Table 4-44

For Bexar County, there are an estimated 29.07 MW of peak generator capacity for the 25-150 MW range. These generators are operated an average of 350 hrs/yr The typical LF for generators is 0.74, and the EF for NOx is 41.47 lbs/MWh.

$$AE_A = 29.07 \text{ MW} \times 350 \text{ (hrs/yr)} \times 0.74 \times 41.47 \text{ (lbs/MWh)} / 2{,}000 \text{ lbs/ton}$$
$$= 156.12 \text{ tons NOx/yr}$$

Equation (4)
Average ozone season day emissions:

$$DE_A = AE_A / DAY$$

Where,

DE_A = Average daily ozone season emissions in County A (tons/day)
AE_A = Annual emissions for generators in County A (tons/yr)
DAYS = Number of days (365 days/yr)

Average ozone season day NOx emissions for Bexar County:

$$DE_A = 156.12 \text{ tons NOx /yr} / 365 \text{ days/yr}$$
$$= 0.428 \text{ (tons NOx/day)}$$

168 *Ibid*. p. 7.

This same procedure was used for CO and VOC for each generator size and type. The emission estimates were aggregated for each size of generators per each county to calculate a county level total emission.

Graphic Arts

The graphic art industry can be divided by technology used, type of substrate used, and type of product or end use. The predominant emissions from graphic arts printing are VOCs contained in the printing inks, fountain solutions, and cleaning solutions. Graphic art printing inks vary widely in composition, but all consist of three major components: pigments composed of finely divided organic and inorganic materials; binders composed of organic resins and polymers; and solvents composed mostly of organic compounds. Furthermore, emissions can originate from proofing presses, cleaning operations, ink storage tanks, and ink mixing operations. Though they are relatively minor compared to the printing process emissions, they do contribute overall.[169]

Methodology

Graphic art emissions are based on Eastern Research Group (ERG) report on "Graphic Arts Area Sources".[170] In this report, graphic arts facilities were broken into five different types (Table 4-45):

- Lithographic,
- Gravure,
- Flexographic,
- Screen Printing, and
- Letterpress[171]

Emissions from gravure printing were not calculated because these operations are usually included in the point source database, there are no emission factors available in the ERG report, and it is not widely used in the AACOG region.

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[169] U.S. Environmental Protection Agency, May 1991. Procedures for the Preparation of Emissions Inventories for Carbon Monoxide and Precursors of Ozone. Volume I. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

[170] Eastern Research Group, Inc., October 4, 2001. 1999 Emissions Inventory for Texas: Graphic Arts Area Sources, Final Report. ERG Project No. 0141.00.016, Morrisville, North Carolina 27560

[171] "Lithography - Method of printing based on the principle of the natural aversion of water to grease, using a chemically-coated plate whose image areas attract ink and whose non-image areas repel ink.
Gravure - method of printing where the image is etched into the metal plate attached to a cylinder.
Flexographic - method of printing on a web press using rubber or flexible plates and using fast drying inks. Mainly used for packaging.
Screen Printing - Method of printing by using a squeegee to force ink through an assembly of mesh fabric and a stencil.
Letterpress - Method of printing process in which a raised image is inked to produce an impression; the impression is then transferred by placing paper against image and applying pressure." Unicorn Graphics, 2006. Glossary. College Point, NY. Available online: https://www.unicorngraphics.com/glossary/a.htm

Table 4-43. Types of Graphic Art Facilities with SIC and NAICS Codes

SIC Name	SIC Code	NAICS Name	NAICS Code	Model Facilities Type
Commercial printing, lithographic	2752	Commercial lithographic printing	323110	Lithographic
		Quick printing	323114	Lithographic
Commercial printing, gravure*	2754	Commercial gravure printing	323111	Gravure
Commercial printing, other	2759	Commercial flexographic printing	323112	Flexographic
		Commercial screen printing	323113	Screen
		Other commercial printing	323119	Letterpress
Manifold business form printing	2761	Manifold business forms	323116	Lithographic
Book printing	2732	Book printing	323117	Lithographic

*Not used in this study

Emission calculations from graphic arts operations in the AACOG 12-county region were based on employment numbers provided by the Texas Workforce Commission[172] and US Census County Business Patterns.[173] The employment database with the highest number of employees for each graphic arts type was used in the calculation.

To assure the quality of the emission estimation, minor point sources were cross-referenced with area sources to ensure no double counting of companies used. Two companies in the point source database were removed from the calculations. The emission factors used in the calculations are listed in Table 4-44.[174] Ink emissions for Lithographic is were reduced by 95% to account for the substrate retention. In addition, 7.3% of the VOCs are captured during waste removal and disposal (0.927 factor).[175]

Table 4-44. Graphic Arts Emission Factors by Facility Type and Operation

Model Facility Type	Number of Employees	Ink Uncontrolled	Ink Controlled	Blanket Roller Wash	Fountain Solution	Total
		VOC Emissions (lbs/year)				
Lithograph	1-4	96.5	4.8	427.4	50.0	482.2
	5-9	270.3	13.5	1,196.7	140.1	1,350.3
	10-19	559.9	28.0	2,478.8	290.2	2,797.0
	20-49	1,332.3	66.6	5,897.8	690.4	6,654.9
	50-99	2,877.0	143.9	12,735.8	1,490.9	14,370.6
Flexographic	1-4	181.8	N/A	31.8	N/A	213.6
	5-9	508.9	N/A	89.1	N/A	598.0
	10-19	1,054.1	N/A	184.5	N/A	1,238.6
	20-49	2,508.1	N/A	438.9	N/A	2,947.0

[172] Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.
[173] U.S. Census Bureau, September 16 2005. County Business Patterns, 2003. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.
[174] Eastern Research Group, Inc., October 4, 2001. 1999 Emissions Inventory for Texas: Graphic Arts Area Sources, Final Report. ERG Project No. 0141.00.016, Morrisville, North Carolina 27560, p. 31.
[175] *Ibid*. p. 32.

Table 4-44. (Cont.)

Model Facility Type	Number of Employees	Ink Uncontrolled	Ink Controlled	Blanket Roller Wash	Fountain Solution	Total
		VOC Emissions (lbs/year)				
Letterpress	1-4	0.2	N/A	47.5	N/A	47.7
	5-9	0.5	N/A	133.0	N/A	133.5
	10-19	0.9	N/A	275.5	N/A	276.4
	20-49	2.2	N/A	655.5	N/A	657.7
	50-99	4.9	N/A	1,415.5	N/A	1,420.4
	100-249	11.4	N/A	3,315.5	N/A	3,326.9
	250-499	24.4	N/A	7,115.5	N/A	7,139.9
Screen Printing	1-4	25.9	N/A	104.7	N/A	130.7
	5-9	72.8	N/A	293.1	N/A	365.8
	10-19	150.7	N/A	607.0	N/A	757.7
	20-49	358.6	N/A	1,444.3	N/A	1,802.9
	50-99	774.3	N/A	3,118.9	N/A	3,893.3

Sample Calculation
Equation (1)
Annual VOC emissions for graphic arts facility by type:

$$AE_A = \sum [(EMP_A \times EF_A)] \times WAS / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual emissions from graphic arts facilities type A (tons VOC/yr)
EMP_A = Number of business in graphic arts facilities type A
EF_A = EF for graphic arts facilities type A, Table 4-46
WAS = Factor to account for the removing of VOC through waste disposal (0.927)

Annual VOC emissions from lithograph operations in Bexar County:

$$AE_A = [(88 \times 482.2 \text{ lbs/yr}) + (31 \times 1{,}350.3 \text{ lbs/yr})) + (9 \times 2{,}797.0 \text{ lbs/yr}) + (11 \times 6{,}654.9 \text{ lbs/yr}) + (6 \times 14{,}370.6 \text{ lbs/yr})] \times 0.927 / 2{,}000 \text{ lbs} = 124.63 \text{ tons VOC /yr}$$

Equation (2)
Total annual VOC emissions per county:

$$TAE_A = LITH_A + FLEX_A + LET_A + SCR_A$$

Where,

TAE_A = Total annual VOC emissions for all operation types in County A (tons/yr.)
$LITH_A$ = VOC emissions from Lithograph in County A (tons/yr), Equation (1)
$FLEX_A$ = VOC emissions from Flexographic in County A (tons/yr), Equation (1)
LET_A = VOC emissions from Letterpress in County A (tons/yr), Equation (1)
SCR_A = VOC emissions from Screen Printing in County A (tons/yr), Equation (1)

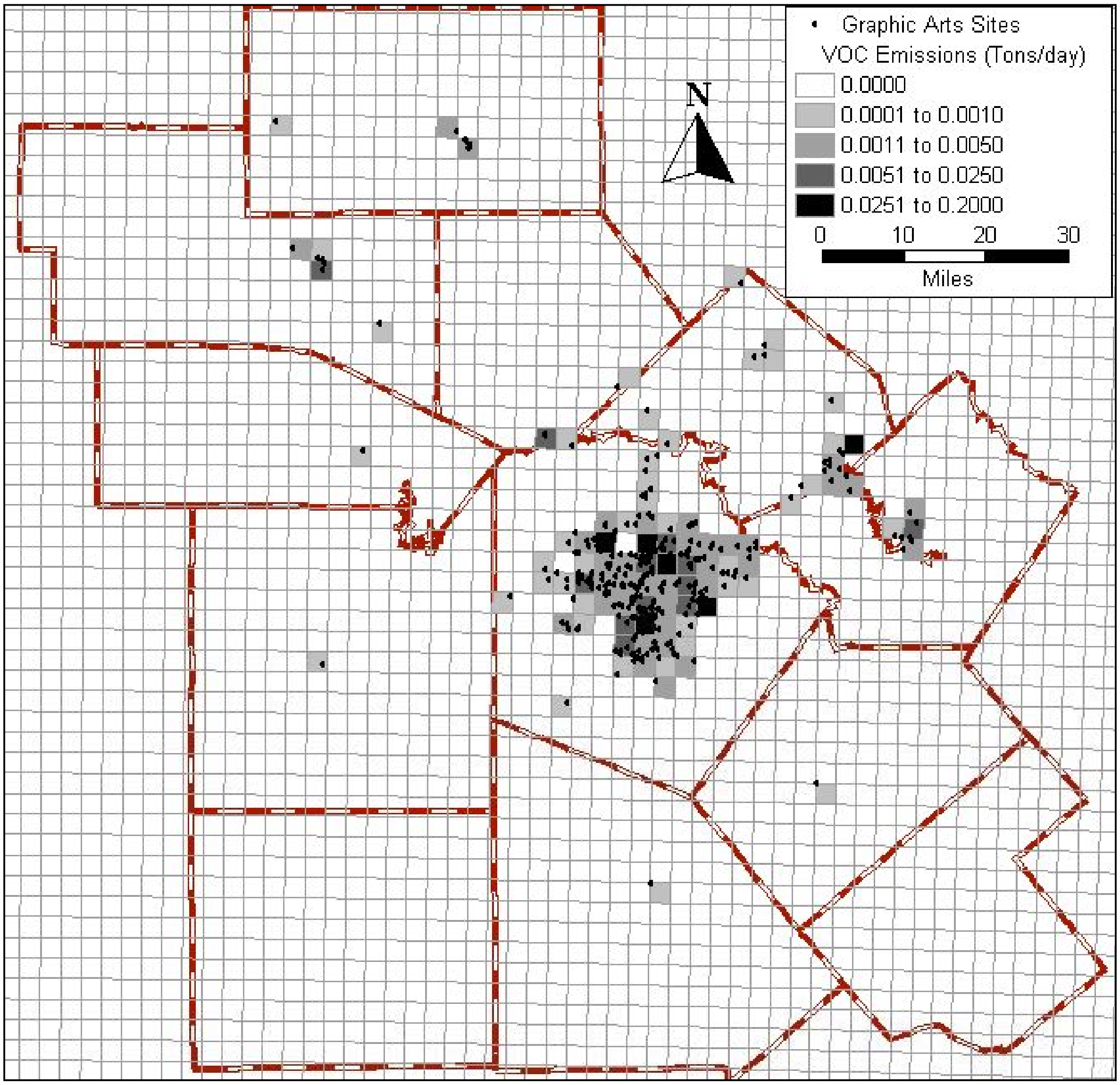
Total annual VOC emissions from graphic arts in Bexar County:

TAE_A = 124.63 tons/yr + 6.71 tons/yr + 0.28 tons/yr + 6.01 tons/yr
= 137.63 tons VOC /year

Seasonal Adjustment
The seasonal adjustment factor is 1. Graphic arts have a daily adjustment factor of 261 days per year (open 5 days a week).

Spatial Allocation
VOC graphic arts emissions were allocated to 4-km grid cells by the location of printing facilities (Figure 4-11). Allocation of emissions to each grid cell will be based on the number of employees for each type of operation located within each grid cell.

Figure 4-11. VOC Emissions from Graphic Arts Facilities, 2005



Plot Date: October 13, 2006
Map Compilation: October 11, 2006
Source: Graphic Arts locations were provided by Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.

Municipal Solid Waste Landfills

Emissions from open landfills in the AACOG region were estimated using data from the TCEQ 2005 landfill report "Municipal Solid Waste in Texas: A Year in Review."[176] According to the report, there are five municipal landfills in the AACOG region receiving waste in 2005. However, the two active landfills in Bexar County are included in the TCEQ 2005 point source emissions database. To avoid double counting, the active Bexar County landfills were removed prior to calculating emissions. In addition to the five active landfills, numerous closed MSW facilities in the AACOG region emit emissions.[177] Only Municipal solid waste (MSW) facilities were included in the emission estimates because other waste sites in the region do not emit significant emissions. In addition, there are no significant ozone precursor emissions from hazardous waste landfills in the region.

Methodology

Emissions from active and closed landfills were calculated in the AACOG region using the EPA LandGEM model version 3.02.[178] The parameters that are required by the LandGEM model include the average acceptation rate, the year the landfill opened, and the year the landfill closed.

In addition to active landfills, EPA guidance recommends calculating emissions from closed landfills. These inactive facilities continue to generate emissions after closure, although the emission rate decreases with time. According to EIIP documentation, it is important to set a cutoff level for landfill size and age in order to avoid excessive investment of resources in landfill calculations.[179] Therefore, only inactive landfills that were closed after 1987 and accepted more than 5 tons of waste a day were included in the calculations. Table 4-47 lists all landfills, open and closed, included in the 2005 Emission Inventory calculations.[180] Several landfills ceased to operate in October 1993 because of a change in MSW regulations on the length of the lease.

Sample Calculation

The LandGEM model provides several emission estimation options including the calculation of emission rates for CO, total NMOC, and individual NMOC species. Total NMOC includes both VOCs and hazardous air pollutants (HAPs). To determine emissions of VOCs, individual VOC species estimates in tons were summed for each landfill runs. The VOC emissions that were summed together are:

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[176] Waste Permits Division, June 2006. Municipal Solid Waste in Texas: A Year in Review 2005 Data Summary and Analysis. TCEQ publication AS-187/06, Available online: http://www.tceq.state.tx.us/permitting/waste_permits/waste_planning/wp_annual.html

[177] Waste Permits Division, December 2004. Municipal Solid Waste in Texas: A Year in Review 2003 Data Summary and Analysis. TCEQ publication, Available online: www.texasenvironment.org/downloadit.cfm?DocID=77

[178] Environmental Protection Agency, May 2005. LandGEM: Landfill Gas Emission Model: Version 3.02. Office of Research and Development, Research Triangle Park, North Carolina. Available online: http://www.epa.gov/ttn/catc/products.html

[179] Eastern Research Group, Inc. January 2001. Volume III: Chapter 15 Landfills. Prepared for the Area Sources Committee: Emission Inventory Improvement Program, p. 15.3-2.

[180] Alamo Area Council of Governments, 2002. Closed Landfill Inventory. San Antonio, Texas. Available online: http://regmapr.aacis.net/website/aacogclis/viewer.htm

Table 4-45. Landfills Inventory

Status	Name	Permit Number	County	Date Open	Date Closed	Avg. Acceptation rate (tons/year)
Open Permits	Waste Man. of TX	66	Comal	5/1/75	2068	310,659
	Tessman Road	1410	Bexar	Point Source		
	City of Kerrville	1506	Kerr	1983	2019	46,821
	Rosillo Creek	1986	Bexar	12/14/90	unknown	Not Active*
	Fredericksburg	1995	Gillespie	1993	2050	23,520
	Covel Gardens	2093	Bexar	Point Source		
Closed Landfills	City of Seguin	97	Guadalupe	1975	1993	14,600
	City of Hondo	185	Medina	1986	1993	4,015
	Atascosa Landfill	260	Atascosa	1975	1985	7,300
	Joint Cities	505	Bexar	7/1/69	11/7/90	9,490
	Devine	1020	Medina	1978	1993	5,475
	Nelson Gardens	1237	Bexar	1982**	1993	1,450,875
	City of San Antonio	1296	Bexar	5/5/81	3/1/91	109,500

* Rosillo Creek Landfill is not open to receiving waste and may never be active

** Nelson Gardens was opened in 1972 or 1978 by Clarks, but did not accept significant amounts of waste until the city of San Antonio bought the landfill in 1982

- 1,1,2,2-Tetrachloroethane
- 1,1-Dichloroethane (ethylidene dichloride)
- 1,1-Dichloroethene (vinylidene chloride)
- 1,2-Dichloroethane (ethylene dichloride)
- 1,2-Dichloropropane (propylene dichloride)
- 2-Propanol (isopropyl alcohol)
- Acrylonitrile
- Benzene - No or Unknown Co-disposal
- Benzene - Co-disposal
- Bromodichloromethane
- Butane
- Carbon disulfide
- Carbon tetrachloride
- Carbonyl sulfide
- Chlorobenzene
- Chloroethane (ethyl chloride)
- Chloroform
- Chloromethane
- Dichlorobenzene - (HAP for para isomer/VOC)
- Dichlorofluoromethane
- Dimethyl sulfide (methyl sulfide)
- Ethanol
- Ethyl mercaptan (ethanethiol)
- Ethylbenzene
- Ethylene dibromide
- Fluorotrichloromethane
- Hexane
- Methyl ethyl ketone
- Methyl isobutyl ketone
- Methyl mercaptan
- Pentane
- Propane
- t-1,2-Dichloroethene
- Toluene - No or Unknown Co-disposal
- Toluene - Co-disposal
- Trichloroethylene (trichloroethene)
- Vinyl chloride
- Xylene

The inventory defaults in LandGEM "are based on emission factors in EPA's *Compilation of Air Pollutant Emission Factors (AP-42)* and can be used to generate emission estimates for use in emission inventories and air permits."[181] The following list is the input factors used in the model:

- Methane Generation Rate (k) = 0.02 (emission inventory for an arid area)
- Potential Methane Gen. Capacity = 100 m3/Mg (emission inventory for an arid area)
- NMOC Concentration ppmv = 600 (emission inventory default because co-disposal of hazardous waste has not occurred)
- Methane Content = 50 percent methane and 50 percent carbon (default)

Of the five active landfills in the AACOG region, two sites have a gas collection system. These sites are the two facilities in Bexar County that are included in the TCEQ 2005 point source database and, consequently, not included in this section. Therefore, no adjustments were made to the emission rates to account for this control. Also, Nelson Gardens started operating a gas collection system in 2006 to operate a power station.

Seasonal Adjustment

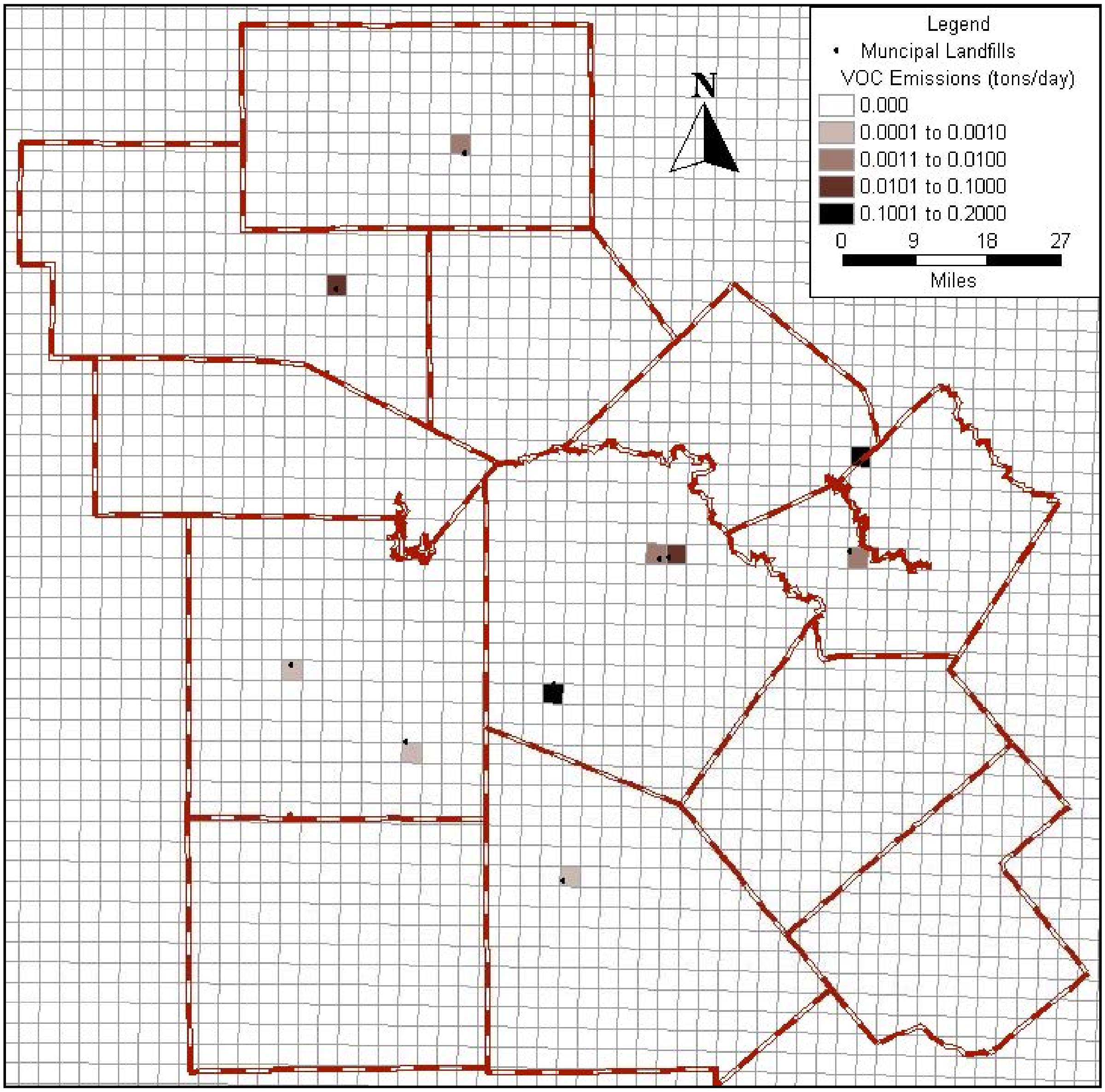
Landfill gas emission activity occurs 365 days a year. No seasonal adjustment factor was applied to the daily emissions rate to calculate ozone season emissions.

Spatial Distribution

Emissions are allocated on the 4km grid based on the location of selected open and closed landfills (Figure 4-12).

[181] Eastern Research Group, May 2005. Landfill Gas Emissions Model (LandGEM) Version 3.02 User'sGuide. Morrisville, NC, p. ii. Available online: http://www.epa.gov/ttn/catc/products.html

Figure 4-12. VOC Emissions from Open and Closed Landfills, 2005



Plot Date:	September 12, 2006
Map Compilation:	September 11, 2006
Source:	Open and Closed landfills locations were determined by Aerial Photography and Alamo Area Council of Governments, 2003. Closed Landfill Inventory. San Antonio, TX. Available online: http://www.aacog.com/cli/default.htm
Note:	The map does not include landfills in the point sources database (Covel Garden and Tessman Road).

Municipal Wastewater Treatment

The state of Texas assumed the authority to administer the National Pollutant Discharge Elimination System (NPDES) program in Texas on Sept. 14, 1998. The NPDES is a federal regulatory program to control discharges of pollutants to surface waters of the United States. The TCEQ Texas Pollutant Discharge Elimination System (TPDES) program now has federal regulatory authority over discharges of pollutants to Texas surface water, with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas.[182] Accordingly, the TCEQ permitting records provide a record of facilities that discharge wastewater according to the following guidelines:[183]

1. Discharges of waste from industry and municipal treatment works, including publicly owned treatment works (POTWs)
2. Discharges and land application of waste from concentrated animal feeding operations (CAFOs)
3. Discharges of storm water associated with industrial activities, including construction sites
4. Discharges of storm water associated with city storm sewers, known formally in the regulations as municipal separate storm sewer systems (MS4s)
5. Oversight of municipal pretreatment programs operated by publicly owned treatment works
6. Disposal and use of sewage sludge

There are two broad categories of wastewater treatment plants defined by the EPA: publicly owned waste treatment (POWT) facilities and package plants. POWTs are government owned entities charged with the handling of wastewater discharge from industries, wastewater collection systems, and other miscellaneous sources. Package plants refer to small, automated (usually) domestic waste treatment plants that do not require full-time supervision. In general, these facilities treat less than one million gallons per day (MGD).[184]

Methodology

For both categories, the industrial wastewater VOCs represent the single most important source of the volatile organic constituents in the entire wastewater stream, while only representing a percentage of the flow total. By applying EFs suitable to the total industrial flow, suitable emission factors were derived. The EPA guidance allows a default value of 1.1×10^{-4} pounds of VOC per gallon of industrial wastewater discharged.[185] This provides an EF of 110 pounds of VOC emitted per million gallons of industrial wastewater discharged. This factor is recommended for estimating VOC emissions from POWTs and package plants where measured emissions data are not available. The EPA-recommended default value is that total wastewater flow is composed of 16 percent industrial wastewater.[186]

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[182] Texas Commission on Environmental Quality, September 28, 2004. Texas Pollutant Discharge Elimination System (TPDES). Available online: http://www.tnrcc.state.tx.us/permitting/waterperm/wwperm/tpdes.html, February 20, 2001.
[183] Texas Commission on Environmental Quality, September 29, 2004. TPDES Program Summary. Available online: http://www.tnrcc.state.tx.us/permitting/waterperm/wwperm/summary.pdf
[184] U.S. Environmental Protection Agency, May 1991. Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume I: General Guidance for Stationary Sources. Publication No. EPA-450/491-016, p. 3-13 and 3-14. Research Triangle Park, North Carolina.
[185] *Ibid*.
[186] *Ibid*.

TCEQ provided the daily average discharge data for wastewater sites in the AACOG 12-county region.[187] Data included daily flow averages in MGD by month for each industrial, municipal, and federal facility. Sites that are in the point source database were removed to prevent double counting of emissions. San Antonio Water System (SAWS) provided emissions from wastewater treatment facilities that they operated.[188]

Annual wastewater flow was figured by calculating the average of the total daily flow averages for all the reported months at each site. The daily flow averages for each month was multiplied by the number of days in that month. The monthly averages were summed and then divided by 365 to provide an average daily discharge amount. Average daily flow per ozone season day was calculated by determining the average discharge amount by the same method employed in determining the annual wastewater flow but for only for the 7 months of the ozone season. Once the monthly flows were obtained and added together, the total was then divided by 214 days.

Sample Calculation
Equation (1)
Annual flow in million gallons per year (MGY) for a municipality wastewater facility:

$$AF = \sum (DAYS_A \times AVG_A)$$

Where,

AF = Annual flow in million gallons per year (MGY)
$DAYS_A$ = Days in month A
AVG_A = Average flow per day in MGD for month A

Annual flow in million gallons per year (MGY) for a municipality wastewater facility in Atascosa County:

$$AF = (31 \times 0.225) + (28 \times 0.217) + (31 \times 0.251) + (30 \times 0.210) + (31 \times 0.219) + (30 \times 0.230) + (31 \times 0.234) + (31 \times 0.232) + (30 \times 0.245) + (31 \times 0.246) + (30 \times 0.229) + (31 \times 0.220)$$
$$= 83.93 \text{ MGY}$$

Equation (2)
Ozone season flow in million gallons per ozone season day (MGD) for a municipality wastewater facility:

$$OSF = \sum (DAYS_A \times AVG_A) / 214 \text{ days/yr.}$$

Where,

OSF = Ozone season flow in million gallons per ozone season day (MGD)
$DAYS_A$ = Days in month A
AVG_A = Average flow per day in MGD for month A

[187] Michael Beatty, August 11, 2006. e-mail “Wastewater Information for 2005”. TCEQ, Austin, Texas.
[188] John T. Reynolds, Corporate Counsel, Nov. 26, 2003. RE: Potential control strategies for the Clean Air Plan related to wastewater/sewage treatment facilities. San Antonio Water System, San Antonio, Texas.

Ozone season flow in million gallons per ozone season day (MGD) for a municipality wastewater facility in Atascosa County:

OSF = [(30 x 0.210)+ (31 x 0.219)+ (30 x 0.230)+ (31 x 0.234) + (31 x 0.232) + (30 x 0.245) + (31 x 0.246)] / 214
= 0.23 MGD

Equation (3)
Annual VOC emissions from municipality wastewater facility:

AE = AF x IND x EF / 2,000 lbs/ton

Where,

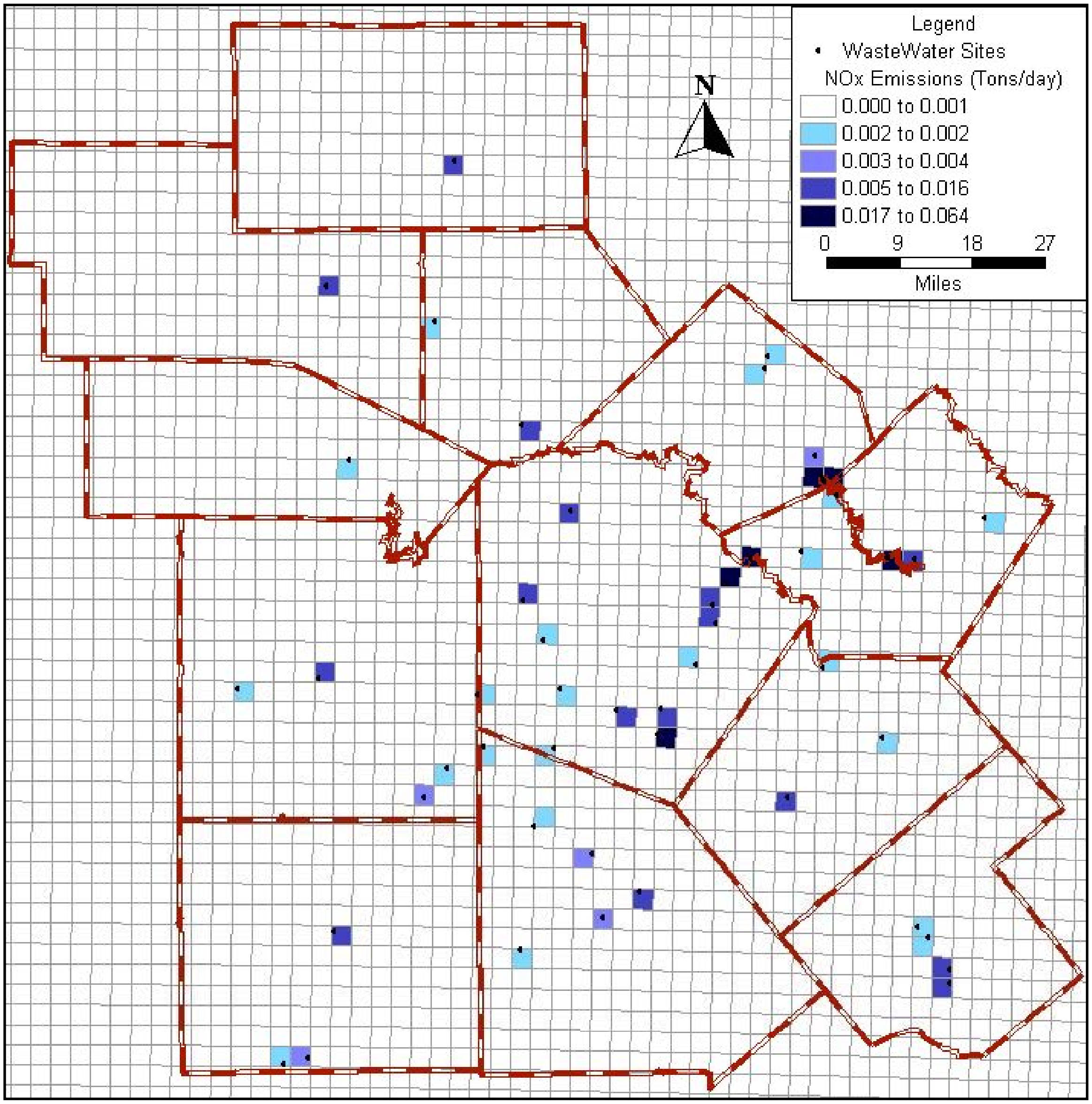
AE = Annual emissions from municipal wastewater facility (tons VOC/year)
AF = Annual Flow (MGY) (from equation (1))
IND = Industrial Wastewater Percentage (16%)
EF = EF (110 lbs of VOC emitted per million gallons)

Annual VOC emissions from for a municipality wastewater facility in Atascosa County:

AE = 83.93 MGY x 0.16 x 110 lbs / 2,000 lbs/ton
= 0.739 tons VOC/year

Spatial Distribution
Emissions are allocated on the 4km grid based on the location of wastewater facility (Figure 4-13).

Figure 4-13. VOC Emissions from Wastewater Facilities, 2005



Plot Date: August 25, 2006
Map Compilation: August 24, 2006
Source: Wastewater treatment facilities' locations were determined by Environmental Protection Agency, May 21, 2006. Facility Registry System (FRS). Available online: http://www.epa.gov/enviro/html/fii/index.html

Oil and Gas Wells Production

Field production of crude oil and natural gas emit various criteria pollutants including NOx, CO, and VOC. Emissions attributed to oil and gas production can be from a variety of sources, such as:

- Storage tanks - oil wells and wells producing condensate
- Dehydration and in-line heater - oil wells
- Fugitive emissions - oil and natural gas wells
- Compressors - natural gas wells
- Dehydrators - natural gas wells

Using the methodology developed by ENVIRON, emissions from oil and gas production were calculated.[189] Also, ERG methodology for compressors at natural gas wells was used.[190] Working and breathing losses from storage tanks was assessed through use of the Environmental Protection Agency's storage tank emissions calculation software, TANKS 4.0. The TANKS model allows users to enter specific information including storage tank dimensions, liquid contents, and turnovers to estimate emissions.[191] Regular producing gas and oil well counts for 2005 were obtained from the Texas Railroad Commission (RRC).[192]

Methodology

The data obtained from the RRC included barrels of oil, barrels of condensate, and amount of casing head and natural gas produced in each individual county (Table 4-48).[193] Casing head natural gas is gas produced from oil wells, while condensate is a liquid produced from the by-product of raw natural gas processing.

Crude Oil and Natural Gas Tankage Emissions

Emission losses from storage tanks in the oil and gas fields include working losses and breathing losses. Working losses are the combined losses attributed to the filling and emptying of the storage tanks. Breathing losses are the release of vapor from a tank due to vapor expansion caused by changes in the daily temperature and pressure.[194] ENVIRON estimated that there is one tank at each oil and condensate well.[195]

[189] ENVIRON International Corporation. August 2001. 1999-2010 Emission Inventory Trends and Projections. Navato, CA.

[190] Clinton E. Burklin and Michael Heaney, August 31, 2005. Natural Gas Compressor Engine Survey and Engine NOx Emissions at Gas Production Facilities. Eastern Research Group, Inc. Morrisville, North Carolina 27560. Available online: http://files.harc.edu/Projects/AirQuality/Projects/H040.T121.2004/H40T121FinalReport.pdf

[191] U.S. Environmental Protection Agency, September 1999. User's Guide to TANKS. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/ttn/chief/software/tanks/index.html

[192] Texas Railroad Commission, February 3, 2006. Oil and Gas Statistics and Reports. Available online: http://www.rrc.state.tx.us/divisions/og/statistics/wells/index.html

[193] Texas Railroad Commission, June 21, 2006. Production Query Data System. Available online: http://webapps.rrc.state.tx.us/PDQ/home.do

[194] U.S. Environmental Protection Agency, September 1999. Emissions Inventory Improvement Program, Volume II: Chapter 10 – Preferred and Alternative Methods of Estimating Air Emissions from Oil and Gas Field Production and Processing Operations. Research Triangle Park, North Carolina.

[195] ENVIRON International Corporation. August 2001. 1999-2010 Emission Inventory Trends and Projections. Navato, CA.

Table 4-46. Production of Oil, Casing Head, GW Gas, and Condensate by County, 2006

FIPS	County	Oil (BBL)	Casing head Natural Gas (Mcf)	Natural Gas from Gas Well (Mcf)	Condensate (BBL)
48013	Atascosa	726,049	233,930	5,826,939	11,624
48019	Bandera	1,524	0	0	0
48029	Bexar	122,739	118	0	0
48091	Comal	0	1	2	3
48163	Frio	542,106	370,873	791,569	1,377
48171	Gillespie	0	1	2	3
48187	Guadalupe	1,349,477	89,767	9,719	353
48255	Karnes	266,421	754,619	7,701,768	82,701
48259	Kendall	0	1	2	3
48265	Kerr	1,039	0	0	0
48325	Medina	84,317	293	10,501	0
48493	Wilson	279,456	23,960	3,764	68
Total		3,373,128	1,473,563	14,344,266	96,132

BBL = barrel of oil or condensate
MCF = Thousand Cubic Feet

The EPA TANKS 4.0 model was used to estimate the amount of emissions emitted by oil and gas wells. Imputed specifications into the TANKS model include roof type, average liquid height, volume, turnovers, shell color, shell condition, roof color, roof condition, roof height, roof radius, and the tank's component. The following specifications were inputted for the all the counties:[196]

- Average volume of 12,600 gallons
- Average working volume of 8,813 gallons
- Shell color/shade of gray/light
- Good shell condition
- Roof color/shade of gray/light
- Good roof condition
- Dome Roof
- Roof height of 1 ft
- Roof radius of 11 ft

Turnovers varied by county. The turnover factor was determined by dividing barrels of production in the county by average working volume (8,813) for both oil and condensate (Table 4-49). The TANKS model defaults were used for the other required factors. Once the specifications were inputted, the TANKS model outputted emission estimates in pounds per year for one individual tank. Emissions were multiplied by the number of oil or natural gas wells for each county. The TANKS model was also used to calculate emissions by month that was converted into tons/day for average ozone season day.

Sample Calculation: Oil Wells Tanks
Equation (1)
Annual *crude oil tankage* emissions for oil wells in County A:

$$AE_A = TOWY_A \times OW_A / 2{,}000 \text{ lbs/ton}$$

Where,

196 *Ibid*.

AE_A = Annual crude oil tankage emissions for County A (tons/yr)
$TOWY_A$ = TANKS 4.0 model emission estimate for regular producing oil wells for County A (lbs/yr)
OW_A = Number of oil wells for County A, Table 4-49

Annual VOC emissions from crude oil tankage for oil wells in Atascosa County:

AE_A = 682.96 lbs/yr X 1,178 / 2,000 lbs/ton
= 402.26 tons VOC/yr

Table 4-47. Producing Oil and Gas Wells by County with Turnover Rates

FIPS	County	Regular Producing Oil Wells	Regular Producing Gas Wells	Wells Producing Condensate	Turnovers (Oil Wells)	Turnovers (Condensate from Gas Wells)
48013	Atascosa	1,178	81	17	2.94	3.26
48019	Bandera	1	0	0	7.26	-
48029	Bexar	2,900	0	0	0.20	-
48091	Comal	0	0	0	-	-
48163	Frio	531	81	6	4.87	1.09
48171	Gillespie	0	0	0	-	-
48187	Guadalupe	1,929	1	1	3.33	1.68
48255	Karnes	108	112	65	11.76	6.06
48259	Kendall	0	0	0	-	-
48265	Kerr	1	0	0	4.95	-
48325	Medina	1,516	3	0	0.27	-
48493	Wilson	619	1	1	2.15	0.32
Total		8,783	279	90		

Equation (2)
Daily *crude oil tankage* emissions for oil wells in County A:

DE_{COT} = $TOWM_A$ x OW_A / 2,000 lbs/ton

Where,

DE_{COT} = Daily crude oil tankage emissions for oil wells (tons/day)
$TOWM_A$ = TANKS 4.0 model emission estimate for regular producing oil wells for County A (lbs/month)
OW_A = Number of oil wells for County A, Table 4-49

Daily VOC emissions for crude oil tankage for oil wells in Atascosa County:

DE_{COT} = 2.28 lbs/day X 1,178 / 2,000 lbs/ton
= 1.34 tons VOC /day

Sample Calculation: Gas Well Tanks
Equation (3)
Annual *condensate tankage* emissions from gas wells in County A:

AE_A = $TCGY_A$ x CGW_A / 2,000 lbs/ton

Where,

AE_A = Annual condensate tankage emissions for gas wells for County A (tons/yr)

$TCGY_A$ = TANKS 4.0 model emission estimate for gas wells producing condensate for County A (lbs/yr)

CGW_A = Number of condensate gas wells for County A, Table 4-49

Annual condensate tankage VOC emissions for gas wells in Atascosa County:

AE_A = 1,535.74 lbs/yr X 17 / 2,000 lbs
= 13.05 tons VOC /yr

Equation (4)
Daily *condensate tankage* emissions for oil wells in County A:

DE_A = $TCGM_A$ x CGW_A / 2,000 lbs/ton

Where,

DE_A = Daily condensate tankage emissions for gas wells for County A (tons/day)

$TCGM_A$ = TANKS 4.0 model emission estimate for gas wells producing condensate for County A (lbs/month)

CGW_A = Number of condensate gas wells for County A, Table 4-49

Daily VOC emissions for crude oil tankage for oil wells in Atascosa County:

DE_A = 5.26 lbs/day X 17 / 2,000 lbs
= 0.04 tons VOC/day

<u>Glycol Dehydration and in-line Heater Emissions for Oil Wells</u>
Heater emissions are produced at oil well sites and are based on the size of the combustion source. ENVIRON surveyed heater types at oil wells in Texas and it was determined that the average size of oil well heaters is 0.5 mm BTU/hr. Of the wells surveyed, data reflected that approximately 75% of the oil wells are equipped with in-line heaters and 24% of wells are equipped with glycol heaters. Heater emissions were estimated by multiplying the size of the heaters with the annual hours (8760) and emission factors of the criteria pollutant (Table 4-25). The VOC, NOx, and CO emission factors are presented in table 4-50.[197] Emissions per well were then multiplied by the number of wells in each county to determine tons per year.

Table 4-48. Average Emission Factors for Glycol Dehydration and In-Line Heaters

Precursor	Emission Factor
VOC	5.5 lbs/mmcf
NOx	100 lbs/mmcf
CO	84 lbs/mmcf

Sample Calculation
Equation (5)
Annual *glycol dehydration and in-line heater emissions* for oil wells in County A:

[197] *Ibid*.

AE_A = HS x HOURS x EF x OW_A x PER / (1,000 BTU/Mfc) / (2,000 lbs/ton)

Where,

AE_A = Annual emissions per heater type, either glycol dehydration (GDH) or in-line (ILH) heaters (tons/yr) for County A
HS = Heater size (0.5 mm BTU/hr)
HOURS = Hours of operation (8,760 hrs/yr)
EF = Emission factors for heaters (lbs/MMcf.), Table 4-50
OW_A = Number of oil wells in County A, Table 4-49
PER = Percentage of heaters by type (23.8% glycol dehydration heaters, 74.6% in-line heaters)

Annual VOC emissions from glycol dehydration heaters for oil wells in Atascosa County:

$AE_{Atascosa}$ = 0.5 mm BTU/hr x 8,760 hrs/yr x 5.5 lbs/Mcf x 1,178 x 0.238 / (1,000 BTU/Mcf) / (2,000 lbs/yr)
= 3.38 tons VOC /yr for glycol dehydration heaters

Annual VOC emissions from in-line heaters for oil wells in Atascosa County:

$AE_{Atascosa}$ = 0.5 mm BTU/hr x 8,760 hrs/yr x 5.5 lbs/Mcf x 1,178 x 0.746 / (1,000 BTU/Mcf) / (2,000 lbs/yr)
= 10.59 tons VOC/yr for In-line heaters

Fugitive Emissions

To calculate fugitive emissions, ENVIRON estimated the average number of valves and fittings at each well site (Table 4-51).[198] The emission factor for each valves or fittings was multiplied by the total number of valves and fittings for each well. Afterwards, the number of natural gas or oil wells in each county was multiplied by the fugitive emissions at a single well site.

Table 4-49. Emission Factors for Oil and Natural Gas Well Fugitive Emissions

Substance	Component	Average number per Well	Emission Factor (kg/hr/component)[199]
Gas Wells	Valves	21	0.0045
	Fittings	49	0.00039
Oil Wells (Light Crude)	Valves	5	0.0025
	Fittings	9	0.00011

Sample Calculation: Fugitive Emissions from Oil Wells

Equation (6)

Annual *fugitive emissions* for oil wells in County A:

AE_A = [(OW_A x V x EF) + (OW_A x NF x EF)] x HOURS / 907.18 kg/ton

[198] ENVIRON International Corporation. August 2001. 1999-2010 Emission Inventory Trends and Projections. Navato, CA.

[199] U.S. Environmental Protection Agency, November 1995. Protocol for Equipment Leak Emission Estimates. Office of Air Quality Planning and Standards, Research Triangle Park, NC, p. 2-15.

Where,

AE_A = Annual fugitive emissions for County A (tons/yr)
OW_A = Number of oil wells in County A, Table 4-49
V = Number of valves (from Table 4-51)
EF = Emission factors for fugitive emissions (kg/hr/component), Table 4-51
NF = Number of fittings, Table 4-51
HOURS = Hours of operation (8,760 hrs/yr)

Annual VOC emissions from fugitive emissions for oil wells in Atascosa County:

$AE_{Atascosa}$ = [(1,178 x 5 components x 0.0025 kg/hr) + (1,178 x 9 components x 0.00011kg/hr)] x 8,760 hrs/yr / 907.18 kg/ton
= 153.31 tons VOC/yr

Sample Calculation: Fugitive Emissions from Natural Gas Wells

Equation (7)

Annual *fugitive* emissions from natural gas wells in County A:

AE_{NGF} = [(GW_A x V x EF) + (GW_A x NF x EF)] x PER x HOURS / 907.18 kg/ton

Where,

AE_{NGF} = Annual fugitive emissions for County A (tons/yr)
GW_A = Number of producing gas wells in County A, Table 4-49
V = Number of valves, Table 4-51
EF = Emission factors for fugitive emissions (kg/hr/component), Table 4-51
NF = Number of fittings, Table 4-51
PER = Percentage of VOC pollutants in natural gas (25 percent)
HOURS = Hours of operation (8,760 hrs/yr)

Annual fugitive VOC emissions from natural gas wells in Atascosa County:

AE_{NGF} = [(81 x 21 x 0.0045 kg/hr) + (81 x 49 x 0.00039 kg/hr)] x 0.25 x 8,760 hr/yr / 907.18 kg/ton
= 22.22 tons VOC/yr

Compressor Emissions

Production from casing head and gas wells was used to estimate compressor engine emissions. ERG estimated that 83% of the compressor engines have a maximum rating less than 500 hp. Furthermore, these engines represents 38% of the total horsepower capacity.[200] Engines greater then 500 hp should be included in the point source emission inventory. Compressors for the San Antonio region were divided into 4-stroke rich, 2-stroke lean, and 4-stroke rich with reduction non-selective catalytic (NSCR). Natural gas compressors were multiplied by the fraction of wells older then 1 year (Table 4-52), compression requirements (3.5 hp-hr/Mscf), fraction of total engine capacity, fuel consumption, and emission factor (Table 4-53).

[200] Clinton E. Burklin and Michael Heaney, August 31, 2005. Natural Gas Compressor Engine Survey and Engine NOx Emissions at Gas Production Facilities. Eastern Research Group, Inc. Morrisville, North Carolina 27560 p. 4-3. Available online: http://files.harc.edu/Projects/AirQuality/Projects/H040.T121.2004/H40T121FinalReport.pdf

Table 4-50. Compressors by Total Horsepower Capacity % and Fuel Consumption Rates

Engine Type	Fraction of Wells greater then 1 year old	Fuel Consumption (MMBtu/hp-hr)	Percentage of total horsepower capacity
4 stroke, rich	88%	0.008769	25%
2 stroke, lean	88%	0.009324	12%
4 stroke, rich w/ NSCR	88%	0.008769	1%

Table 4-51. Emission Factors for Compressors <500 HP (lb/MMBtuHHV)[201]

Pollutant	4 stroke rich	2 stroke lean	4 stroke rich, w/ NSCR
NO_x	2.27	1.94	0.23
CO	3.51	0.35	0.35
VOC	0.0296	0.12	0.0029

Sample Calculation:
Equation (8)
Annual *compressor* emissions for gas wells in County A:

$$AE = (CH_A + NGW_A) \times FW \times R \times PEC \times FCR \times EF / 2{,}000 \text{ lbs/ton}$$

Where,

AE = Annual compressor emissions (tons/yr.) by type, 4 stroke rich (FSR), 2 stroke lean (TSL), and 4 stroke rich w/ NSCR (FSN)
CH_A = Casing head for natural gas wells for County A (from Table 4-48) (MCF)
NGW_A = Natural gas from gas well for County A (from Table 4-48) (MCF)
FW = Fraction of wells > 1 year old, Table 4-52
R = Compression requirements (3.5 hp-hr/Mscf)
PEC = Percentage of total engine capacity, Table 4-52)
FCR = Fuel consumption (from Table 4-52) (MMBtu/hp-hr)
EF = Emission factors for compressors (lb./MMBtuHHV), Table 4-53

Annual VOC emissions for 4 stroke, rich compressors in Atascosa County:

4 stroke, rich = (233,930 MCF + 5,826,939 MCF) x 0.88 x 3.5 x 0.25 x 0.008769 MMBtu/hp-hr x 0.0296 lb./MMBtuHHV / 2,000 lbs/ton
= 0.61 tons VOC/yr

Dehydrator Emissions

Dehydrator emissions were calculated based on total natural gas production. Dehydrator emissions were determined by multiplying the amount of gas extracted by the amount of VOC lost in dehydration (1.2163 lbs/mmscf).[202]

Sample Calculation:
Equation (9)
Annual *dehydrator emissions* for natural gas wells in County A:

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[201] U.S. Environmental Protection Agency, July 2000. Compilation of Air Pollutant Emission Factors, AP-42, Research Triangle Park, NC.
[202] ENVIRON International Corporation. August 2001. 1999-2010 Emission Inventory Trends and Projections. Navato, CA.

AE_A = (CH_A + NGW_A) x LOST / (2,000 lbs/ton) / (1,000 BTU/mfc)

Where,

AE_A = Annual emissions from dehydration (tons/yr)
CH_A = Casing head for natural gas wells for County A (MCF), Table 4-48
NGW_A = Natural gas from gas well for County A (MCF), Table 4-48
LOST = Amount of VOC lost in dehydration (1.2163 lbs/MMcf)

Annual VOC emissions from dehydration of gas wells in Atascosa County:

$AE_{Atascosa}$ = (233,930 MCF+ 5,826,939 MCF) x 1.2163 lbs/MMcf / 2,000 lbs / 1,000 MCF/MMCSCF
= 3.69 tons VOC/yr

Sample Calculation: Total Oil Well Emissions
Equation (10)
Total annual emissions for oil wells in County A:

TAE_A = ΣAE_S

Where,

TAE_A = Total annual oil well emissions in County A (tons/yr)
AE_S = Annual emissions in County A (tons/yr) by source (crude oil tankage, glycol dehydration heater, in-line heater, and fugitive)

Total annual VOC emissions from oil wells in Atascosa County:

$TAE_{Atascosa}$ = 402.26 tons/yr + 3.38 tons/yr + 10.59 tons/yr + 153.31 tons/yr
= 569.54 tons VOC/year

Sample Calculation: Total Natural Gas Well Emissions
Equation (11)
Total annual emissions for natural gas wells in County A:

$NGAE_A$ = ΣTAE_S

Where,

$NGAE_A$ = Annual condensate tankage emissions for gas wells in County A (tons/yr)
TAE_S = Annual 4 stroke rich compressor emissions, annual 2 stroke lean compressor emissions, and annual 4 stroke rich w/ NSCR compressor emissions in County A (tons/yr)

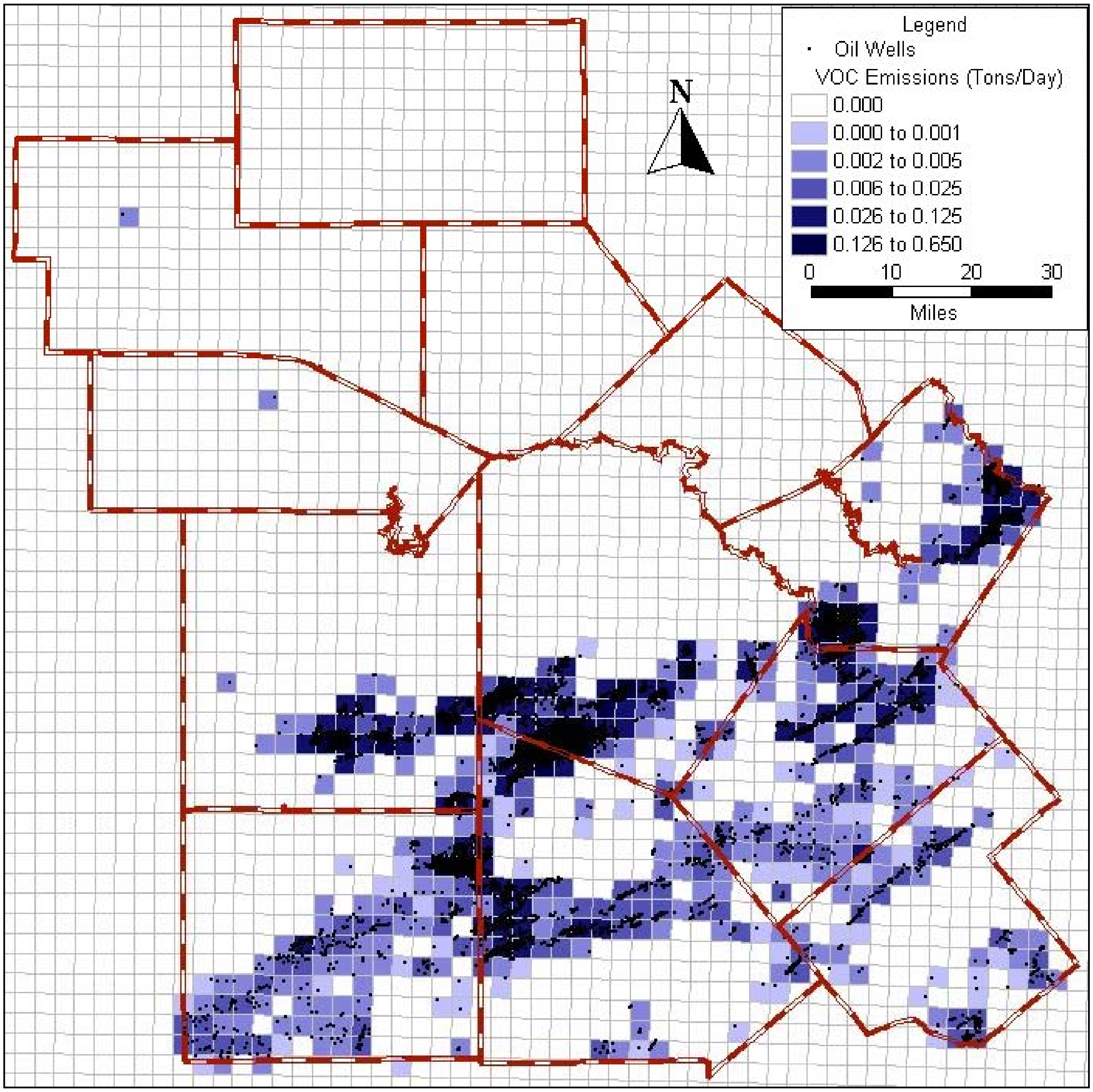
Total annual VOC emissions from natural gas wells in Atascosa County:

$TAE_{atascosa}$ = 13.05 tons VOC/yr + 0.61 tons VOC/yr + 1.25 tons VOC/yr + 0.0024 tons VOC/yr + 22.20 tons VOC/yr + 3.69 tons VOC/yr
= 40.80 tons VOC/yr

Seasonal Adjustment
Besides crude oil and condensate tankage, the seasonal adjustment factor for oil and gas well emissions is 1, with activity 7 days a week for 52 weeks. For the crude oil and condensate tankage, daily emissions were calculated based on Tanks Model output as shown above.

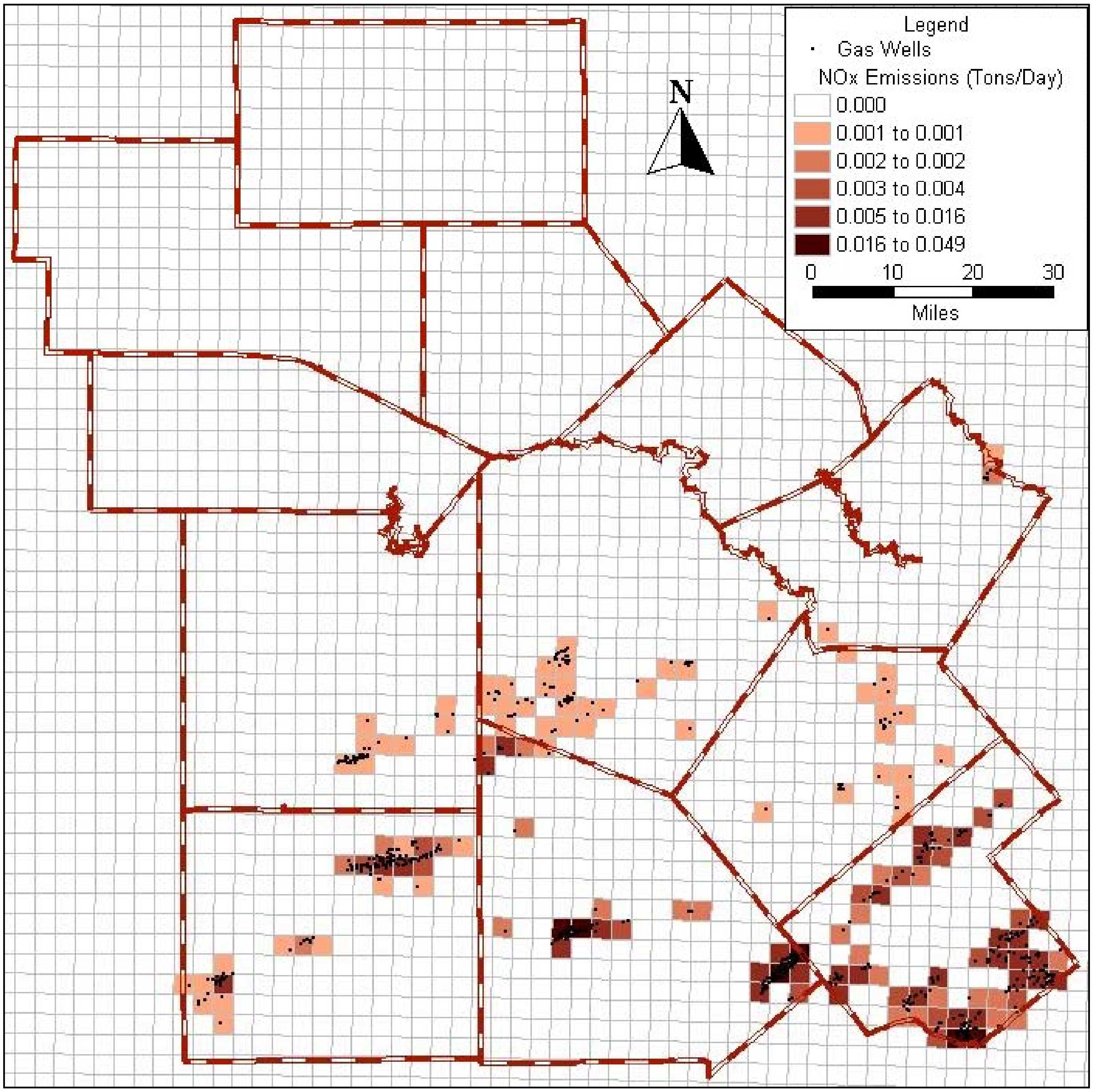
Spatial Distribution
Emissions are allocated on the 4km grid by the location of the oil and gas wells (Figure 4-14 and Figure 4-15).

Figure 4-14. VOC Emissions from Oil Wells, 2005



Plot Date: July 24, 2006
Map Compilation: July 24, 2006
Source: Oil Well location data was provided by Texas Railroad Commission, September 2005. Digital Map Information. Austin, Texas.

Figure 4-15. NOx Emissions from Natural Gas Compressors at Gas Wells, 2005



Plot Date: July 24, 2006
Map Compilation: July 24, 2006
Source: Gas Well location data was provided by Texas Railroad Commission, September 2005. Digital Map Information. Austin, Texas.

Pipelines and Pumping Stations

Emissions from pipelines, used for the transportation of crude oil and gasoline, occur in the form of volatile organic compounds (VOC) emitted from valves, pump seals, fittings/flanges, and open-ended lines. These emissions occur at pump stations, pig receivers, and valves along the length of the pipeline. Pumping stations are "used to boost the volume of oil moved through the pipeline system by increasing the average pressure. As oil flows through the pipe, friction between the oil and the pipe causes the oil to lose pressure. Without pump stations, liquids would eventually stop flowing through the pipeline."[203]

Natural Gas pipeline emissions were not calculated due to the lack of data availability. Diesel pipeline emissions were found to be insignificant due to a higher boiling point than gasoline and for this reason were not included. Emissions from terminals and refineries along the pipelines are included in the point source emissions. Therefore, only emissions from gasoline and crude oil pipelines were calculated for this category.

Methodology

Location and miles of pipeline (Table 4-54) for each county were obtained from the Texas Railroad Commission (RRC).[204] Next, number of valves, pump seals, fittings/flanges, and open-ended lines per county were determined. Local oil companies were surveyed to determine the number of pumping stations, pig receivers, and valves per mile of pipeline. The survey reflected an estimated 0.022 pumping station or pig receivers per mile of pipeline in the AACOG region; each pumping station/pig receiver had an average of 2 pump seals and 18 valves. There were an estimated 0.271 valves per mile of pipeline in addition to the pumping stations valves. Two fittings/flanges were counted for each valve and five fittings/flanges for each pump seal. Likewise, it was estimated that there was two open-ended lines at each pump station. The number of components per mile was multiplied by the length of gasoline & crude oil pipeline in each county.

The total number of valves, pump seals, fittings/flanges, and open-ended lines in each county was multiplied by the emission factor for each component (Table 4-55).[205] Light oil production emission factors were used because it is considered equivalent to gasoline and crude oil transported in pipelines through the region.[206] For gasoline and crude oil shipped in local pipelines, total organic compounds is equivalent to total VOC.[207] The sum of emissions for valves, pumps, fittings/flanges, and open-ended lines equals the total emissions from pipelines in each county.

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[203] Kinder Morgan, June 15, 2006. TMX-2 - Pump Stations Questions and Answers. p. 1. Available online: www.tmxproject.com/data/3/rec_docs/528_PumpStations%2005-18-06.pdf

[204] Texas Railroad Commission, February 3, 2006. Oil and Gas Statistics and Reports. Available online: http://www.rrc.state.tx.us/divisions/og/statistics/wells/index.html

[205] U.S. Environmental Protection Agency, November 1995. Protocol for Equipment Leak Emission Estimates. Office of Air Quality Planning and Standards, Research Triangle Park, NC, p. 2-15.

[206] ENVIRON International Corporation. August 2001. 1999-2010 Emission Inventory Trends and Projections. Navato, CA, p. 2-9

[207] *Ibid*.

Table 4-52. Quantities of Pipeline-Miles, Valves, Pump Seals, Fittings, and Open-Ended Lines per County, 2005

County	FIPS	Pipeline Miles	Valves	Pumps	Fittings/ Flanges	Open-Ended Lines
Atascosa	48013	40.6	27.1	1.8	63.0	1.8
Bandera	48019	0.0	0.0	0.0	0.0	0.0
Bexar	48029	128.3	85.5	5.6	199.1	5.6
Comal	48091	9.6	6.4	0.4	14.8	0.4
Frio	48163	28.1	18.7	1.2	43.6	1.2
Gillespie	48171	83.2	55.4	3.7	129.1	3.7
Guadalupe	48187	110.4	73.5	4.8	171.3	4.8
Karnes	48255	101.0	67.2	4.4	156.6	4.4
Kendall	48259	0.0	0.0	0.0	0.0	0.0
Kerr	48265	0.0	0.0	0.0	0.0	0.0
Medina	48325	94.7	63.1	4.2	147.0	4.2
Wilson	48493	55.8	37.1	2.4	86.5	2.4
AACOG		651.7	434.0	28.6	1,011.2	28.6

Table 4-53. Light Oil Production Operations Emission Factors, kg/hr/source

Pollutant	Valves	Pumps Seals	Fittings/Flanges	Open-Ended Lines
Total Organic Compound	0.0025	0.013	0.00011	0.0014

Sample Calculation
Equation (1)
Number of Valves/Pump Seals/Open-Ended lines for County A:

$$N_{V/PS/OL} = (CM_{V/PS/OL} \times MP_A) + (CP_{V/PS/OL} \times Pumps \times MP_A)$$

Where,

$N_{V/PS/OL}$ = Number of Valves/Pump Seals/Open-Ended lines
$CM_{V/PS/OL}$ = Number of Valves/Pump Seals/Open-Ended Lines per Mile
MP_A = Miles of pipeline for county A (from Table 4-54)
$CP_{V/PS/OL}$ = Number of Valves/Pump Seals/Open-Ended Lines per pumping station
Pumps = Pumping stations per mile

Number of Valves/Pump Seals/Open-Ended lines for 40.6 miles of pipelines in Atascosa County:

N_V = (0.271 valves/mi. x 40.6 mi.) + (18 valves/station x 0.022 stations/mi. x 40.6 mi.)
= 27.1 valves for Atascosa County

N_{PS} = (0 pump seals/mi. x 40.6 mi.) + (2 pump seals/station x 0.022 stations/mi. x 40.6 mi.)
= 1.8 pump seals for Atascosa County

N_{OL} = (0 pump seals/mi. x 40.6 mi.) + (2 open-ended lines/station x 0.022 stations/mi. x 40.6 mi.)
= 1.8 open-ended lines for Atascosa County

Equation (2)
Number of Fittings/Flanges for County A:

F/FL_A = (N_V x FV) + (N_{PS} x VP)

Where,

F/FL_A = Number of fittings/flanges for county A
N_V = Number of valves per county
FV = Number of fittings/flanges per Valve (2)
N_{PS} = Number of pump seals per county
VP = Number of fittings/flanges per pump seal (5)

Number of Fittings/Flanges for Atascosa County:

F/FL_A = (27.1 valves x 2 fittings/flanges per valve) + (1.8 pump seals x 5 fittings/flanges per pump seal)
= 63.0 fittings/flanges

Equation (3)
Annual VOC emissions for pipelines in County A:

AE_A = [(N_V x HRS x VEF) + (N_{PS} x HRS x PSEF) + (F/FL x HRS x FEF) + (N_{OL} x HRS x OLEF)] x (2.2046 lbs/kg) / 2,000 lbs/ton

Where,

AE_A = Annual emissions for pipelines in County A (tons VOC/yr)
N_V = Number of valves per County, Table 4-54
HRS = Hours per component (8,760 hours/year)
VEF = Emission factor per valve (kg/hr/source), Table 4-55
N_{PS} = Number of pump seals per County, Table 4-54
PSEF = Emission factor per pump seal (kg/hr/source), Table 4-55
F/FL = Number of fittings/flanges per County, Table 4-54
FEF = Emission factor per fitting/flanges (kg/hr/source), Table 4-55
N_{OL} = Number of open-ended lines per County, Table 4-54
OLEF = Emission factor per open-ended lines (kg/hr/source), Table 4-55

Annual VOC emissions for 40.6 mile of pipeline in Atascosa County:

AE_A = [(27.1 valves x 8,760 hrs/yr x 0.00250 kg/hr/valve) + (1.8 pump seals x 8,760 hrs/yr x 0.013 kg/hr/pump seal) + (63.0 fittings/flanges x 8,760 hrs/yr x 0.0001 kg/hr/fitting/flanges) + (1.8 open-ended lines x 8,760 hrs/yr x 0.0014 kg/hr/open-ended lines)] x 2.2046 lbs/kg / 2,000 lbs/ton
= 0.97 tons VOC/yr

Seasonal Adjustment
Pipeline emission activity occurs 365 days a year, 24 hours a day. To calculate ozone season day emissions, yearly emissions were divided by 365.

Small Stationary Source Fossil Fuel Use

Small Stationary Source Fossil Fuel Use is divided into 7 types of fuel. Each type of fuel can be used for residential, commercial, or industrial purposes.

- Coal
- Fuel Oil - Distillate
- Fuel Oil - Residual
- Kerosene
- Natural Gas
- Liquid Petroleum Gas (LPG)
- Wood

Methodology – Coal Consumption

There was no significant usage of coal for home heating and commercial usage in Texas (12,000 short tons for residential use in 2005).[208] Only 16 homes in the AACOG region reported that they used coke or coal for heating in 1999.[209] Industrial usage of coal is reported within the Point Source section. No emissions are calculated for coal consumption for Area Sources.

Methodology – Fuel Oil Distillate Consumption

Residential Distillate Consumption

In the state of Texas, the quantity of distillate oil is consumed in residences is insignificant. It is small for two main reasons: Texas is a major natural gas producer and natural gas is the fuel most often used for residential heating. Second, winters are not severe in Texas compared to other states. The 2004 residential consumption of distillate fuel in Texas was report at 145,000 gallons[210] and only 462 homes in the AACOG region use fuel oil, kerosene, and distillate for heating.[211] In addition, previous work done by the Texas Air Control Board (TACB) indicates that the pollutant emissions of VOC, CO and NO_x in this category are insignificant.[212] Therefore, emissions were not calculated for residential usage of distillate fuel oil.

Commercial Distillate Consumption

The statewide commercial consumption of distillate in 2005 was 114,032,000 gallons.[213] The statewide consumption was multiplied by a commercial employment ratio to yield the amount of distillate usage for each county. Commercial employment numbers were obtained using NAICS

[208] Energy Information Administration (EIA), September 2006. Table 26. U.S. Coal Consumption by End Use Sector, by Census Division and State, 2005, 2004. Available online: http://www.eia.doe.gov/emeu/states/sep_use/res/use_res_tx.html

[209] U.S. Census Bureau, April 1, 2000. Census 2000 Summary File 3 (SF 3) - Sample Data: H40. Housing Fuel. Available online: http://factfinder.census.gov/home/saff/main.html?_lang=en

[210] Energy Information Administration (EIA), August 9, 2006. Table F4: Residual Fuel Consumption, Price, and Expenditure Estimates by Sector, 2004. Available online: http://www.eia.doe.gov/emeu/states/sep_fuel/html/fuel_use_df.html

[211] U.S. Census Bureau, April 1, 2000. Census 2000 Summary File 3 (SF 3) - Sample Data: H40. Housing Fuel. Available online: http://factfinder.census.gov/home/saff/main.html?_lang=en

[212] Texas Air Control Board, 1992. 1990 Base Year Ozone Emission Inventory of Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), and Carbon Monoxide (CO) Emissions for Dallas/Fort Worth, Texas Nonattainment Area. Austin, Texas.

[213] Energy Information Administration (EIA), December 2006. Texas Total Distillate Sales/Deliveries to Commercial Consumers. Available online: http://tonto.eia.doe.gov/dnav/pet/pet_cons_821dst_dcu_STX_a.htm

codes 42, 44, 45, 52, 53, 71, 72, and 81.[214] Once commercial distillate use was determined for each county, distillate use was multiplied by the appropriate emission factors in Table 4-56.[215]

Table 4-54. Commercial Distillate Emission Factors (lbs / 1,000 gallons)

Source Category	VOC	NOx	CO
Commercial Distillate	0.34	20	5

Sample Calculation
Equation (1)
Commercial distillate consumption per county:

CDC_A = (CCE / TCE) x TD

Where,

CDC_A = Commercial distillate consumption for County A (gallons/yr)
CCE_A = County A commercial employment (employees)
TCE = Texas commercial employment (employees)
TD = Texas commercial distillate consumption (114,032,000 gallons/yr)

Bexar County commercial distillate consumption:

CDC = (205,319 emp. / 3,391,961 emp.) x 114,032,000 gal/yr
= 6,902,478 gal/yr

Equation (2)
Annual emissions for commercial distillate per county:

AE_A = CDC_A x EF / 2,000 lbs/ton

Where,

AE_A = Annual emissions for commercial distillate (tons/yr)
CDC_A = County commercial distillate usage (gal/yr)
EF = Emission Factor for VOC, NOx, or CO (lbs/1,000 gal.), Table 4-56

Annual NOx emissions from commercial distillate for Bexar County:
AE_{Bexar} = 6,902,478 gal/yr x 20 lbs / 1,000 gal. / (2,000 lbs/ton)
= 69.02 tons NOx/yr

Industrial Distillate Consumption
This was reported as point source emissions only. No emissions were calculated for area sources.

Methodology – *Fuel Oil - Residual Consumption*
Fuel Oil Residual Consumption
There was no significant usage of residual for residential and commercial usage in Texas (0

[214] U.S. Census Bureau, July 14, 2006. County Business Patterns, 2004. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.
[215] Environmental Protection Agency, September 1998. AP 42, Fifth Edition, Volume I: Chapter 1: External Combustion Sources. pp. 1.3-12 and 1.3-14. Available online: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf

gallons in 2004).[216] Also all industrial usage of residual was reported as a point source. No emissions are calculated for area sources.

Methodology – Kerosene Consumption

Residential Kerosene Consumption

The statewide residential consumption of Kerosene in 2005 was 646,000 gallons.[217] The statewide residential Kerosene usage in 2005 was multiplied by a household ratio of houses using Kerosene or Fuel Oil for heating to yield the amount of Kerosene usage for each county (Table 4-57).[218] Once residential Kerosene use was determined by county, gallons of Kerosene was multiplied by appropriate emission factors. The emissions factors used in the calculations are provided in Table 4-58.[219]

Table 4-55. Kerosene Consumption by County by Household

County	FIPS	Number of Households	Percent of Households	Residential Kerosene (1,000 Gallons)
Atascosa	48013	12	0.22%	1
Bandera	48019	16	0.29%	2
Bexar	48029	213	3.91%	25
Comal	48091	19	0.35%	2
Frio	48163	5	0.09%	1
Gillespie	48171	36	0.66%	4
Guadalupe	48187	31	0.57%	4
Karnes	48255	17	0.31%	2
Kendall	48259	28	0.51%	3
Kerr	48265	30	0.55%	4
Medina	48325	41	0.75%	5
Wilson	48493	14	0.26%	2
Texas	48000	5,452	100.00%	646

Table 4-56. Residential Kerosene Emission Factors (lbs / 1,000 gallons)

Source Category	VOC	NOx	CO
Residential Kerosene	0.7	17.4	4.8

According to the EPA, "Kerosene consumption may be assumed to be exclusively for space heating."[220] Since there is insignificant number of heating degree-days during the summer in

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[216] Energy Information Administration (EIA), December 2006. Texas Residual Fuel Oil Adj Sales/Deliveries. Available online: http://tonto.eia.doe.gov/dnav/pet/pet_cons_821rsda_dcu_STX_a.htm

[217] Energy Information Administration (EIA), December 2006. Texas Kerosene Adjusted Sales/Deliveries to Residential Consumers. Available online: http://tonto.eia.doe.gov/dnav/pet/hist/kdrvarstx1a.htm

[218] U.S. Census Bureau, April 1, 2000. Census 2000 Summary File 3 (SF 3) - Sample Data: H40. Housing Fuel. Available online: http://factfinder.census.gov/home/saff/main.html?_lang=en

[219] Environmental Protection Agency, September 2002. Final Summary of the Development and Results of a Methodology for Calculating Area Source Emissions from Residential Fuel Combustion. Emission Factor and Inventory Group, Emissions Monitoring and Analysis Division, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina, p. 11. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/draft1999_residfuel_inven_apr2003.zip

[220] Environmental Protection Agency. April 1999. Residential and Commercial/Institutional Fuel Oil and Kerosene Combustion. p. 5. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/fueloil.pdf

San Antonio,[221] no emissions from residential Kerosene heating were calculated for ozone season daily emissions.

$$Fuel_{MONTH} = Fuel_{ANNUAL} \times \frac{\text{Heating Degree Days}_{MONTH}}{\text{Heating Degree Days}_{ANNUAL}}$$

Sample Calculation

Equation (1)

Residential kerosene consumption per county:

$$RKC_A = (CHK_A / THK) \times TK$$

Where,

RKC_A = Residential kerosene consumption for County A(gal/yr)
CHK_A = County A households using kerosene or fuel oil, Table 4-57
THK = Texas households using kerosene or fuel oil, Table 4-57
TK = Texas residential kerosene consumption (gal/yr), Table 4-57

Bexar County residential kerosene consumption:

$$RKC_{Bexar} = (213 \text{ households} / 5{,}452 \text{ households}) \times 646{,}000 \text{ gal/yr}$$
$$= 25{,}238 \text{ gal/yr}$$

Equation (2)

Annual emissions for residential kerosene per county:

$$AE_A = CK_A \times EF / (2{,}000 \text{ lbs/ton})$$

Where,

AE_A = Annual emissions of residential kerosene for County A(tons/yr)
CK_A = County A kerosene usage (gallons), Equation (1)
EF = Emission factor for VOC, NOx, or CO (lbs/1,000 gal), Table 4-58

Annual NOx emissions for residential kerosene in Bexar County:

$$AE_{Bexar} = 25{,}238 \text{ gal/yr} \times 17.4 \text{ lbs} / 1{,}000 \text{ gal} / 2{,}000 \text{ lbs/ton}$$
$$= 0.22 \text{ tons NOx/yr}$$

Commercial Kerosene Consumption

The statewide commercial consumption of kerosene in 2005 (1,827,000 gallons)[222] was multiplied by a commercial employment ratio to yield the amount of kerosene usage for each county. Commercial employment numbers were obtained using NAICS codes 42, 44, 45, 52, 53, 71, 72, and 81.[223] To determine the emission factor for commercial kerosene, E.H. Pechan

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[221] National Oceanic and Atmospheric Administration, June 2005. Climatography of the United States NO. 81 Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971 – 2000. 41 – Texas. National Climatic Data Center. Asheville, NC. Available online: http://cdo.ncdc.noaa.gov/climatenormals/clim81/TXnorm.pdf

[222] Energy Information Administration (EIA), December 2006. Texas Total Distillate Sales/Deliveries to Commercial Consumers. Available online: http://tonto.eia.doe.gov/dnav/pet/pet_cons_821dst_dcu_STX_a.htm

[223] U.S. Census Bureau, July 14, 2006. County Business Patterns, 2004. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.

& Associates multiplied the EPA EF for distillate oil[224] by 135/140, Table 4-59. According to E.H. Pechan & Associates, "this factor is based on the ratio of the heat content of kerosene (135,000 Btu/gallon) to the heat content of distillate oil (140,000 Btu/gallon)."[225] The estimated commercial kerosene consumption was then multiplied by the appropriate emission factor to calculate annual emissions per county.

Table 4-57. Commercial Kerosene Emission Factors (lbs/1,000 gallons)

Source Category	VOC	NOx	CO
Distillate Oil	0.34	20	5
Commercial Kerosene	0.33	19.29	4.82

Sample Calculation
Equation (1)
Commercial kerosene consumption per county:

$$CKC_A = (CCE_A / TCE) \times TK$$

Where,

CKC_A = Commercial kerosene consumption for County A (gal/yr)
CCE_A = County A commercial employment (employees)
TCE = Texas commercial employment (employees)
TK = Texas commercial kerosene consumption (1,827,000 gal/yr)

Commercial kerosene consumption for Bexar County:

$$CKC_{Bexar} = (205{,}319 \text{ emp.} / 3{,}391{,}961 \text{ emp.}) \times 1{,}827{,}000 \text{ gal/yr}$$
$$= 110{,}590 \text{ gal/yr}$$

Equation (2)
Annual emissions for commercial kerosene per county:

$$AE_A = CK_A \times EF / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual emissions of commercial kerosene for County A (tons/yr)
CK_A = County A commercial kerosene usage (gal/yr), Equation (1)
EF = Emission factor for VOC, NOx, or CO (lbs/1,000 gal), Table 4-59

Annual NOx emissions for commercial kerosene in Bexar County:

$$AE_{Bexar} = 110{,}590 \text{ gal/yr} \times 19.29 \text{ lbs} / 1{,}000 \text{ gal} / 2{,}000 \text{ lbs/ton}$$
$$= 1.07 \text{ tons NOx/yr}$$

Industrial Kerosene Consumption

This was reported as point source emissions only. No emissions were calculated for area sources.

[224] Environmental Protection Agency, September 1998. AP 42, Fifth Edition, Volume I: Chapter 1: External Combustion Sources. pp. 1.3-12 and 1.3-14. Available online: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf

[225] E.H. Pechan & Associates, Inc., July 2006. Documentation for the Final 2002 Nonpoint Sector (Feb 06 Version) National Emission Inventory for Criteria and Hazardous Air Pollutants. EPA68-D-02-063, Durham, NC, p. A-48. Available online: http://www.epa.gov/ttn/chief/net/2002inventory.html

Methodology – Natural Gas Consumption

Residential Natural Gas Consumption

In Texas, there was 177,979 million cubic feet (MMcf) of residential natural gas consumed during 2005.[226] Table 4-60 lists the natural gas usage by month for Texas (orange shading indicates the ozone season months), along with Texas total for 2005.

To estimate the amount of residential natural gas used for each county, a ratio was developed between county and Texas households that used natural gas for heating in 2000.[227] This ratio for each county was then multiplied by the statewide consumption of residential natural gas, Equation (1). The results are listed in Table 4-60 under the heading of *Natural Gas Usage (MMcf) by County*. The value for Bexar County, 13,169 MMcf, was compared to the City Public Service (CPS) Energy residential consumption rate of 10,349 MMcf for 2005[228] to assess whether the value was realistic. CPS supplies a large portion of the residential natural gas usage in Bexar County; thus, there was an excellent correlation between the two values.

Table 4-58. Natural Gas Usage by County and Number of Household

County	FIPS	Households using Natural Gas for Heating	Natural Gas Usage (MMcf/yr)	Month	Natural Gas Usage (MMcf)
Atascosa	48013	2,698	150	01/2005	38,311
Bandera	48019	400	22	02/2005	30,786
Bexar	48029	236,225	13,169	03/2005	22,111
Comal	48091	5,607	313	04/2005	12,194
Frio	48163	1,616	90	05/2005	7,718
Gillespie	48171	2,392	133	06/2005	6,219
Guadalupe	48187	5,558	310	07/2005	5,776
Karnes	48255	1,813	101	08/2005	5,322
Kendall	48259	932	52	09/2005	5,652
Kerr	48265	3,901	217	10/2005	6,452
Medina	48325	3,648	203	11/2005	10,392
Wilson	48493	1,852	103	12/2005	27,045
Texas	48000	3,192,579		Yearly	177,979

For calculation purposes, Residential Natural Gas was divided into four categories: Space Heating, Water Heating, Cooking, and Clothes Dryers. The fuel use for the four types was based on a survey developed by the U.S. Department of the Interior for appliance and equipment fuel usage in government and private rental housing market in the mid-south region.[229] For each type of equipment (Hot Water Heater, Kitchen Range, and Clothes Dryer), average natural gas fuel usage in thousands of cubic feet (Mcf) per year was determined by gross square feet of living space (Table 4-61).

[226] Energy Information Administration (EIA), October 27, 2006. Natural Gas Consumption by End Use: Texas Natural Gas Residential Consumption. Available online: http://tonto.eia.doe.gov/dnav/ng/ng_cons_sum_dcu_STX_m.htm

[227] U.S. Census Bureau, April 1, 2000. Census 2000 Summary File 3 (SF 3) - Sample Data: H40. Housing Fuel. Available online: http://factfinder.census.gov/home/saff/main.html?_lang=en

[228] CPS Energy. Available online: http://www.cpsenergy.com

[229] U.S. Department of the Interior, March 6, 2005. Regional Quarters Rental Survey Covering Government-Furnished Quarters Located in Mid South Survey Region. National Business Center Products and Services, p. 71. Available online: http://www.nbc.gov/RptMS04.PDF

Table 4-59. Monthly Natural Gas Fuel (Mcf) Used by Appliance Type, 2004

Square-Foot Range	Hot Water Heater	Kitchen Range	Clothes Dryer
< 301	0.55	0.19	0.06
301- 500	0.55	0.21	0.06
501- 700	1.05	0.21	0.11
701-1,100	1.05	0.21	0.11
1,101-1,300	1.58	0.36	0.15
1,301-1,500	1.58	0.36	0.15
1,501-1,900	2.05	0.36	0.15
1,901-2,100	2.05	0.36	0.15
2,101-2,500	2.56	0.36	0.17
> 2,500	3.01	0.36	0.21

In addition, the report provided annual million British thermal units (MBTU) usage[230] for single story-houses, two-story houses, apartments, and mobile homes (Table 4-62).[231] For single-family homes, the fuel usage was based on "Partial" (<50%) or "No Basement" houses, as most houses in the San Antonio region do not have basements. Also, it is estimated that there is an equal distribution of single story and two story homes in the region.

The amount of residential natural gas used for heating is based on the number of heating degree-days for each county (Table 4-63).[232] The counties farther north in the AACOG region had more heating degree days and more residential natural gas was allocated to heating purposes. The percentage of houses in each square-foot range for the San Antonio metropolitan area[233] (Table 4-64) was multiply by the monthly natural gas used for appliances (Table 4-61) and heating (Table 4-62) in each county to estimate the Monthly natural gas consumption for each source type per household type per county, Equation (2).

[230] 1 MBTU = 1 MCF of Natural Gas
[231] *Ibid*., pp. 42-47.
[232] National Oceanic and Atmospheric Administration, June 2005. Climatography of the United States NO. 81 Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971 – 2000. 41 – Texas. National Climatic Data Center. Asheville, NC. Available online: http://cdo.ncdc.noaa.gov/climatenormals/clim81/TXnorm.pdf
[233] U.S. Census Bureau, October 2005. American Housing Survey for the San Antonio Metropolitan Area: 2004: Table 2 Units in Structure by Selected Characteristics - Occupied Units. Available online: http://www.census.gov/hhes/www/housing/ahs/metropolitandata.html

Table 4-60. Annual MBTU Usage by Square Footage, 2004

Heating Degree Days	Type of Housing	Residence Size (SQF)															
		100	200	400	600	800	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000
1250	Single Family, One Story	1.3	2.5	5.1	7.6	10.1	12.7	15.2	17.8	20.3	22.8	25.4	27.9	30.4	33.0	35.5	38.0
	Single Family, Two Story	1.1	2.2	4.5	6.7	8.9	11.2	13.4	15.7	17.9	20.1	22.4	24.6	26.8	29.1	31.3	33.5
	Apartments	0.8	1.6	3.3	4.9	6.5	8.2	9.8	11.4	13.1	14.7	16.3	18.0	19.6	21.2	22.9	24.5
	Mobile Homes	2.1	4.2	8.4	12.5	16.7	20.9	25.1	29.3	33.5	37.6	41.8	46.0	50.2	54.4	58.6	62.7
1500	Single Family, One Story	1.5	3.0	6.1	9.1	12.2	15.2	18.3	21.3	24.4	27.4	30.4	33.5	36.5	39.6	42.6	45.7
	Single Family, Two Story	1.3	2.7	5.4	8.1	10.7	13.4	16.1	18.8	21.5	24.2	26.8	29.5	32.2	34.9	37.6	40.3
	Apartments	1.0	2.0	3.9	5.9	7.8	9.8	11.8	13.7	15.7	17.6	19.6	21.6	23.5	25.5	27.4	29.4
	Mobile Homes	2.5	5.0	10.0	15.1	20.1	25.1	30.1	35.1	40.2	45.2	50.2	55.2	60.2	65.3	70.3	75.3
1750	Single Family, One Story	1.8	3.6	7.1	10.7	14.2	17.8	21.3	24.9	28.4	32.0	35.5	39.1	42.6	46.2	49.7	53.3
	Single Family, Two Story	1.6	3.1	6.3	9.4	12.5	15.7	18.8	21.9	25.0	28.2	31.3	34.4	37.6	40.7	43.8	47.0
	Apartments	1.1	2.3	4.6	6.9	9.1	11.4	13.7	16.0	18.3	20.6	22.9	25.1	27.4	29.7	32.0	34.3
	Mobile Homes	2.9	5.9	11.7	17.6	23.4	29.3	35.1	41.0	46.8	52.7	58.6	64.4	70.3	76.1	82.0	87.8
2000	Single Family, One Story	2.0	4.1	8.1	12.2	16.2	20.3	24.4	28.4	32.5	36.5	40.6	44.6	48.7	52.8	56.8	60.9
	Single Family, Two Story	1.8	3.6	7.2	10.7	14.3	17.9	21.5	25.0	28.6	32.2	35.8	39.4	42.9	46.5	50.1	53.7
	Apartments	1.3	2.6	5.2	7.8	10.4	13.1	15.7	18.3	20.9	23.5	26.1	28.7	31.3	34.0	36.6	39.2
	Mobile Homes	3.3	6.7	13.4	20.1	26.8	33.5	40.2	46.8	53.5	60.2	66.9	73.6	80.3	87.0	93.7	100.4
2250	Single Family, One Story	2.3	4.6	9.1	13.7	18.3	22.8	27.4	32.0	36.5	41.1	45.7	50.2	54.8	59.4	63.9	68.5
	Single Family, Two Story	2.0	4.0	8.1	12.1	16.1	20.1	24.2	28.2	32.2	36.2	40.3	44.3	48.3	52.3	56.4	60.4
	Apartments	1.5	2.9	5.9	8.8	11.8	14.7	17.6	20.6	23.5	26.4	29.4	32.3	35.3	38.2	41.1	44.1
	Mobile Homes	3.8	7.5	15.1	22.6	30.1	37.6	45.2	52.7	60.2	67.8	75.3	82.8	90.4	97.9	105.4	112.9

Table 4-61. Heating Degree Days by County, 1971-2000

County	FIPS	Actual Number of Days	Closest SQF Range
Atascosa	48013	1,119	1,250
Bandera	48019	2,086	2,000
Bexar	48029	1,573	1,500
Comal	48091	1,840	1,750
Frio	48163	1,119	1,250
Gillespie	48171	1,916	2,000
Guadalupe	48187	1,573	1,500
Karnes	48255	1,418	1,500
Kendall	48259	2,086	2,000
Kerr	48265	2,355	2,250
Medina	48325	1,592	1,500
Wilson	48493	1,418	1,500

Table 4-62. Percentage of Housing Type by Square-Foot Range, AACOG - 2005

Square-Foot Range	Single-Family Homes	Mobile Homes Or Apartments
Under 301	0.5%	1.3%
301-500	0.3%	0.9%
501-700	1.8%	10.0%
701-1,100	14.7%	31.1%
1,101-1,300	11.7%	18.1%
1,301-1,500	11.7%	18.1%
1,501-1,900	21.0%	11.0%
1,901-2,100	8.6%	3.8%
2,101-2,500	13.2%	4.3%
Over 2,500	16.6%	1.3%
Total	100.0%	100.0%

For single-family homes, apartments, and mobile homes, the average monthly natural gas consumption by source was multiplied by twelve months/year for a yearly estimate. These yearly estimates were then multiplied by the corresponding housing type distribution percentage (Table 4-65) and summed to estimate yearly natural gas consumption per source for each county, Equation (3). Table 4-65 lists the percentages for Bexar, Comal, and Guadalupe, from the 2005 American Community Survey,[234] and the percentages for Atascosa, Bandera, Frio, Gillespie, Karnes, Kendall, Kerr, Medina, and Wilson counties, from the 2000 Decennial Census.[235]

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[234] U.S. Census Bureau, November 2006. American Community Survey: B25024. Units in Structure. Available online: http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=ACS&_submenuId=&_lang=en&_ts=

[235] U.S. Census Bureau, April 1, 2000. Census 2000 Summary File 3 (SF 3) - Sample Data: H30: Units in Structure. Available online: http://factfinder.census.gov/home/saff/main.html?_lang=en

Table 4-63. Percentage of Housing Type by County, AACOG - 2000 and 2005

County	FIPS	Source Date	Single Family	Apartment	Mobile	Total
Atascosa	48013	2000	62.46%	5.40%	32.15%	100.00%
Bandera	48019	2000	63.88%	2.36%	33.76%	100.00%
Bexar	48029	2005	67.79%	29.17%	3.03%	100.00%
Comal	48091	2005	70.94%	15.58%	13.48%	100.00%
Frio	48163	2000	65.50%	12.99%	21.51%	100.00%
Gillespie	48171	2000	76.94%	8.49%	14.58%	100.00%
Guadalupe	48187	2005	67.69%	11.48%	20.83%	100.00%
Karnes	48255	2000	71.90%	9.54%	18.56%	100.00%
Kendall	48259	2000	77.37%	8.93%	13.71%	100.00%
Kerr	48265	2000	64.74%	16.04%	19.23%	100.00%
Medina	48325	2000	62.80%	6.28%	30.92%	100.00%
Wilson	48493	2000	65.35%	3.71%	30.95%	100.00%

Table 4-66 lists the average amount of residential natural gas used by housing type and source for counties with 1,500 heating degree days. Since there is an insignificant number of heating degree days during the summer in San Antonio,[236] it was estimated that there was no natural gas used for heating during the ozone season; therefore natural gas use during the summer was applied to only appliances. According to the EPA, cooking and water heating "can be subtracted from the annual total, and the remaining consumption, which is being used for space heating, can be allocated by month using proportions of annual and monthly heating degree days."[237]

$$\text{Residential Fuel}_{\text{month}} = \text{Residential Fuel}_{\text{Annual}} \times \frac{\text{Heating Degree Days}_{\text{month}}}{\text{Heating Degree Days}_{\text{Annual}}}$$

Table 4-64. Average Residential Natural Gas Used (MMcf) by Housing Type and Source

Source	Type of House	Monthly*	Yearly
Heating (based on 1,500 Heating Degree Days)	Single Family, One Story	-	28.222
	Single Family, Two Story	-	24.883
	Apartments	-	12.944
	Mobile Homes	-	33.148
Hot water heater	Single Family, One Story	1.989	23.871
	Single Family, Two Story	1.989	23.871
	Apartments	1.470	17.641
	Mobile Homes	1.470	17.641

236 National Oceanic and Atmospheric Administration, June 2005. Climatography of the United States NO. 81 Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971 – 2000. 41 – Texas. National Climatic Data Center. Asheville, NC. Available online: http://cdo.ncdc.noaa.gov/climatenormals/clim81/TXnorm.pdf

237 Environmental Protection Agency. April 1999. Emission Inventory Improvement Program: Area Source Method Abstracts – Natural Gas and LPG Combustion. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/ng.pdf

Table 4-66. (Cont.)

Source	Type of House	Monthly*	Yearly
Kitchen Range	Single Family, One Story	0.334	4.006
	Single Family, Two Story	0.334	4.006
	Apartments	0.295	3.538
	Mobile Homes	0.295	3.538
Clothes dryer	Single Family, One Story	0.155	1.863
	Single Family, Two Story	0.155	1.863
	Apartments	0.133	1.599
	Mobile Homes	0.133	1.599

*Note: There was no use of Natural Gas for Heating during the summer months

The percentage of households using natural gas was determined by source type for the twelve AACOG counties. The number of households using natural gas for the source type is provided by the Housing Survey[238] under the subcategories listed in Table 4-67. To estimate the number of households using natural gas by category type, the numbers of households per subcategory, under each category type, were summed. Then the percentage of households using natural gas for each category (Cooking, Water Heater, Clothes Dryer, and Heating) was determined by dividing the subcategory, ***Pipe Gas***, by the Total (Table 4-67).

Table 4-65. Number and Percentage of Households Using Natural Gas by Source Type, 2004

Household Fuel Source	Cooking	Water Heating	Clothes Dryer	House Heating*	Central Air*	Total Heating Number
	Number of household by 1,000s that use listed fuel source.					
Electricity	409.5	310.3	392.7	*379.8*	*449.3*	
Pipe Gas	227.9	332.7	52.8	*242.2*	*9.8*	
Bottle Gas				*18.2*		
Kerosene or other liquid				*2.7*		
Wood				*1.1*		
Solar		0.2				
Other	0.5	2.5	3.2	*1.6*	*1.5*	
Total	637.9	645.7	448.7	*645.6**	*460.6**	
Percentage	**35.73%**	**51.53%**	**11.77%**	*37.52%**	*2.13%**	**39.64%**

*Note: To get the total number of households using natural gas for heating purposes, the number for the House Heating Fuels category was added to the number for the Central Air category, producing a Total Heating percentage.

The percentage, of natural gas used for each source type, was multiplied by the corresponding average yearly fuel usage; these four values were then summed to estimate the average consumption of natural gas per household (Mcf/yr), Equation (4), for each county. To estimate a county percentage of yearly natural gas used per source, the average yearly fuel usage for each source type was multiplied by the percentage of households using natural gas for that source type and dividing by the total yearly average natural gas usage per household within that county, Equation (5).

[238] U.S. Census Bureau, October 2005. American Housing Survey for the San Antonio Metropolitan Area: 2004: Table 2 Units in Structure by Selected Characteristics - Occupied Units. Available online: http://www.census.gov/hhes/www/housing/ahs/metropolitandata.html

Finally, the corresponding emission factors, table 4-68, were applied to estimate annual emissions per source type in tons per year, Equation (6). The estimated emissions for heating, hot water heaters, cooking, and clothes dryers were summed to obtain the residential natural gas emissions estimate for each county, Equation (7).

Following the methodology used by California Air Resource Board (CARB),[239] the emission factor for space heaters comes from the EPA AP-42 factor for uncontrolled residential furnaces.[240] The NOx and CO factors for Water Heating and Cooking were developed the CARB "Methods for Assessing Area Source,"[241] and the VOC for cooking comes from the EPA AP-42.[242] Also, the VOC factor for water heating was developed by CARB. No emissions were calculated for clothes dryers because amount of natural gas used was small (less than 1 percent) and emissions would be insignificant.

Table 4-66. Residential Natural Gas Consumption Emission Factors (lbs/MMcf)

Source Category	VOC	NOx	CO
Space Heating	5.5	94.0	40.0
Water Heating	1.7	126.0	13.2
Cooking	5.5	73.0	100.0

Control Strategies
According to the Texas Administrative Code Rule §117.465, all "type 2 natural gas-fired water heaters manufactured on or after July 1, 2002, must not exceed 0.037 lb/MMBtu of heat input."[243] This represents an emission factor cap of 37 lbs per Mcf of natural gas. A Type 2 natural gas-fired water heater is "any water heater, boiler, or process heater with a maximum rated capacity greater than 400,000, but no more than 2.0 million British thermal units per hour."[244] Type 0 and 1 water heaters had a slightly higher NOx rating according to the rule compared to the larger type 2 units (~68 lbs per Mcf). This emission reduction was not taken into account because most of the older natural gas fired boilers are still operating in private households. However, this control strategy should be taken into account in future emission inventory.

Sample Calculation
Equation (1)
Residential natural gas consumption for County A:

$$CHH_A = (STF_A / THH) \times TGC$$

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[239] S. Claire. Source Inventory: Fuel Combustion – Stationary Sources, Domestic Natural Gas. P. 7.1.1 - 1. Available online: http://www.arb.ca.gov/ei/areasrc/districtmeth/BayArea/C283.pdf
[240] Environmental Protection Agency, March 1998. Chapter 1: External Combustion Sources, 1.4: Natural Gas Combustion. p. 1.4-5. Available online: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf
[241] MAASEC: September 1991. Methods for Assessing Area Source Emissions in California. State of California Air Resources Board.
[242] Environmental Protection Agency, March 1998. Chapter 1: External Combustion Sources, 1.4: Natural Gas Combustion. p. 1.4-6, Available online: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf
[243] Title 30 Environmental Quality Chapter 117: Control of Air Pollution from Nitrogen Compounds Subchapter D - Small Combustion Sources Division 1, Water Heaters, Small Boilers, and Process Heaters rule §117.465. Available online: http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=117&sch=D&div=1&rl=Y
[244] *Ibid*.

Where,

CHH_A = Natural gas consumption for County A (MMcf)
STF_A = Number of households using residential gas for heating for County A, Table 4-60
THH = Number of Texas households using residential gas for heating, Table 4-60
TGC = Texas residential gas consumption, Table 4-60

Residential natural gas consumption in Bexar County:

$$CHH_A = (236{,}225 / 3{,}192{,}579) \times 177{,}979 \text{ MMcf} = 13{,}169 \text{ MMcf}$$

Equation (2)
Monthly amount of natural gas used for each source type by household type. For household heating, the MBTU usage depends on the number of heating degree days from Table 4.63.

$$HS_A = \Sigma(MTG_A \times PER)$$

Where,

HS_A = Average monthly residential natural gas usage by source (heating, water heater, kitchen range, or clothes dryer) for each household in County A
MTG = Amount of residential natural gas used for by household square footage (Under 301, 301-500, 501-700, 701-1,100, 1,101-1,300, 1,301-1,500, 1,501-1,900, 1,901-2,100, 2,101-2,500, and over 2,500 sq. feet), Tables 4-61 and 4-62
PER = Percent of building for each square footage, Table 4-64

Monthly amount of natural gas used for hot water heaters for single-family homes in Bexar County:

$$HS_A = [(0.55 \times 0.005) + (0.55 \times 0.003) + (1.05 \times 0.018) + (1.05 \times 0.147) + (1.58 \times 0.117) + (1.58 \times 0.117) + (2.05 \times 0.210) + (2.05 \times 0.086) + (2.56 \times 0.132) + (3.01 \times 0.166)]$$
$$= [0.003 + 0.002 + 0.019 + 0.154 + 0.184 + 0.184 + 0.430 + 0.175 + 0.339 + 0.498]$$
$$= 1.989 \text{ Mcf/month}$$

Equation (3)
Yearly amount of natural gas used per source for a county:

$$GH_A, GW_A, GC_A, GCD_A = (HS_A \times 12 \text{ months} \times SING_A) + (HA_A \times 12 \text{ months} \times APT_A) + (HM_A \times 12 \text{ months} \times MOB_A)$$

Where,

GS_A = Average fuel use for natural gas for each source: Gas for heating (GH_A), gas for water heater (GW_A), gas for cooking (GC_A), gas for clothes dryer (GCD_A) in County A, Mcf/yr
HS_A = Average monthly residential natural gas usage by source for single family home for County A, Equation (2) and Table 4-65
$SING_A$ = Percentage of single family homes for County A, Table 4-66

HA_A = Average monthly residential natural gas usage by source for an apartment for County A, Equation (2) and Table 4-65
APT_A = Percentage of apartments for County A, Table 4-66
HM_A = Average monthly residential natural gas usage by source for a mobile home for County A, Equation (2) and Table 4-65
MOB_A = Percent of mobile homes for County A, Table 4-66

Amount of natural gas used by water heaters in Bexar County during 2005:

GW_{Bexar} = (1. 989 x 12 x 0.6779) + (1.470 x 12 x 0.2917) + (1.470 x12 x 0.0303)
= 16.2025 + 5.1456 + 0.5345
= 21.86 MMcf/yr

Equation (4)
Average amount of natural gas (Mcf) used per household:

TGU_A = (GH_A x HPER) + (GW_A x WPER) + (GC_A x CPER) + (GCD_A x CDPER)

Where,

TGU_A = Total average gas use for each household for County A
GH = Average fuel use for natural gas ***heating***, Equation (3)
HPER = % of houses using natural gas ***heating*** (0.3964), Table 6-67
GW = Average fuel use for natural gas ***water heater***, Equation (3)
WPER = % of houses using natural gas ***water heaters*** (0.5153), Table 6-67
GC = Average fuel use for natural gas ***cooking***, Equation (3)
CPER = % of houses using natural gas ***cooking*** (0.3573), Table 6-67
GCD = Average fuel use for natural gas ***clothes dryer***, Equation (3)
CDPER = % of houses using natural gas ***clothes dryer*** (0.1177), Table 6-67

Total average gas use (Mcf) per household in Bexar County:

TGU_A = (22.78 Mcf x 0.3964) + (21.86 Mcf x 0.5153) + (3.86 Mcf x 0.3573) + (1.78 Mcf x 0.1177)
= 9.0303 + 11.2645 + 1.3792 +0.2095
= 21.88 Mcf/yr

Equation (5)
Percentage of yearly natural gas used by source type:

PER_A = GW x HPER x / TGU_A

Where,

PER_A = Yearly percentage of natural gas used by source type for County A
GW_A = Average fuel use for each source type in County A, Equation (3)
$HPER_S$ = Percentage of houses using natural gas for each source type S (0.3964, 0.5153, 0.3573, or 0.1177), Table 4-67
TGU_A = Total average gas use for each household for County A, Equation (4)

Percentage of yearly natural gas used for water heaters in Bexar County:

PER_A = 21.86 Mcf x 0.5153 / 21.88 Mcf
= 0.5148

Equation (6)
Annual emissions in tons/yr (NOx):

$$AE_A = CHH_A \times PER_A \times EF / 2000 \text{ lbs/ton}$$

Where,

AE_A = Annual emissions for residential natural gas use for County A
CHH_A = Natural gas consumption for County A (MMcf), Table 4-60 & Equation (1)
PER_A = Yearly % of natural gas used by source for County A, Equation (5)
EF = Emission factor for VOC, NOx, or CO, Table 4-68 (lbs/MMcf)

Annual emissions for water heaters in Bexar County

$$AE_A = 13{,}169 \text{ MMcf} \times 0.5148 \times 126 \text{ lbs/MMcf} / 2000 \text{ lbs/ton} = 427.09 \text{ tons/yr of Nox}$$

Equation (7)
Annual emissions for residential natural gas consumption per county:

$$AE_C = \Sigma AE_A$$

Where,

AE_C = Annual emissions for County C
AE_A = Annual emissions for source A, Equation (6)

Annual residential natural gas NOx emissions for Bexar County in 2005:

$$AE_{Bexar} = (255.4419 \text{ tons/yr} + 427.0946 \text{ tons/yr} + 30.2554 \text{ tons/yr} + 0.0000 \text{ tons/yr}) = 712.79 \text{ tons/yr NOx}$$

Seasonal Adjustment Factor
Seasonal adjustment was based on average monthly usage, with heating degree days used to weight the natural gas consumption for heating heavier in the counties on the Northern side of the AACOG region. There was no weekend day adjustment.

Equation (8)
Ozone season adjustment factor:

$$OSAF = [\Sigma(MGC) / 214 \text{ days}] / (YGC / 356 \text{ days})$$

Where,

OSAF = Ozone season adjustment factor
MGC = Texas residential natural gas consumed during each ozone season month (April – October), Table 4-60
YGC = Yearly Texas residential gas consumption (177,979 MMcf)

Ozone season adjustment factor for natural gas usage:

$$OSAF = [(12{,}194 \text{ MMcf} + 7{,}718 \text{ MMcf} + 6{,}219 \text{ MMcf} + 5{,}776 \text{ MMcf} + 5{,}322 \text{ MMcf} + 5{,}652 \text{ MMcf} + 6{,}452 \text{ MMcf}) / 214 \text{ days}] / [177{,}979 \text{ MMcf}/ 365 \text{ days}] = 230.53 \text{ MMcf/day} / 487.61 \text{ MMcf/day} = 0.473$$

Equation (9)
Daily emissions for each source type:

$$DE_A = (CHH_A / 365) \times OSAF \times PER_A \times EF / 2000 \text{ lbs/ton}$$

Where,

DE_A = Daily emissions for residential natural gas use for County A
CHH_A = Natural gas consumption for County A (MMcf), Table 4-60 and Equation (1)
OSAF = Ozone season adjustment factor for natural gas usage, Equation (7)
PER_A = Daily percentage of natural gas used by source type for County A, Equation (5)
EF = Emission factor for VOC, NOx, or CO, Table 4-66

Daily emissions for water heaters in Bexar County:

$$DE_A = (13{,}169 / 365) \times 0.473 \times 0.9183 \times 126 / 2000 \text{ lbs/ton}$$
$$= 0.987 \text{ tons/day of NOx}$$

Equation (10)
Daily residential natural gas emissions per county:

$$DE_C = \Sigma DE$$

Where,

DE_C = Daily Emissions for County C
DE = Daily Emissions for each source type, Equation (9)

Daily residential natural gas NOx Emissions for Bexar County:

$$DE_{Bexar} = (0.0000 \text{ tons/day} + 0.9868 \text{ tons/day} + 0.0485 \text{ tons/day} + 0.0000 \text{ tons/day})$$
$$= 1.0352 \text{ tons NOx/ozone season day}$$

Commercial Natural Gas Consumption

Statewide consumption of natural gas by commercial establishments in Texas in 2005 was estimated at 206,439 MMcf.[245] To estimate the commercial natural gas consumption per county (Equation (1)), a ratio between the county and state workforces[246] in NAICS codes 42, 44, and 73 was calculated. This ratio was then multiplied by the statewide commercial consumption for 2005. The amount of natural gas used for vehicles was removed from the total amount based on a ratio of total national use of natural gas for vehicles (0.72%) and commercial natural gas use for other sources (99.28%).[247]

Furthermore, commercial natural gas used by point sources was subtracted from the total natural gas usage. Natural gas use by military bases came from Department of the Army,[248]

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[245] Energy Information Administration (EIA), November 29, 2006. Natural Gas Deliveries to Commercial Consumers in Texas. Available online: http://tonto.eia.doe.gov/dnav/ng/hist/n3020tx2m.htm

[246] U.S. Census Bureau, July 14, 2006, County Business Patterns, 2004. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.

[247] Energy Information Administration (EIA), November 29, 2006. Natural Gas Consumption by End Use. Available online: http://tonto.eia.doe.gov/dnav/ng/ng_cons_sum_dcu_nus_a.htm

[248] Headquarters and Support Activities Joint Cross Service Group, April 20 2005. Volume VII Final Base Realignment and Closure (BRAC) 2005 Report HSA Joint Cross-Service Group (JCSG) Capacity

while natural gas use for the San Antonio International Airport was based on the airport Master Plan.[249] The results are listed in Table 4-69 under the heading *Natural Gas w/o Point Sources*.

Table 4-67. Commercial Employment and Natural Gas Consumption (MMcf) by County

County	FIPS	Employment	Commercial Natural Gas (MMcf)	Point Source Natural Gas	Natural Gas w/o Point Sources
Atascosa	48013	2,389	217	0	217
Bandera	48019	765	70	0	70
Bexar	48029	100,758	9,155	12	9,143
Comal	48091	9,498	863	0	863
Frio	48163	754	69	0	69
Gillespie	48171	2,743	249	0	249
Guadalupe	48187	7,945	722	0	722
Karnes	48255	604	55	0	55
Kendall	48259	2,943	267	0	267
Kerr	48265	4,287	390	0	390
Medina	48325	1,987	181	0	181
Wilson	48493	1,123	102	0	102
Texas	48000	2,271,963	206,439		

Similar to a methodology developed by STI in California,[250] commercial Natural Gas usage was broken into Boilers, Package Heating Units, Cooking, Space Heaters, Furnaces, Water Heaters, and Process. Table 4-70 provides the breakdown based on the EIA survey of Natural Gas usage in Commercial buildings for the EIA West South region (Arkansas, Louisiana, Oklahoma, and Texas).[251] Since there was no data on the percentage of natural gas used for water heaters and processes, the STI average percentages (30% and 7%) for California was used.[252] It would be ideal to have more accurate data on water heaters and processes, but the data is not available.

Analysis Installation Management. Department of the Army. Available online: http://www.dod.mil/brac/pdf/VolVII_HQsSupport-o.pdf

[249] Ricondo & Associates, Inc, Jan. 1998. San Antonio International Airport Master Plan Study: Volume 3. San Antonio, Texas.

[250] Sonoma Technology, Inc. September 16, 2002. Attachment A: Commercial and Industrial Fuel Combustion. Petaluma, Ca. Available online: http://www.arb.ca.gov/ei/areasrc/ccosmeth/att_a_commercial_industrial_combustion.doc

[251] Energy Information Administration (EIA), June 2006. 2003 Commercial Buildings Energy Consumption Survey (CBECS) Detailed Tables: Table C29. Natural Gas Consumption and Conditional Energy Intensity by Census Division for Non-Mall Buildings, 2003: Part 3. Available online: http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/detailed_tables_2003.html

[252] Sonoma Technology, Inc. September 16, 2002. Attachment A: Commercial and Industrial Fuel Combustion. Petaluma, Ca. Available online: http://www.arb.ca.gov/ei/areasrc/ccosmeth/att_a_commercial_industrial_combustion.doc

Table 4-68. Commercial Natural Gas Consumption Rates by Source

Source Category	Percentage of Natural Gas Use
Boilers	11.1%
Package Heating Units	12.5%
Cooking	24.5%
Space Heaters	3.4%
Furnaces	11.5%
Water Heaters	30.0%
Process	7.0%
Total	100.0%

Once the fuel usage was calculated for each process, the values were multiplied by the emission factor provided in Table 4-71. Following the methodology used by California Air Resource Board (CARB),[253] the emission factor for space heaters and furnaces comes from EPA's AP-42 factor for uncontrolled residential furnaces.[254] The NOx and CO factors for Water Heating and Cooking were documented within the CARB "Methods for Assessing Area Source,"[255] and the VOC for cooking comes from the EPA AP-42.[256] Likewise, the VOC factor for water heating was also developed by CARB. Emission factors for boilers and package heating units came from AP-42. There are no emissions associated with process uses.

Table 4-69. Commercial Natural Gas Consumption Emission Factors (lbs / Mcf)

Source Category	VOC	NOx	CO
Small Boilers – Uncontrolled	5.5	100	84
Package Heating Units	5.5	100	84
Cooking	5.5	73	100
Space Heating	5.5	94	40
Furnace	5.5	94	40
Water Heating	1.7	126	13.2

Sample Calculation

Equation (1)

County commercial natural gas consumption for County A:

$$CNG_A = (STF / TCE) \times TGC - (TGC \times AUTO) - PT$$

Where,

CNG_A = County commercial natural gas consumption for County A
CHH_A = County commercial employment for County A, Table 4-69
TCE = Commercial employees in Texas (2,271,963)
TGC = Texas commercial natural gas consumption (207,941.5 MMcf)

[253] S. Claire. Source Inventory: Fuel Combustion – Stationary Sources, Domestic Natural Gas. P. 7.1.1 - 1. Available online: http://www.arb.ca.gov/ei/areasrc/districtmeth/BayArea/C283.pdf
[254] Environmental Protection Agency, Mar. 1998. Chapter 1: External Combustion Sources, 1.4: Natural Gas Combustion. p. 1.4-5, Available online: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf
[255] MAASEC: September 1991. Methods for Assessing Area Source Emissions in California. State of California Air Resources Board.
[256] Environmental Protection Agency, Mar. 1998. Chapter 1: External Combustion Sources, 1.4: Natural Gas Combustion. p. 1.4-6, Available online: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf

$AUTO$ = Percentage of natural gas used for vehicles (0.72%)
PT_A = Point source natural gas usage for County A, Table 4-69

Commercial natural gas consumption for Bexar County:

CNG_A = (100,758 / 2,271,963) x 207,941.5 MMcf - (207,941.5 MMcf x 0.0072) - 12 MMcf
= 9,143 MMcf

Equation (2)
Annual Emissions in tons/yr. for each type of commercial natural gas use (NOx)

AE_A = CNG x CPER x EF / 2000 lbs/ton

Where,

AE_A = Annual emissions for each type of commercial natural gas use for County A
CNG_A = Natural gas usage for County A, Table 4-69
$CPER$ = Percentage of gas used for each type of commercial natural gas usage, Table 4-70
EF = Emission Factor for VOC, NOx, or CO, Table 4-71

Annual Emissions for commercial cooking in Bexar County:

AE_A = 9,143 MMcf x 0.245 x 73 lbs / 2000 lbs/ton
= 81.78 tons/year of NOx

Equation (3)
Total Annual Emissions in tons/yr. (NOx):

$TAE_A = BOIL_A + COOK_A + FUR_A + WAT_A$

Where,

TAE_A = Annual emissions for commercial natural gas use for County A
$BOIL_A$ = Emissions from boilers for County A, Equation (2)
$COOK_A$ = Emissions from commercial cooking for County A, Equation (2)
FUR_A = Emissions from space heating / furnace for County A, Equation (2)
WAT_A = Emissions from water heating for County A, Equation (2)

Total commercial natural gas NOx emissions in Bexar County:

TAE_A = 107.99 tons/year of NOx + 81.78 tons/year of NOx + 63.98 tons/year of NOx + 172.87 tons/year of NOx
= 426.50 tons/year of NOx

Seasonal Adjustment Factor
Equation (4)
Seasonal natural gas adjustment factor for Texas and the AACOG region:

$OSAF = [\Sigma(MTG_A) / 214 \text{ days}] / [TGC / 356 \text{ days}]$

Where,

$OSAF$ = Ozone season adjustment factor
MTG_A = Amount of commercial natural gas used for month A in Texas
TGC = Yearly Texas commercial natural gas consumption (207,941.5 MMcf)

OSAF = [(15,125 MMcf + 14,938 MMcf + 13,718 MMcf + 12,354 MMcf + 13,420 MMcf + 13,469 MMcf + 13,176 MMcf) / 214 days] / [207,941.5 MMcf / 365 days]
= 0.789

Industrial Natural Gas Consumption
Statewide consumption of natural gas by industrial in Texas was 1,348,427 MMcf for 2005.[257] To estimate the county industrial natural gas consumption a ratio of MMcf per employee for each type of industry that was developed using southern U.S. data from EIA (Table 4-72).[258]

Table 4-70. Industrial Natural Gas Use per Employee in the EIA South Region, 2002

Sub-sector and Industry	NAICS Code(a)	Total Natural Gas Use (Bcf)	Total Employ. (2004)[259]	MMcf / employee
Food	311	165	522,118	0.32
Beverage and Tobacco Products	312	18	58,544	0.31
Textile Mills	313	50	166,296	0.30
Textile Product Mills	314	23	99,248	0.23
Paper	322	236	175,378	1.35
Petroleum and Coal Products	324	548	49,918	10.98
Chemicals	325	1,301	321,062	4.05
Plastics and Rubber Products	326	56	303,579	0.18
Nonmetallic Mineral Products	327	179	184,899	0.97
Primary Metals	331	221	46,851	4.72
Machinery	333	16	318,369	0.05
Computer and Electronic Products	334	8	275,477	0.03
Elect. Eq., Appliances, and Components	335	18	150,539	0.12
Total		2,839	2,672,278	1.06

Gas use by employee was multiply by the number of employees in each North American Industry Classification System (NAICS) code for each county. Since Texas uses more natural gas per employee, an adjustment factor (1.796) was developed base on actual gas use compared to predicted gas use for Texas. Afterwards, Industrial natural gas used by point sources was subtracted from the total natural gas usage (Table 4-73). The point source natural gas usage was calculated based on type of use and employment. Also, natural gas used by the oil industry was removed because the natural gas emissions are already account for oil and gas well section or the point source section.

[257] Energy Information Administration (EIA), November 29, 2006. Texas Natural Gas Industrial Consumption. Available online: http://tonto.eia.doe.gov/dnav/ng/hist/n3035tx2a.htm
[258] Energy Information Administration (EIA), March 8, 2005. 2002 Energy Consumption by Manufacturers. Table 3.1. Fuel Consumption, 2002; Level: National and Regional Data. Available online: http://www.eia.doe.gov/emeu/mecs/mecs2002/data02/shelltables.html
[259] U.S. Census Bureau, July 14, 2006. County Business Patterns, 2004. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.

Table 4-71. Industrial Natural Gas Use for the AACOG Region, 2005

County	FIPS	Total Natural Gas use	Point Source NG use	NG w/o Point Sources
Atascosa	48013	558	473	84
Bandera	48019	50	0	50
Bexar	48029	24,310	5,266	19,044
Comal	48091	2,427	1,391	1,035
Frio	48163	0	0	0
Gillespie	48171	108	0	108
Guadalupe	48187	2,740	2	2,738
Karnes	48255	20	0	20
Kendall	48259	2,708	0	2,708
Kerr	48265	11	0	11
Medina	48325	765	0	765
Wilson	48493	46	0	46
Total		33,742	7,133	26,609

Industrial natural gas was broken into boiler, turbine and feedstock base on end use reported by the EIA for the south region.[260] Conventional boiler use, combined heat and power (CHP) / cogeneration process, and process heating facility HVAC was classified as boilers, while process cooling and refrigeration, machine drive, and other process use conventional electricity generation used turbines (Table 4-74). Feedstock, usually in the process of making chemicals, represented only a small portion of the total and no emissions were calculated because the natural gas was not used as a fuel for machines. These totals do not include natural gas used in large electric generating units in the point source section of the emission inventory.

Once the fuel usage was calculated for boilers and turbines, the values were multiplied by the emission factor provided in table 4-75. The emission factor for boilers[261] and turbines[262] comes from the EPA AP-42.

260 Energy Information Administration (EIA), March 8, 2005. 2002 Energy Consumption by Manufacturers. Table 5.5 End Uses of Fuel Consumption, 2002. Available online: http://www.eia.doe.gov/emeu/mecs/mecs2002/data02/shelltables.html

261 Environmental Protection Agency, Mar. 1998. Chapter 1: External Combustion Sources, 1.4: Natural Gas Combustion. p. 1.4-5. Available online: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdfn

262 Environmental Protection Agency, April 2000. Chapter 3: Stationary Internal Combustion Sources, Stationary Gas Turbines. p. 3.1-10 and 3.1-11. Available online: http://www.epa.gov/ttnchie1/ap42/ch03/final/c03s01.pdf

Table 4-72. Industrial Natural Gas by Use in the EIA West South Central Region, 2002

End Use	Total Natural Gas (Bcf)	Boiler		Turbine		Feedstock	
		%	Bcf	%	Bcf	%	Bcf
Conventional Boiler Use	643	100%	643	0%	0	0%	0
CHP / Cogeneration Pro.	630	100%	630	0%	0	0%	0
Process Heating	1,375	100%	1,375	0%	0	0%	0
Process Cooling and Ref.	35	0%	0	100%	35	0%	0
Machine Drive	71	0%	0	100%	71	0%	0
Other Process Use	60	0%	0	100%	60	0%	0
Facility HVAC	106	100%	106	0%	0	0%	0
Conventional Electricity Gen.	34	0%	0	100%	34	0%	0
Other Uses	12	0%	0	0%	0	100%	12
End Use Not Reported*	37	0%	0	0%	0	0%	0
Total	3,005	92.9%	2,754	6.7%	200	0.4%	12

*Not used in the calculation

Table 4-73. Industrial Natural Gas Consumption Emission Factors (lbs / Mcf)

Source Category	VOC	NOx	CO
Large Boilers - Flue gas recirculation	5.5	100	84
Small Boilers – Uncontrolled	5.5	100	84
Turbine: Water-Steam Injected	2.1	130	30

Sample Calculation

Equation (1)

Natural gas consumption for County A:

CNG_A = CEMP / SEMP x SING x 1000

Where,

CNG_A = Natural gas usage for each industrial type for County A
CEMP = Employment for each industrial type in County A
SEMP = Employment for each industrial type in the EIA South Region, Table 4-72
SING = Bcf for each industrial type in the EIA South Region, Table 4-72

Food Industry Industrial Natural Gas Consumption for Bexar County

CNG_A = 5,187 / 522,118 x 165 x 1000
= 1,639 MMcf

Equation (2)

Total industrial natural gas used in County A:

TNG_A = $\Sigma(CNG_A)$ x TADJ - PT_A

Where,

TNG_A = Natural gas usage for County A
CNG_A = Natural gas usage for each industrial type for County A

$TADJ$ = Texas adjustment factor (1.796)
PT_A = Point source natural gas usage for County A, Table 4-73

Total industrial natural gas used in Bexar County:

TNG_A = (1,639 MMcf + 259 MMcf + 4 MMcf + 323 MMcf + 809 MMcf + 2,580 MMcf + 5,580 MMcf + 193 MMcf + 1,722 MMcf + 241 MMcf + 117 MMcf + 33 MMcf + 36 MMcf) x 1.796 - 5,266 MMcf
= 19,044 MMcf

Equation (3)
Annual Emissions in tons/yr. (NOx) for County A:

NGO_A = TNG_A x PER x EF / 2000 lbs/ton

Where,

NGO_A = Emissions from for each type of operation in County A
TNG_A = Natural gas usage for County A, Table 4-74
PER = Percentage of natural gas used for each type of operation, Table 4-64
EF = Emission Factor for VOC, NOx, or CO, Table 4-75

Annual Emissions in tons/yr. (NOx) for Industrial Boilers in Bexar County

NGO_A = 19,044 MMcf x 0.929 x 100 lbs / 2000 lbs/ton
= 883.86 tons/year of NOx

Equation (4)
Annual Emissions in tons/yr. (NOx)

TAE_A = $BOIL_A$ + $TURB_A$

Where,

TAE_A = Total annual emissions for County A
$BOIL_A$ = Emissions from Boilers for County A, Equation (3)
$TURB_A$ = Emissions from Turbines for County A, Equation (3)

Total industrial natural gas emissions in tons/year of NOx for Bexar County

TAE_A = 883.86 tons/year of NOx + 83.44 tons/year of NOx
= 967.31 tons/year of NOx

Equation (5)
Ozone Season Adjustment Factor

$OSAF$ = [Σ(MIG_A) / 214 days] / [TGC / 356 days]

Where,

$OSAF$ = Ozone season adjustment factor
MIG_A = Amount of industrial natural gas used for month A in Texas
TGC = Yearly Texas industrial natural gas consumption (1,348,427 MMcf)

Ozone Season Adjustment Factor:

$OSAF$ = [(114,834 + 116,579 + 113,064 + 117,712 + 119,656 + 96,288 + 101,491) / 214 days] / [1,348,427 / 365 days]
= 0.986

Methodology – Liquid Petroleum Gas Consumption

Residential LPG Consumption

The statewide residential consumption of LPG in 2004 was 308,616,000 gallons.[263] The statewide residential LPG usage in 2005 was multiplied by a household ratio of houses using LPG for heating to yield the amount of LPG usage for each county (Table 4-76).[264]

Table 4-74. Households Using LPG for Heating and LPG Usage by County

County	FIPS	Number of Households	Percent of Households	Residential LPG (1,000 gal)
Atascosa	48013	2,562	0.55%	1,683
Bandera	48019	1,635	0.35%	1,074
Bexar	48029	10,371	2.21%	6,814
Comal	48091	3,141	0.67%	2,064
Frio	48163	623	0.13%	409
Gillespie	48171	1,990	0.42%	1,308
Guadalupe	48187	3,381	0.72%	2,222
Karnes	48255	811	0.17%	533
Kendall	48259	1,271	0.27%	835
Kerr	48265	2,152	0.46%	1,414
Medina	48325	2,242	0.48%	1,473
Wilson	48493	2,726	0.58%	1,791
Texas	48000	469,684	100.00%	308,616

Once residential LPG use was determined by county, the gallons of LPG were multiplied by appropriate emission factors. The EPA states that since "no emission factors were located for the combustion of LPG for residential consumption, emission factors for (LPG) commercial boilers may be used for residential emissions."[265] The emissions factors used in the calculations are provided in Table 4-77.[266]

Table 4-75. Residential LPG Emission Factors (lbs / 1,000 gal)

Source Category	VOC	NOx	CO
Residential LPG	0.5	14	1.9

It is estimated that there was no LPG was used for heating during the ozone season. According to the EPA, the LPG "consumption, which is being used for space heating, can be allocated by

[263] Energy Information Administration (EIA), August 2006. Table F6: Liquefied Petroleum Gases Consumption, Price, and Expenditure Estimates by Sector, 2004. Available online: http://www.eia.doe.gov/emeu/states/sep_fuel/html/pdf/fuel_lg.pdf

[264] U.S. Census Bureau, April 1, 2000. Census 2000 Summary File 3 (SF 3) - Sample Data: H40. Housing Fuel. Available online: http://factfinder.census.gov/home/saff/main.html?_lang=en

[265] Environmental Protection Agency, April 1999. Emission Inventory Improvement Program: Area Source Method Abstracts – Natural Gas and LPG Combustion. p. 3. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/ng.pdf

[266] Environmental Protection Agency, October 1996. AP 42, Fifth Edition, Volume I: Chapter 1: External Combustion Sources. p 1.5-3. Available online: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s05.pdf

month using proportions of annual and monthly heating degree days."[267] Since there is insignificant number of heating degree-days during the summer in San Antonio,[268] no emissions from residential LPG heating was calculated for ozone season daily emissions.

$$\text{Residential Fuel}_{\text{month}} = \text{Residential Fuel}_{\text{Annual}} \times \frac{\text{Heating Degree Days}_{\text{month}}}{\text{Heating Degree Days}_{\text{Annual}}}$$

Sample Calculation

Equation (1)

Residential LPG consumption for County A:

$RLPG_A = (CHH_A / THH) \times TLPG$

Where,

$RLPG_A$ = Residential LPG usage for County A
CHH_A = Households using LPG in County A, Table 4-74
THH = Texas households using LPG, Table 4-74
TLPG = Texas residential LPG consumption, Table 4-74

Residential LPG consumption in Bexar County:

$RLPG_A = (10{,}371 / 469{,}684) \times 308{,}616{,}000$
$= 6{,}814{,}489$ gallons

Equation (2)

Annual Emissions in tons/yr. (NOx)

$AE_A = RLPG_A \times EF / 1000 / 2000$ lbs/ton

Where,

AE_A = Annual emissions for County A
$RLPG_A$ = Residential LPG use in County A, Table 4-74
EF = Emission factor for VOC, NOx, or CO, Table 4-75

Annual Emissions for residential LPG in Bexar County

AE_A = 6,814,489 gallons x 14 lbs / 1000 / 2000 lbs/ton
= 47.70 tons/year of NOx

Commercial LPG Consumption

The statewide commercial consumption of LPG in 2004 was 54,474,000 gallons.[269] The statewide commercial LPG usage in 2004 was multiplied by a commercial employment ratio to yield the amount of LPG usage for each county. Commercial employment numbers were

[267] Environmental Protection Agency. April 1999. Emission Inventory Improvement Program: Area Source Method Abstracts – Natural Gas and LPG Combustion. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/ng.pdf

[268] National Oceanic and Atmospheric Administration, June 2005. Climatography of the United States NO. 81 Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971 – 2000. 41 – Texas. National Climatic Data Center. Asheville, NC. Available online: http://cdo.ncdc.noaa.gov/climatenormals/clim81/TXnorm.pdf

[269] Energy Information Administration (EIA), August 2006. Table F6: Liquefied Petroleum Gases Consumption, Price, and Expenditure Estimates by Sector, 2004. Available online: http://www.eia.doe.gov/emeu/states/sep_fuel/html/pdf/fuel_lg.pdf

obtained using NAICS codes 42, 44, 45, 52, 53, 71, 72, and 81.[270] Once commercial LPG use was determined for each county, LPG use was multiplied by appropriate emission factors in Table 4-76.[271]

Table 4-76. Commercial LPG Emission Factors (lbs / 1,000 gal)

Source Category	VOC	NOx	CO
Residential LPG	0.5	14	1.9

Sample Calculation

Equation (1)

Commercial LPG consumption for County A:

$CLPG_A$ = (CCE_A / TCE) x TLPG

Where,

$CLPG_A$ = Commercial LPG usage for County A
CCE_A = Commercial employment for County A
TCE = Texas commercial employment (3,391,961)
TLPG = Texas commercial LPG consumption (54,474,000)

Commercial LPG consumption in Bexar County:

$CLPG_A$ = (205,319 / 3,391,961) x 54,474,000
= 3,297,369 gallons

Equation (2)

Annual emissions in tons/yr. (NOx) for commercial LPG use in County A:

AE_A = $CLPG_A$ x EF / 1000 / 2000 lbs/ton

Where,

AE_A = Total annual emissions for County A
$CLPG_A$ = Commercial LPG use for County A, Equation (1)
EF = Emission factor for VOC, NOx, or CO, Table 4-78

Annual emissions in tons/yr. (NOx) for commercial LPG use in Bexar County:

AE_A = 3,297,369 gallons x 14 lbs / 1000 / 2000 lbs/ton
= 23.08 tons/year of NOx

Industrial LPG Consumption

Texas statewide industrial consumption of LPG in 2004 was 18,370,380,000 gallons;[272] however, there is no data available on how much is used by point sources. To determine emissions from Industrial LPG, a ratio of Houston MSA industrial sector employment compared to industrial sector employment for each AACOG County was used instead. Industrial employment numbers were obtained using NAICS codes 21, 22, 23, 31, 32, and 33.[273] The

[270] U.S. Census Bureau, July 14, 2006. County Business Patterns, 2004. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.

[271] Environmental Protection Agency, October 1996. AP 42, Fifth Edition, Volume I: Chapter 1: External Combustion Sources. p 1.5-3. Available online: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s05.pdf

272 Energy Information Administration (EIA), August 2006. Table F6: Liquefied Petroleum Gases Consumption, Price, and Expenditure Estimates by Sector, 2004. Available online: http://www.eia.doe.gov/emeu/states/sep_fuel/html/pdf/fuel_lg.pdf

[273] U.S. Census Bureau, July 14, 2006. County Business Patterns, 2004. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.

employment ratio was multiplied by the total emission estimate for industrial LPG in the Houston area.[274] This yielded tons/year estimates for each of the twelve AACOG counties. According to the TCEQ, activity occurs 312 days a year and there is no seasonal adjustment.[275]

Sample Calculation
Equation (1)
Annual Emissions in tons/yr (NOx)

AE_A = (CIE / HIE) x HEM

Where,

AE_A = Total annual emissions for County A
CIE_A = Industrial employment for County A
HIE = Houston MSA 2002 industrial employment (382,694)
HEM = Houston MSA 2002 industrial LPG emissions (2.10 tons/day of VOC, 106.20 tons/day of NOx, 26.53 tons/day of CO)

Annual emissions for industrial LPG in tons/yr. (NOx) for Bexar County

AE_A = (62,766 / 382,694) x 106.20
= 17.42 tons/year of NOx

Methodology – Wood Consumption

Residential Wood Consumption

Texas 2003 statewide consumption of residential wood use was 628,000 Cords.[276] To estimate the amount of residential wood used for each county, a ratio was developed between county households using wood for heating by Texas households using wood for heating in 2000.[277] This ratio was then multiplied by the statewide consumption of residential wood (Table 4-77).

[274] TCEQ. Detailed 2002 Area Inventory for Non-Attainment and NearNon-Attainment Counties by County and Region. Available online: http://www.tceq.state.tx.us/implementation/air/areasource/binary/detail_area_2002_by_region_736258.pdf

[275] *Ibid*.

276 Energy Information Administration (EIA), October 24, 2006. Table 8. Residential Sector Energy Consumption Estimates, Selected Years, 1960-2003, Texas. Available online: http://www.eia.doe.gov/emeu/states/sep_use/res/use_res_tx.html

[277] U.S. Census Bureau, April 1, 2000. Census 2000 Summary File 3 (SF 3) - Sample Data: H40. Housing Fuel. Available online: http://factfinder.census.gov/home/saff/main.html?_lang=en

Table 4-77. Households Using Wood for Heating and Wood Usage per County

County	FIPS	Households using Wood for Heating	Wood (tons/yr)
Atascosa	48013	203	6,270
Bandera	48019	253	7,814
Bexar	48029	621	19,180
Comal	48091	273	8,432
Frio	48163	77	2,378
Gillespie	48171	352	10,872
Guadalupe	48187	324	10,007
Karnes	48255	18	556
Kendall	48259	161	4,973
Kerr	48265	404	12,478
Medina	48325	189	5,837
Wilson	48493	105	3,243
Texas	48000	32,046	92,039

To calculate the amount of tons in every cord of wood, the square feet of wood in each cord were determined (79 ft^3). Also, the type of wood burning in wood fireplaces and woodstoves in San Antonio is similar to the South Central region's Oak-Pine with specific gravity of 0.639. To determine tons of residential wood used, the total cords of wood were multiplied by the square feet, specific gravity, and weight of a cubic foot of water (62.4 lbs).[278] The cord of wood was divided into 7 different categories of Fireplaces and woodstoves based on the 2002 National Emission Inventory produced by the EPA.[279] Table 4-78 lists the percentage of wood used for each type of fireplaces and woodstoves in the US.

Table 4-78. Percentage of U.S. Residential Cordwood Usage by Fireplace/Woodstove Source Category, 2001

Source Category	SCC	Wood (tons/yr)	Percentage
Fireplaces: Without Insets	2104008001	2,475,565	12.49%
Fireplaces: Insets - Catalytic - non-EPA-certified	2104008002	7,427,566	37.49%
Fireplaces: Insets - Non-Catalytic - EPA-certified	2104008003	453,991	2.29%
Fireplaces: Insets - Catalytic - EPA-certified	2104008004	183,189	0.92%
Woodstoves: Conventional	2104008010	8,531,118	43.06%
Woodstoves: Catalytic	2104008030	213,278	1.08%
Woodstoves: Non-catalytic	2104008050	528,558	2.67%

[278] Emission Inventory Improvement Program, EPA, January 2001. Residential Wood Combustion: Revised Final. Eastern Research Group, p. 2.5-3. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii02_apr2001.pdf

[279] E.H. Pechan & Associates, Inc., July 2006. Documentation for the Final 2002 Nonpoint Sector (Feb 06 Version) National Emission Inventory for Criteria and Hazardous Air Pollutants. EPA68-D-02-063, Durham, NC, p. A-147. Available online: http://www.epa.gov/ttn/chief/net/2002inventory.html

Once the total tonnage of residential wood used was calculated, the ton of wood used for each type of Fireplace or Woodstove was multiplied by the emission factor in table 4-79.[280] Since there is insignificant number of heating degree-days during the summer in San Antonio,[281] no emissions from residential LPG heating was calculated for ozone season daily emissions.

$$\text{Residential Fuel}_{month} = \text{Residential Fuel}_{Annual} \times \frac{\text{Heating Degree Days}_{month}}{\text{Heating Degree Days}_{Annual}}$$

Table 4-79. Residential Wood Combustion Emission Factors

Source Category	SCC	Emission Factor (lbs/ton)		
		VOC	NOx	CO
Fireplaces: Without Insets	2104008001	229	2.6	128
Fireplaces: Insets - Catalytic - non-EPA-certified	2104008002	53	2.8	231
Fireplaces: Insets - Non-Catalytic - EPA-certified	2104008003	12	0	141
Fireplaces: Insets - Catalytic - EPA-certified	2104008004	15	2	104
Woodstoves: Conventional	2104008010	53	2.8	231
Woodstoves: Catalytic	2104008030	15	2	104
Woodstoves: Non-catalytic	2104008050	12	0	141

Sample Calculation
Equation (1)
Wood consumption in cords for each county:

CWC_A = (CHH_A / THH) x TWC

Where,

CWC_A = County wood consumption for County A in cords
CHH_A = Number of households using wood for heating for County A, Table 4-70
THH = Number of Texas households using wood for heating, Table 4-79
TWC = Texas residential wood consumption (628,000 Cords)

Residential wood consumption in cords for Bexar County:

CWC_A = (621 / 32,046) x 628,000 Cords
= 12,170 Cords

Equation (2)
Convert cords into tons of wood for each county:

TWC_A = CWC_A x ASW x SG x WW / 2000 lbs/ton

Where,

TWC_A = County wood consumption for County A in tons
CWC_A = County wood consumption for County A in cords, Equation (1)

[280] *Ibid*., p. A-148-154.
[281] National Oceanic and Atmospheric Administration, June 2005. Climatography of the United States NO. 81 Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971 – 2000. 41 – Texas. National Climatic Data Center. Asheville, NC. Available online: http://cdo.ncdc.noaa.gov/climatenormals/clim81/TXnorm.pdf

ASW = Area of solid wood (79 ft^3)
SG = Specific gravity for South Oak-Pine Hardwood (0.639)
WW = Weight of a cubic foot of water (62.4 lbs)

Residential wood consumption in cords for Bexar County:

TWC_A = 12,170 Cords x 79 ft^3 x 0.639 x 62.4 lbs / 2000 lbs/ton
= 19,180 tons

Equation (3)
Annual emissions in tons/yr. (VOC) of residential cordwood usage by fireplace/woodstove type for each county:

AE_A = TWC_A x PW x EF / 2000 lbs/ton

Where,

AE_A = Annual emissions for each by fireplace/woodstove type for County A
TWC_A = County wood consumption for County A in tons, (from equation (2)
PW = Percentage of wood used by fireplace/woodstove type, Table 4-79
EF = Emission factor for VOC, NOx, or CO, Table 4-81

Annual emissions for residential wood fireplace without Insets in Bexar County

AE_A = 19,180 tons x 0.1249 x 229 lbs / 2000 lbs/ton
= 274.39 tons/year of VOC

Equation (4)
Total annual residential wood emissions in tons/yr (VOC) for each county:

$TAE_A = \Sigma(AE_A)$

Where,

TAE_A = Total annual emissions for County A
AE_A = Annual emissions for each by fireplace/woodstove type for County A, Equation (3)

Annual residential wood emissions for Bexar County

TAE_A = (274.39 tons + 190.54 tons + 2.64 tons + 1.33 tons + 218.85 tons + 1.55 tons + 3.07 tons)
= 692.36 tons/year of VOC

Surface Coatings

The surface coating industry contains many different types of coatings, which include paints, varnishes, polishes, sealers, etc. Typically, coatings provide protection or decoration to a substrate or surface. In a typical coating sequence, three coatings are used: a primer, an intermediate coat, and a topcoat. The majority of emissions that are produced during surface coatings are due to evaporation of the solvents contained in the coatings.

Methodology

Per employee emission factors were used in calculating the emissions for the categories listed below. The ENVIRON Report "Area and Mobile Source Emissions Inventory, Technical Support Project" was used to acquire the emission factors (Table 4-80) and the activity days per week, which is five days, for each category.[282] Texas Workforce Commission[283] and US Census County Business Patterns[284] provided data on the number of employees by SIC codes for each of the categories. Since Texas Workforce Commission employment database sometimes misses employment from business that do not report, employment figures were compared to the County Business Patterns database. Surface coating point source emissions were subtracted from the area source categories to prevent overlapping.

Sample Calculation

Equation (1)

Annual VOC emissions by SIC:

$$AE_A = EMP_A \times EF / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual VOC emissions by SIC code for County A (tons/yr)
EMP_A = Number of employees per SIC code for County A (employees)
EF = VOC emission factor (lbs/employee/yr), Table 4-80

Annual paper, foil and film coating VOC emissions for Bexar County:

$$AE_A = 147 \text{ employees} \times 152.10 \text{ lbs VOC/employee/yr.} / 2{,}000 \text{ lbs/ton}$$
$$= 11.18 \text{ tons VOC/yr.}$$

Table 4-80. Surface Coating Operations SIC Codes and Emission factors

Coating Subcategories	SIC Codes	VOC EF (lbs/emp- yr)
Factory Finished Wood: Coating	246, 2429, 243, 244, 245, 2493, 2499	30.33
Wood Furniture: Coating	2511, 2512, 2517, 2521, 2541	1,349.00
Metal Furniture: Coating	2514, 2515, 2519, 2522, 253, 2542, 2599	577.20
Paper, Foil, And Film: Coating	2671, 2672, 2673, 3081, 3082	152.10
Metal Cans: Coating	341	5,017.00
Sheet, Strip, and Coil: Coating	3479	3,101.00
Machinery and Equipment: Coating	35	55.83
Appliances: Coating	363	323.10
Electronic and Other Electrical: Coating	3357, 3612	49.88
Motor Vehicles: Coating	371	737.60
Aircraft: Coating	3721	183.20
Marine: Coating	373	289.60
Railroad: Coating	374	1,190.00
Miscellaneous Manufacturing: Coating	All of 20-39 except those listed above	18.39

[282] ENIVIRON. August 2001. Area and Mobile Source Emissions Inventory, Technical Support Project. Ch. 2.8 and 5.10. Navato, CA.
[283] Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.
[284] U.S. Census Bureau, September 16, 2005. County Business Patterns, 2003. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html.

Seasonal Adjustment
Equation (2)
Daily VOC emissions by SIC code:

$$DE_A = AE_A / AR$$

Where,

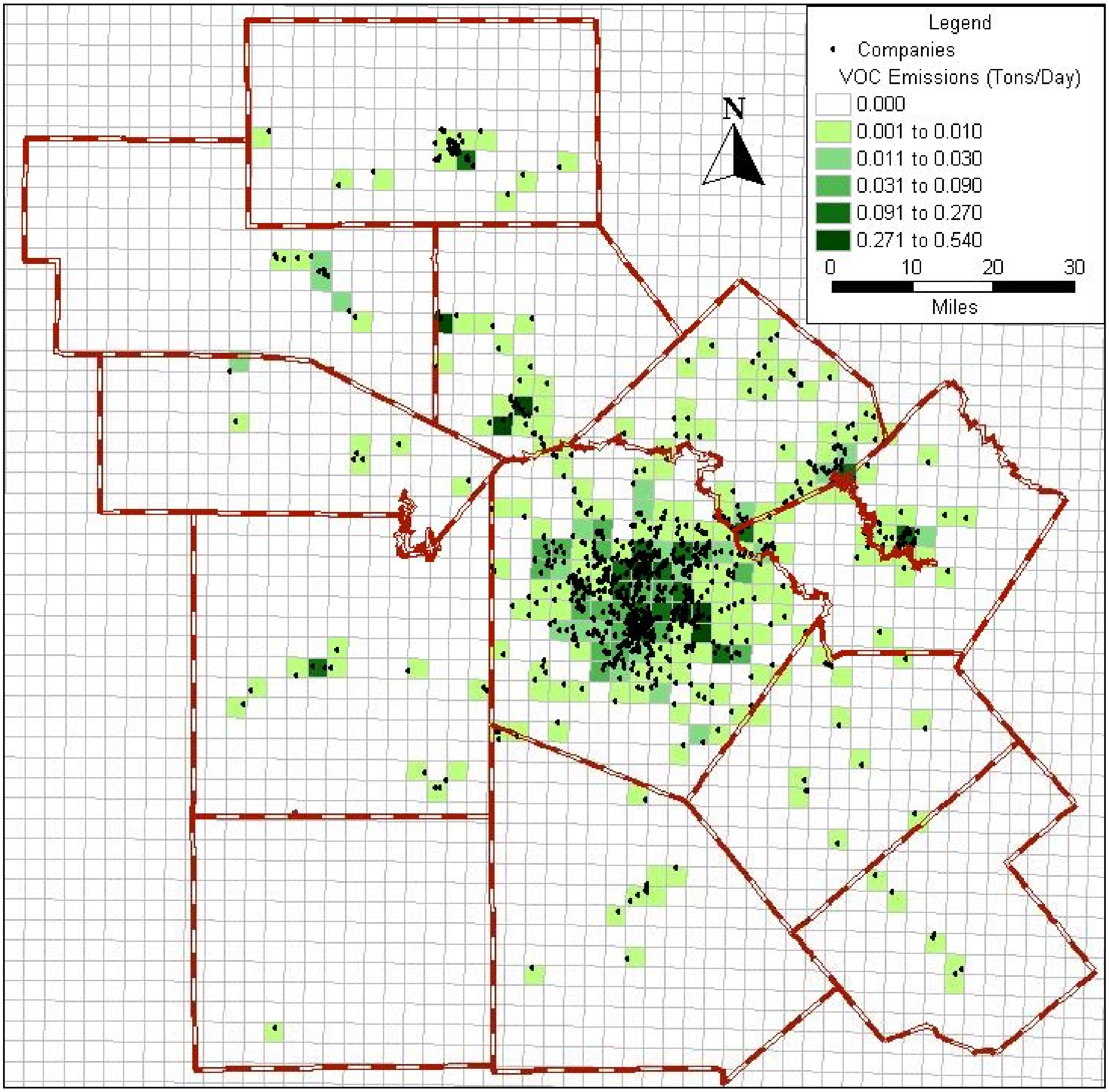
DE_A = Daily VOC emissions by SIC code for County A (tons/day)
AE_A = Annual VOC emissions by SIC code for County A (tons/yr)
AR = Activity rate is 5 days per week, 260 days per year (days/yr)

Daily paper, foil and film coating VOC emissions for Bexar County:

$$DE_A = 11.18 \text{ tons VOC/yr.} / 260 \text{ days/yr}$$
$$= 0.043 \text{ tons VOC/day}$$

Spatial Distribution
Emissions are allocated to the 4km grid by the location of the companies that do surface coating operations (Figure 4-16).

Figure 4-16. VOC Emissions From Surface Coating Operations, 2005



Plot Date: July 15, 2006
Map Compilation: July 19, 2006
Source: Surface Coating Operation's locations were provided by Texas Workforce Commission, 2005. Employment Data for 3rd quarter 2004. Austin, Texas.

Traffic Markings

Traffic markings consist of centerlines, edge stripes, and directional markings found on highways as well as markings on paved and unpaved surfaces, such as parking lots. Various materials are used to make traffic markings, including solvent-based paints, water-based paints, thermoplastics, preformed tapes, field-reacted materials, and permanent markers. Three of these materials emit VOC in appreciable amounts: water- and solvent-based non-aerosol paint, water- and solvent-based aerosol paint, and preformed tapes applied with adhesive primer.

Methodology

The first step in the calculation of traffic marking emissions is to determine the paint consumption for use on state, county, city, and private highways and roads for each of the 12 AACOG counties.

State Highways

Two methods were used to obtain this data:

1) Paint consumption provided by the Texas Department of Transportation (TXDOT) [285] was sorted by county and totaled by month and year. TXDOT data was used for 10 of the AACOG 12-county region: Atascosa, Bandera, Bexar, Comal, Frio, Guadalupe, Kendall, Kerr, Medina, And Wilson.
2) For Gillespie and Karnes counties, paint consumption was estimated based on the ratio of total county-highway lane miles to total lane miles in the other 10 AACOG counties.[286]

Along with the paint consumption information, TXDOT provided the VOC content of the paint used: 95 grams per liter (0.79 lbs/gal). The VOC content was multiplied by the paint consumption and control factor (CF) of 0.8 to calculate VOC emissions.[287]

County, City, and Private Roads

The next step is to allocate paint consumption for state, county, city, and private roadways.[288] Of the traffic paint for the whole state, on average 65% is used on state highways, 25% is used on city and county roads, and 10% is used on private roads (Table 4-81). A survey was conducted for county and city usage of traffic marking coating operations to update the amounts used and emission factors.

Control Factor

A rate of progress factor of 0.8 was applied to the traffic marking emissions to account for the amount of emission reductions due to use of improved techniques and/or implementation of new regulations.[289]

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285 Texas Department of Transportation – Austin District. April 2004. Paint purchased and paint specifications. Austin, Texas.

286 Texas Department of Transportation - San Antonio District. April 2004. County Centerline Miles and Lane Miles. Austin, Texas.

287 The Capital Area Planning Council (CAPCO), December 2003. Austin-Round Rock MSA 2007 Future Year Ozone Precursor Modeling Emissions Inventory. Austin, Texas. p. 16. Available online: http://www.capcog.org/capcoairquality/DEC_31/Future%20Year%20Emissions%20Inventory.pdf

288 ENVIRON International Corporation, et. al. August 31, 2001. Area and Mobile Source Emissions Inventory Technical Support Project. Navato, CA.

289 Environ International Corporation, 2001. Future-Year Ozone Modeling of the Austin, Texas Region: Draft Final Report. Novato, CA.

Table 4-81. Traffic Marking Paint for TxDOT, City/County Roads, and Private Roads, 2005

County	TxDOT (gal)		City / County Roads (gal)		Private Roads (gal)	
	Yearly	Ozone Season Daily	Yearly	Ozone Season Daily	Yearly	Ozone Season Daily
Atascosa	8,570	36	3,296	14	1,318	6
Bandera	384	1	148	1	59	0
Bexar	17,024	32	6,548	12	2,619	5
Comal	2,089	5	803	2	321	1
Frio	9,802	46	3,770	18	1,508	7
Gillespie	3,413	9	1,313	4	525	1
Guadalupe	2,508	7	965	3	386	1
Karnes	3,424	9	1,317	4	527	1
Kendall	3	-	1	-	0	-
Kerr	557	2	214	1	86	0
Medina	2,028	6	780	2	312	1
Wilson	3,198	14	1,230	5	492	2
Total	53,000	170	20,385	65	8,154	26

Seasonal Adjustment

For the 10 counties with data from TxDOT on traffic markings, the ozone season adjustment was based on the traffic markings used during ozone season months. The same seasonal adjustment was assumed for city and county roads, and private roads. For Gillespie and Karnes counties, the yearly use of traffic markings were divided by 365.

Sample Calculation

Equation (1)

Annual VOC emissions for the 10 AACOG counties with TxDOT data:

$$AE_A = TXG_A \times EF \times CF / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual VOC emissions for County A (tons/yr.)

TXG_A = Annual amount of TXDOT traffic coatings used in County A (gal/yr), Table 4-83

EF = VOC content in traffic coatings (0.79 lbs/gal)

CF = Control factor (0.8)

Annual VOC emissions from state highways traffic markings in Atascosa County:

$$AE_A = 8{,}569.72 \text{ gal/yr.} \times 0.79 \text{ lbs VOC/gal} \times 0.8 / 2{,}000 \text{ lbs/ton}$$
$$= 2.71 \text{ tons VOC/yr.}$$

Equation (2)

Ozone season day VOC emissions for the 10 AACOG counties with TxDOT data:

$$DE_A = OSG_A \times EF \times CF / 2{,}000 \text{ lbs/ton} / 170 \text{ days/ozone season}$$

Where,

DE_A = Daily ozone season VOC emissions for County A (tons/ozone season day)
OSG_A = Amount of TXDOT traffic coatings used in County A (gal/yr.) during the ozone season (gal./ozone season), Table 4-81
EF = VOC content in traffic coatings (0.79 lbs/gal)
CF = Control factor (0.8)

Daily ozone season VOC emissions from state highways traffic markings in Atascosa County:

DE_A = 7,785.83 gal./ozone season x 0.79 lbs VOC/gal x 0.8 / 2,000 lbs/ton / 170 days/ozone season
= 0.0145 tons VOC/ozone season day

Sample Calculation
Equation (3)
Annual VOC emissions for the Karnes and Gillespie counties:

AE_A = AAE x PER_A

Where,
AE_A = Annual emissions for County A (tons/yr.)
AAE = Annual emissions for the other 10 AACOG Counties (14.59 tons/yr.)
PER_A = Percentage of total lane miles for County A (7.39% for Gillespie County and 7.42% for Karnes County)

Annual VOC emissions from traffic markings in Gillespie County:

AE_A = 14.59 tons VOC/yr. x 0.0739
= 1.08 tons VOC/yr.

Underground and Above Ground Storage Tanks

Working and breathing losses from petroleum storage tanks result in the emission of volatile organic compounds (VOC). Emissions from above and under ground storage tanks were estimated using the TANKS 4.09d model, which is available through the Technology Transfer Network (TTN) Bulletin Board System maintained by the United States Environmental Protection Agency (EPA).[290] The TANKS model was designed to estimate emissions for specific liquids being stored. Once specific tank and fluid properties are entered, the model uses AP-42 methodology and emission factors to calculate total losses in lbs per year. The Texas Commission on Environmental Quality (TCEQ) provided the database of tanks within the AACOG region.[291]

Methodology
To effectively estimate losses from the petroleum storage tanks with the AACOG region without entering all active tanks into the model, model runs were performed for distinct volumes for each RVP value and chemical stored. The database of storage tanks was culled to remove tanks at

[290] U.S. Environmental Protection Agency, Oct 3, 2005. TANKS Emission Estimation Software. Available online: http://www.epa.gov/ttn/chief/software/tanks/index.html
[291] Texas Commission on Environmental Quality, November 2005. UST and AST Database files. Austin, TX.

diesel tanks, empty tanks, tanks abandoned in place, and tanks removed from the ground. All valid tanks remaining in the database were then sorted by volume and substance stored. Tanks located at gas stations were removed because the emissions are calculated in the Gasoline Distribution section. Also, storage tanks in the point source database were removed to prevent double counting of emissions. Once the tanks were sorted by volume and component, model runs using the TANKS model was performed.

Specific tank properties are required to be able to effectively run the TANK model. The database made available by the TCEQ did not detail all properties required for the model. The TANKS model contains defaults for color (white/white),[292] condition (good)[293] and pressure settings. To calculate tank dimensions, TCEQ provided the following formulas:[294]

Horizontal Tanks:
R = cube root (Volume/15π)
Where diameter = 2r and length = 4r.

Vertical Tank:
R = cube root (Volume/30π)
Where diameter = 2r and length = 2r.

Example: Horizontal tank with a volume of 2,000 gallons
R = cube root (2,000/15π) = 2.8 ft
Diameter = 5.6 ft, length = 11.2 ft

To estimate turnover for each tank substance, total fuel sales for the region was divided by total volume of above and under ground storage tanks (AST and UST) used for fuel storage. There was 12,690,770,000 of gasoline,[295] 4,242,500 gallons of kerosene,[296] and 196,890,700 gallons of distillate fuel supplied in Texas between November 2004 and October 2005.[297] The amount of jet fuel and aviation gasoline was based on the San Antonio Airport Master Plan.[298] Since the supply of used oil was not available, a default of 4 turnovers per year was used (Table 4-82).[299]

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[292] Emission Factor and Inventory Group. Sept. 30, 1999. User's Guide to Tanks: Storage Tank Emissions Calculation Software Version 4.0. EPA, p. 4-4. Available online: http://www.epa.gov/ttn/chief/software/tanks/index.html

[293] *Ibid*.

[294] Texas Commission on Environmental Quality, 1999. E-mail communication. Austin, TX

[295] U.S. Energy Information Administration, Jan. 5, 2006. Texas Total Gasoline All Sales/Deliveries by Prime Supplier (Thousand Gallons per Day). Available online: http://tonto.eia.doe.gov/dnav/pet/hist/c100030481m.htm

[296] U.S. Energy Information Administration, Jan. 5, 2006. Texas Kerosene All Sales/Deliveries by Prime Supplier (Thousand Gallons per Day). Available online: http://tonto.eia.doe.gov/dnav/pet/hist/c600030481m.htm

[297] U.S. Energy Information Administration, Jan. 5, 2006. Texas No. 2 Fuel Oil All Sales /Deliveries by Prime Supplier (Thousand Gallons per Day). Available online: http://tonto.eia.doe.gov/dnav/pet/hist/c210030481m.htm

[298] Ricondo & Associates, Inc, Jan. 1998. San Antonio International Airport Master Plan Study, Volume 3.

[299] Emission Factor and Inventory Group. Sept. 30, 1999. User's Guide to Tanks: Storage Tank Emissions Calculation Software Version 4.0. EPA, p. 4-4. Available online: http://www.epa.gov/ttn/chief/software/tanks/index.html

Table 4-82. Storage Capacity, Gallons Sold, and Turnovers per Year for AACOG, 2005

Fuel Type	Storage Capacity		Gallons Sold	Turnovers per year
	UST	AST		
Gasoline	29,056,779	2,840,101	1,136,930,618	35.64
Jet Fuel	340,098	22,000	70,520,300	194.75
Kerosene	39,000	59,698	380,074	3.85
Aviation Gasoline[300]	62,000	1,001,100	25,034,527	23.55
Distillate Fuel Oil	106,303	72,500	17,872,397	99.96
Used Oil	66,080	0	N/A	4.00

N/A = Not Available

Sample Calculation
Equation (1)
Amount of fuel supplied to the AACOG region for substance type A:

$GAL_A = GAL_A \times (APOP / TPOP)$

Where,

GAL_A = Gallons supplied in the AACOG region for substance type A
$TGAL_A$ = Gallons supplied to Texas for substance type A
$APOP$ = AACOG population[301] or commercial employment[302] (1,984,875 or 418,336)
$TPOP$ = Texas population or commercial employment (22,155,787 or 4,608,580)

Amount of gasoline supplied to the AACOG region:

GAL_A = 12,690,770,000 * (1,984,875 / 22,155,787)
= 1,136,930,618

Equation (2)
Annual turnovers per tank for substance type A:

$TO_A = GAL_A / (USTV_A + ASTV_A)$

Where,

TO_A = Turnovers for substance type A
GAL_A = Gallons supplied in the AACOG region for substance type A, Equation (1)
$USTV_A$ = UST Volume for substance type A, Table 4-84
$ASTV_A$ = AST Volume for substance type A, Table 4-84

Annual turnovers per tank for gasoline:

TO_A = 1,136,930,618 / (1,984,875 + 29,056,779)
= 35.64 turnovers per year

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[300] See the airport section of the emission inventory for methodology
[301] Texas Water Development Board, Feb. 17, 2004. 2006 Regional Water Plan: County Population Projections for 2000 – 2060. Available online: http://www.twdb.state.tx.us/data/popwaterdemand/2003Projections/Population%20Projections/STATE_REGION/County_Pop.htm
[302] U.S. Census Bureau, September 16 2005. County Business Patterns. Available online: http://www.census.gov/epcd/cbp/view/cbpview.html

Since the only residual fuel oil available in the model was "residual oil no 6", distillate Fuel Oil 2 was used in the calculation for all fuel oils. Residual oil No. 6 fuel oil includes "Bunker C fuel oil and is used for the production of electric power, space heating, vessel bunkering, and various industrial purposes."[303] Residual oil, besides point source uses, is not widely used in the San Antonio region.

Distillate Fuel Oil is "a general classification for one of the petroleum fractions produced in conventional distillation operations. No. 2 Fuel Oil is a distillate fuel oil that has a distillation temperature of 640 degrees Fahrenheit at the 90-percent recovery point. It is used in atomizing type burners for domestic heating or for moderate capacity commercial/industrial burner units."[304] Distillate fuel oil included the categories of Distillate Fuel Oil, Hydraulic Lift Oil, New Oil, and Used Oil. For aviation gasoline, RVP 6 gasoline was used in the model because most aviation gasoline has an RVP between 5.5 and 7.[305] Some of the minor substances were not calculated, i.e. ethanol, alcohol blended fuels and oil water separator, because the volumes or emissions were insignificant.

To arrive at a throughput value, the volume for each respective volume category multiplied the turnover rate by the TANKS model. Most tanks were calculated based on a fixed roof horizontal tank with dome shaped roofs. However, AST tanks larger then 15,000 gallons in Bexar County were checked by aerial photography to determine if the tanks were horizontal or vertical. There was 12 gasoline AST and 2 aviation gasoline AST that were fixed roof vertical tanks. The aerial photography was also used to determine shell diameter.

The meteorological and physical characteristics used in the model are listed below.

Pressure Setting:	The default vacuum setting is -0.03 psig.
Pressure Setting:	The default pressure setting is 0.03 psig.
Internal Shell Condition:	Light Rust as the default condition.
Tank Construction:	Welded as the default value
Primary Seal:	Mechanical shoe primary seal as the default value
Loss Factor, KD:	The default value is 0.14 (lb-mole/ft-yr).
Type of Tank:	Horizontal Tank
Tank Heated (y/n):	No
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig):	0.03
Meterological Data:	San Antonio, Texas
Atmospheric Pressure:	14.33 psia)
Horizontal UST	
Daily Liquid Surface Temp. Avg.	68.06 (Annual)
Daily Liquid Surface Temp. Min.	68.06 (Annual)
Daily Liquid Surface Temp. Max.	68.06 (Annual)
Liquid Bulk Temp. (deg. F)	67.62 (Annual)

[303] Energy Information Administration/Petroleum, January 2006. Marketing Monthly. p. 154. Available online: http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_marketing_monthly/current/pdf/glossary.pdf#search='Distillate%20fuel%20oil%20gov%20glossary'
[304] *Ibid*., p. 158
[305] Purvis Brothers, Inc., March 6, 1999. Aviation Gasoline Specifications – Current. Available online: http://www.purvisbros.com/avgspec.htm

Horizontal AST	
Shell Color/Shade:	White/White
Shell Condition:	Good
Daily Liquid Surface Temp. Avg.	70.73 (Annual)
Daily Liquid Surface Temp. Min.	64.95 (Annual)
Daily Liquid Surface Temp. Max.	76.52 (Annual)
Liquid Bulk Temp. (deg. F)	68.64 (Annual)

Vertical Fixed Roof Above Ground Tank (15ft diameter 21,000 gallon tank)

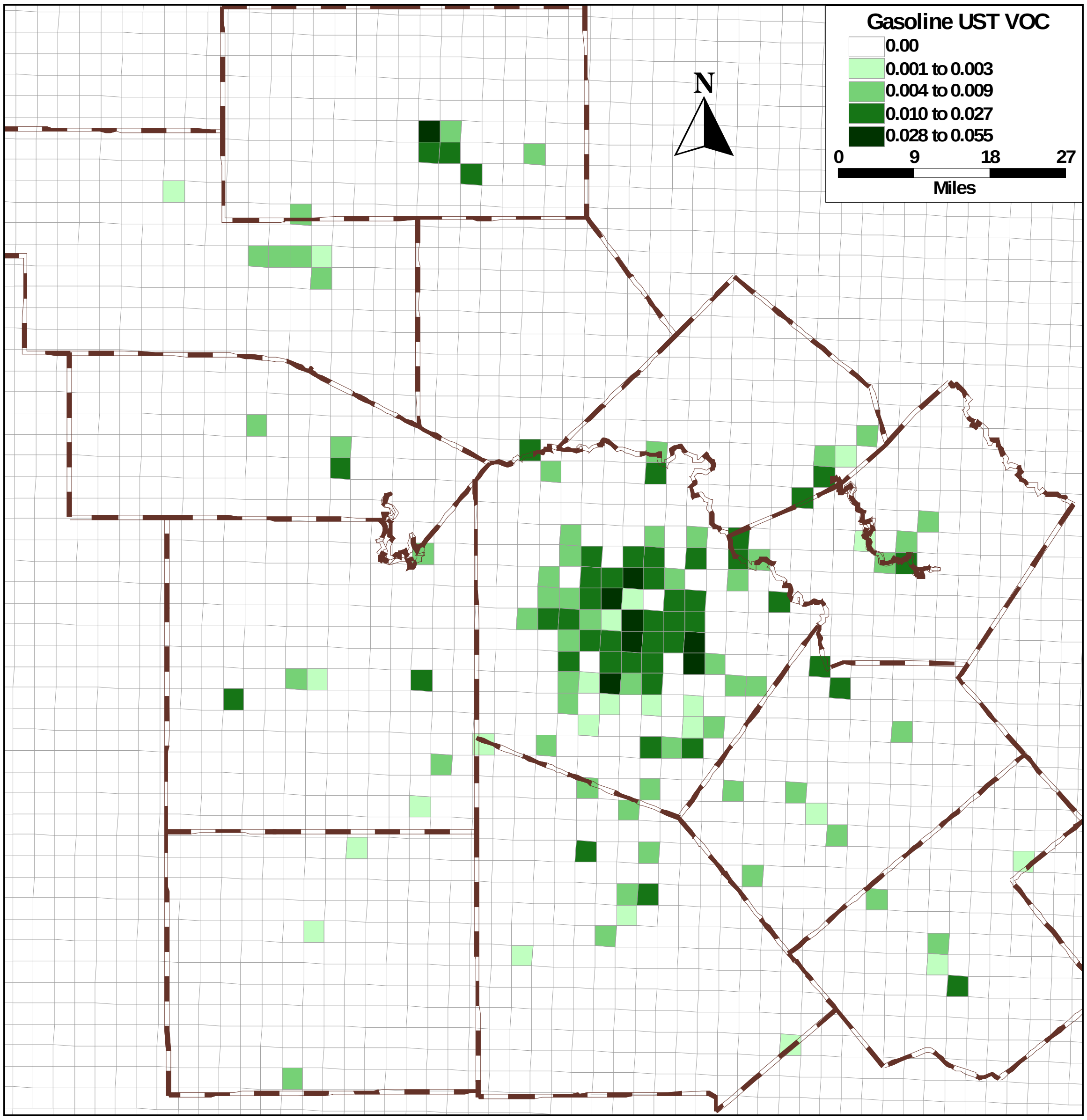
Shell Height (ft):	15.9 (did not affect emission calculations)
Diameter (ft):	15.0
Maximum Liquid Height (ft)	15.9
Average Liquid Height (ft)	15.9
Shell Color/Shade:	White/White
Shell Condition:	Good
Roof Color/Shade:	White/White
Roof Condition:	Good
Roof Type:	Dome
Roof Radius (ft):	15
Roof Height (ft):	0 (did not affect emission calculations)
Daily Liquid Surface Temp. Avg.	70.73 (Annual)
Daily Liquid Surface Temp. Min.	64.95 (Annual)
Daily Liquid Surface Temp. Max.	76.52 (Annual)
Liquid Bulk Temp. (deg. F)	68.64 (Annual)

One of the inputs required of the TANKS model to estimate emissions for gasoline emissions is the Reid Vapor Pressure (RVP) of the gasoline used in the county. To account for different RVP values within the region, summer losses for tanks within Atascosa, Bexar, Comal, Guadalupe, Karnes, and Wilson counties were calculated using an RVP value of 7.8. The remaining counties in the AACOG region – Bandera, Frio, Gillespie, Kendall, Kerr, and Medina and for annual totals were calculated using an RVP value of 9.

Spatial Allocation

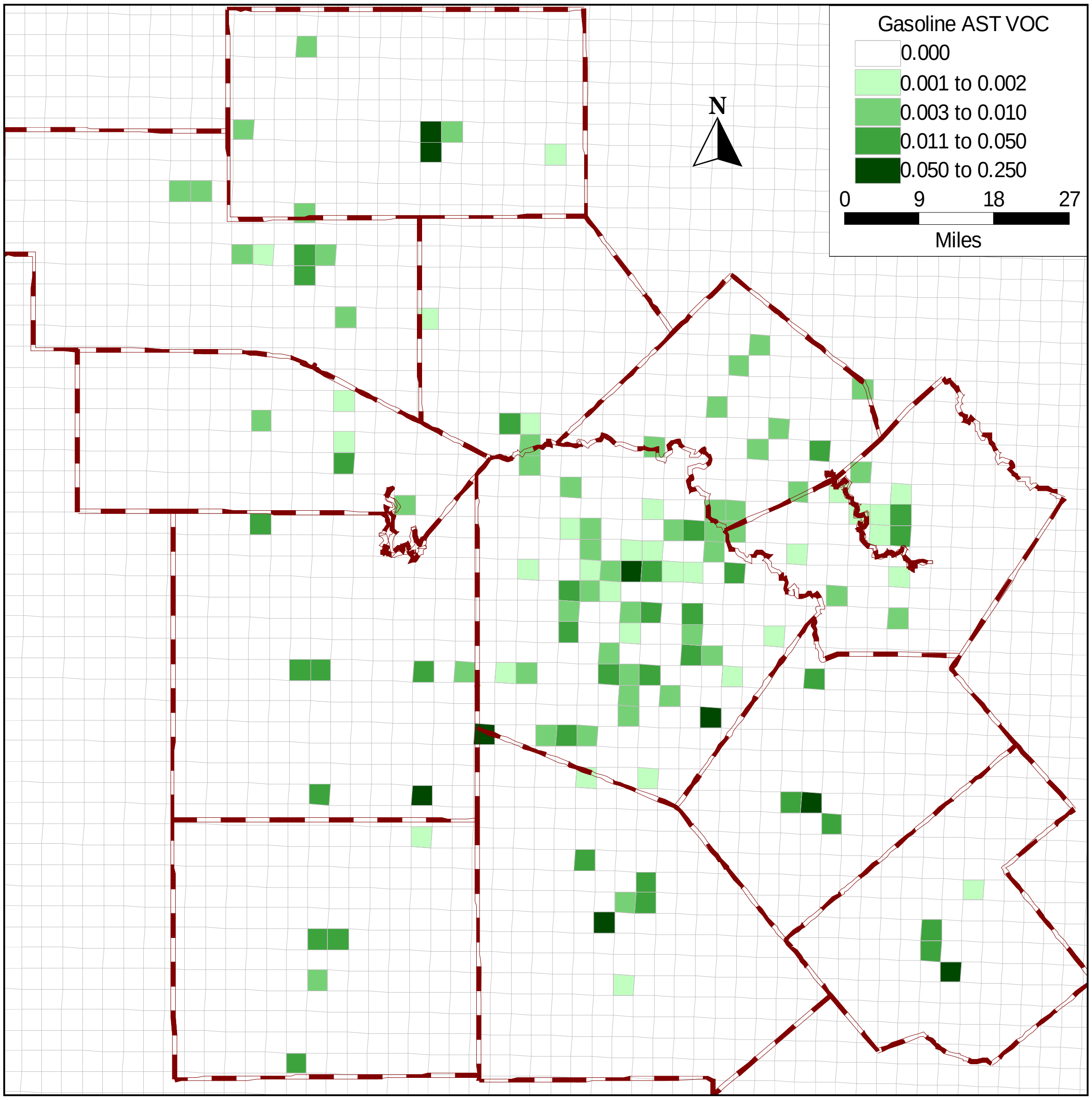
The Gasoline and Aviation Gasoline AST and UST were geo-coded to the location of the tanks in the 4km grid (Figure 4-17 and Figure 4-18). Tanks with other substance were not geo-coded because the emissions were insignificant.

Figure 4-17. VOC Emissions from Gasoline UST



Plot Date: Feb. 3, 2006
Map Compilation: Feb. 3, 2006
Source: Texas Commission on Environmental Quality, November 2005. "UST and AST Database files". Austin, TX.

Table 4-18. VOC Emissions from Gasoline AST



Plot Date:	Feb. 3, 2006
Map Compilation:	Feb. 3, 2006
Source:	Texas Commission on Environmental Quality, November 2005. "UST and AST Database files". Austin, TX.

Underground Storage Tanks Remediation

This category of the 2005 Emissions Inventory estimates emissions from the remediation of underground storage tanks (UST). The amount of emissions that occur when a leaking underground storage tank has been unearthed for removal is estimated. The initial emitting of pollutants occurs in the first 3-4 days to two weeks of activity during a remediation event and can last as long as 30 days.[306]

Methodology

The number of underground storage tank removals for each county in the AACOG region was obtained from the Texas Commission on Environmental Quality (TCEQ) and listed in Table 4-83.[307] Remediated tanks during the ozone season (April-Oct.) and total remediated tanks for the whole year was provided by TCEQ. These figures were used to calculate VOC emissions from the soil after tank removal.

Table 4-83. Remediated Tanks in the AACOG Region, 2005

County	FIPS Code	Remediated Tanks	Remediated Tanks (April-Oct.)
Atascosa	48013	7	7
Bandera	48019	0	0
Bexar	48029	83	29
Comal	48091	0	0
Frio	48163	0	0
Gillespie	48171	0	0
Guadalupe	48187	3	0
Karnes	48255	0	0
Kendall	48259	3	0
Kerr	48265	3	3
Medina	48325	0	0
Wilson	48493	0	0
Total		99	39

Guidance provided by the EPA Emission Inventory Improvement Program (EIIP) estimated a default emission factor of 28 pounds of VOC per tank remediation per ozone season day "initiated at the midpoint of the ozone season."[308] The emission factor was developed to represent typical levels of unleaded gasoline contamination, quantities of soil removed, as well as typical ozone season temperatures reflecting the midpoint of the ozone season. Applying the emission factor to all remediated storage tanks may overestimation of emissions in the event that some of the leaking storage tank contained contents of a lower volatility. However, the factor would provide an appropriate representation of emissions for such tanks in the event the

[306] U.S. Environmental Protection Agency, 2001. Remediation of Leaking Underground Storage Tanks (UST). Emission Inventory Improvement Program, Volume III. Research Triangle Park, North Carolina.
[307] Texas Commission on Environmental Quality, November 2005. UST and AST Database files. Austin, TX.
[308] Radian Corporation, Dec. 16, 1999. Memorandum: VOC Emissions from Leaking Underground Storage Tanks. Inventory Guidance and Evaluation Section, EPA. Available online: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/ust2_dec2000.pdf

soil was exposed to the air for a long enough period and cause emittance of all the contaminant.[309]

Sample Calculation
Equation (1)
Annual VOC emissions from underground storage tanks remediation in County A:

$$AE_A = TANK_A \times EF \times DAY / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual VOC emissions for County A (tons/yr.)
$TANK_A$ = number of tanks removed from County A (gal/yr.), Table 4-85
EF = Emission factor (28 lbs VOC/day)
DAY = number of ozone season days (214)

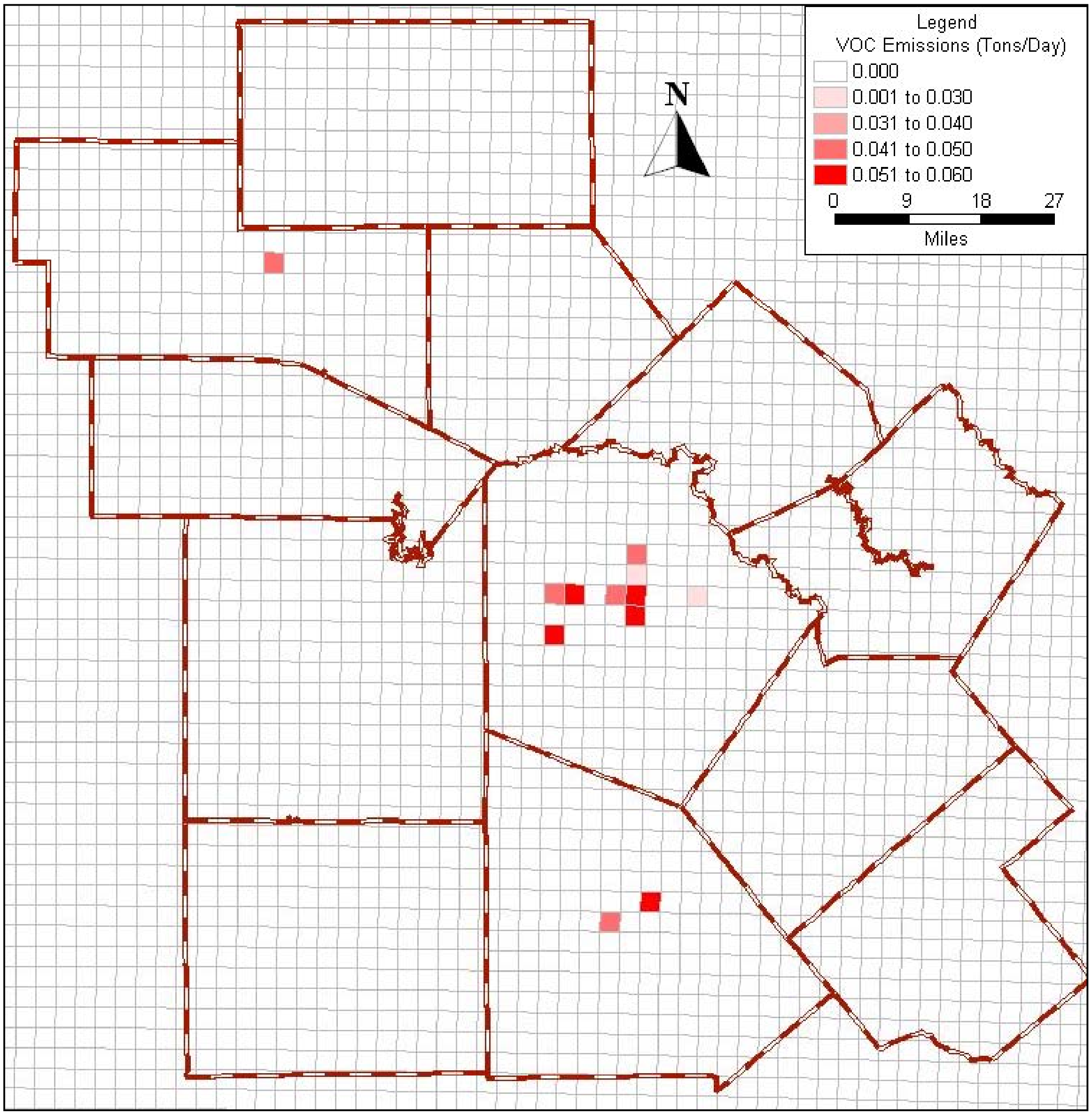
Annual VOC emissions from underground storage tanks remediation in Bexar County:

$$AE_A = 83 \times 28 \text{ lbs VOC/day} \times 214 / 2{,}000 \text{ lbs/ton}$$
$$= 248.668 \text{ tons VOC/yr.}$$

Spatial Distribution
Emissions are allocated to the 4km grid by the location of remediated tanks during the ozone season based on the TCEQ database.

[309] U.S. Environmental Protection Agency, 2001. Remediation of Leaking Underground Storage Tanks (UST). Emission Inventory Improvement Program, Volume III. Research Triangle Park, North Carolina.

Figure 4-19. VOC Emissions from Underground Storage Tanks Remediation, 2005



Plot Date: May 4, 2007
Map Compilation: August 10, 2006
Source: Underground Storage Tanks Remediation location data was provided by the Texas Commission on Environmental Quality, November 2005. "UST and AST Database files". Austin, TX.

Wineries

The business of wine has seen an explosive growth in Texas in the new millennium. Even since the 2002 EI, the number of wineries has doubled within the AACOG region. Out of the eleven wineries in the 2002 EI only one has closed; whereas, eleven additional wineries have opened, bringing the total for the region from eleven to twenty-one. Most of these wineries lie in the Texas Hill County and have small vineyards on the property. The Bexar County wineries consist of wine shops that bottle wine individually according the customers preferences. Wine shops are located for the most part in small strip-centers featuring custom shops in the affluent areas of Boerne, Castle Hills, and Stone Oak.

Emissions from wineries are a consequence of the biological process of grape fermentation, filtration process of grape solids from grape juice, and the fugitive emissions from the wine bottling process. The primary emission resulting from these processes is ethanol. The wineries within the AACOG Region are calculated as area source emissions since they are too small to be considered point sources.

Methodology

The preferred methodology is based on complete survey responses. A survey was sent to the wineries to request production levels, types of wine produced, when the wine is bottled, and how many days are spent bottling. Due to the poor survey response, additional data was necessary to determine emissions for some wineries.

The emissions for red and white wine are calculated separately due to differing emissions factors (EF). The production of white wine has an EF of 1.76 lbs/1,000 gallons produced; red wine has an EF of 5.52 lbs/1,000 gallons produced. The gallons produced is multiplied by the EF for each wine type and then converted to tons.[310]

Sample Calculation

Equation (1)

Annual wine emissions per winery:

$$AW_A = AG_A \times EF / 2{,}000 \text{ lbs/ton}$$

Where,

AE_A = Annual wine emissions for winery A (tons/yr)

AG_A = Annual gallons of wine produced at winery A (gal/yr)

EF = Emission factor for wine (1.76 lbs/1, 000 gal. for white and 5.52 lbs/1, 000 gal. for red)

Annual emissions for 4,559 gallons of white wine produced at one of the wineries in 2005.

$$AE_A = 4{,}559 \text{ gal/yr} \times (1.76 \text{ lbs/1,000 gallons}) / 2{,}000 \text{ lbs/ton}$$
$$= 0.00401 \text{ tons VOC/year}$$

Daily emissions from white and red wines are based on the gallons of wine bottled during the ozone season months, and number of days per ozone season.

[310] U.S. Environmental Protection Agency, May 1991. Stationary Point and Area Sources", Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I. Research Triangle Park, North Carolina.

Equation (2)
Ozone season day wine emissions per winery:

$$DE_A = DG_A \times EF \times ACT / DAY / 2{,}000 \text{ lbs/ton}$$

Where,

DE_A = Ozone Season wine emissions for winery A (tons/yr)
DG_A = Annual gallons of wine produced at winery A (gal/yr)
EF = Emission factor for wine (1.76 lbs/1, 000 gal. for white and 5.52 lbs/1, 000 gal. for red)
ACT = Number of activity days for the winery during the ozone season
DAY = Number of weekdays during the ozone season (214)

Ozone season day emissions for 270 gallons of white wine produced at one of the wineries in 2005:

$$DE_A = 270 \text{ gal/yr} \times (1.76 \text{ lbs/1,000 gallons}) / 214 / 2{,}000 \text{ lbs/ton}$$
$$= 0.0000011 \text{ tons VOC/day}$$

A secondary method was used to calculate emissions for those wineries that did not return a completed survey. This methodology was based on the number of grape producing acres for the vineyards associated with each winery. Some of the wineries listed their producing acres on their website; for the others, the county acres were obtained from the United States Department of Agriculture.[311] The acres form the wineries that responded to the survey were subtracted from the total; the remaining acres were divided by the number of remaining wineries. There are 3,300 acres of vineyards in Texas producing 854,000 gallons of wine[312] or 259 gallons per acre.

Sample Calculation
The following sample calculation is for a winery in Kendall County. There are three wineries in Kendall County, with one known to have a vineyard with 5.02 producing acres. The total acres of producing vineyards in Kendall County is 18; so, the 12.98 remaining acres are divided by 2 to obtain the estimated acres of 6.49. For Gillespie County, the number of acres per winery was 17.29. The state average of 5.50 acres per wineries was used for Bexar and Comal County because there are very few acres of grapes in these counties.

Equation (3)
Annual wine emissions per winery:

$$AE = \Sigma[(ACRE / NUM) \text{ X } WIN \text{ X } PER_A \text{ X } EF_A / 2{,}000 \text{ lbs/ton}]$$

Where,

AE = Annual wine emissions for winery A (tons/yr)
ACRE = Acres of grapes for wineries in each county
NUM = Number of wineries in each county
WIN = Gallons of wine per acre of grapes (259 gallons/acre)

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[311] United States Department of Agriculture, June 2004. 2002 Census of Agriculture: Volume 1 Chapter 1: Texas State Level Data: Table 31. Fruits and Nuts: 2002 and 1997. Available online: http://www.nass.usda.gov/census/census02/volume1/tx/st48_2_031_031.pdf
[312] Freedman, Dan, May. 5, 2005.The Wines of Texas are Upon You. Hearst Newspapers. Available online: http://www.azcentral.com/home/wine/articles/0505texaswine05.html

PER_A = Percent of acres by wine type A from survey data (44.32% for white wine and 55.68% for red wine)
EF_A = Emission factor for wine type A (1.76 lbs/1, 000 gal. for white and 5.52 lbs/1, 000 gal. for red)

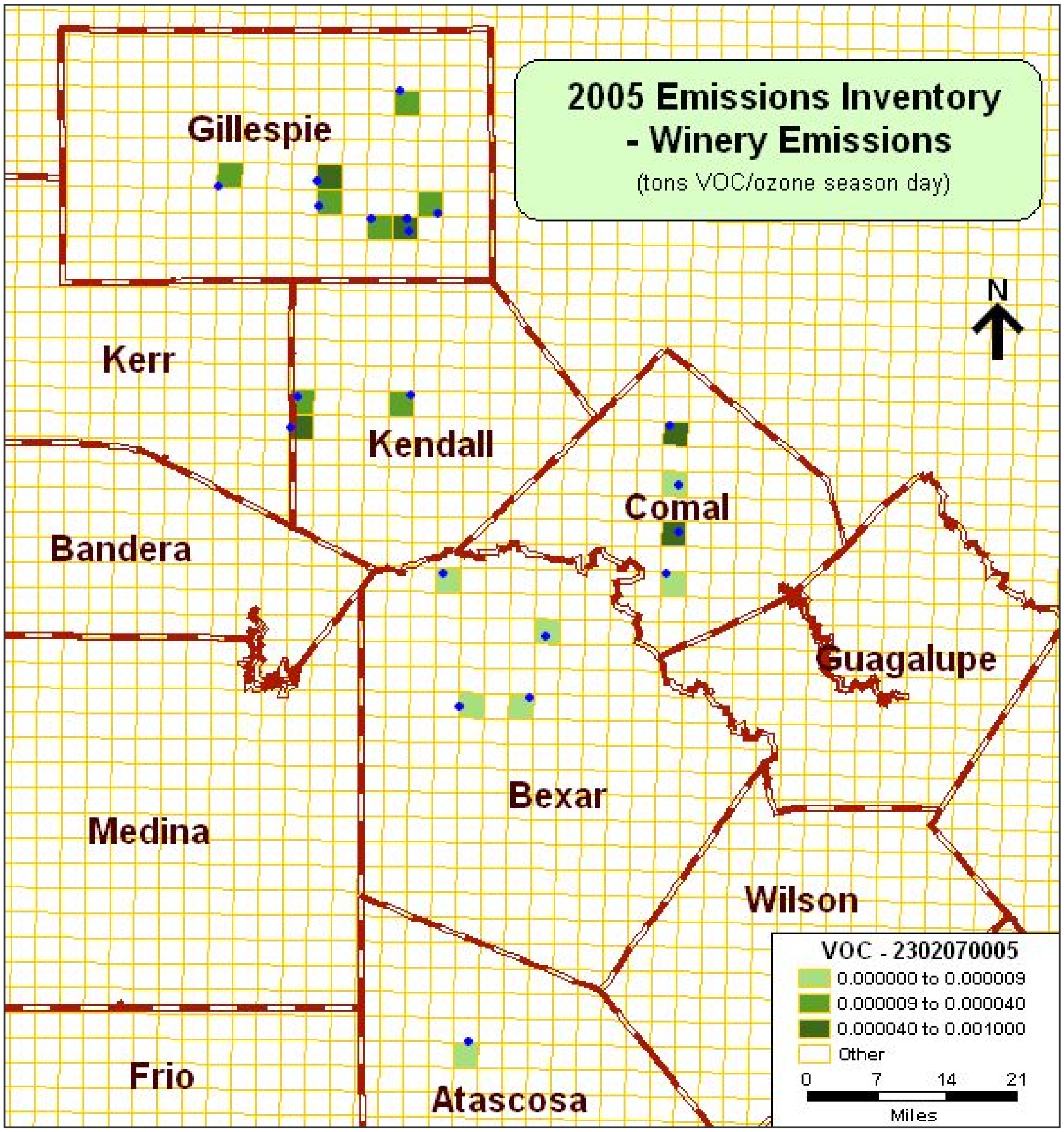
Annual emissions for wine produced at one of the wineries in 2005 in Kendall County:

AE = [(12.98 / 2) x 259 x 0.4432 x (1.76 lbs/1,000 gallons) / 2,000 lbs/ton] + [(12.98 / 2) x 259 x 0.5568 x (5.52 lbs/1,000 gallons) / 2,000 lbs/ton]
= 0.003239 tons VOC/year

Seasonal adjustment
For wineries without survey data, the seasonal adjustment factor is 1. These wineries have a daily adjustment factor of 365 days per year (7 days a week).

Spatial Allocation
The emissions from wineries were geo-coded to the physical location of where the bottling is performed. Figure 4-20 contains a spatial representation of the winery emissions from 2005.

Figure 4-20. VOC Emissions from Wineries, 2005



Plot Date: May 10, 2007
Map Compilation: May 10, 2007
Source: Survey of Wineries located within the AACOG 12-county region, as well as collaboration with the San Antonio extension of the Texas Alcohol and Beverage Commission (TABC).

Sample Survey

July 17, 2006

Company

Address

ATTENTION: OPERATIONS MANAGER

The Alamo Area Council of Governments (AACOG) requests your assistance in completion of the 2005 Air Quality Emissions Inventory Wineries survey. The survey information will be used to assess and quantify emissions from wine making within the AACOG 12-County region. Survey responses are required to obtain accurate local data. The San Antonio region currently risks being declared in non-attainment of federal air quality standards (NAAQS); thus this inventory is a significant part of the emissions management process.

The purpose of this survey is to provide better information and services to the region, as well as help minimize additional regulations on the community. Your response is vital to this process and will enable a more precise emissions inventory for 2005.

To increase the accuracy of this information we ask that you review the attached survey and input the necessary data. You can return it to us in the self-addressed envelope or fax to (210) 225-5937 attention Donna Hessong, Natural Resources / Transportation Specialist, Alamo Area Council of Governments. Please submit your response by August 18, 2006.

Thank you for your time and participation. If you have any questions or comments please feel free to contact Steven Smeltzer, Environmental Manager, Alamo Area Council of Governments at (210) 362-5266.

Regionally Yours,

Al J. Notzon III
Executive Director

Enclosures (1)

DRAFT

2005 Emissions Inventory Survey for Wineries

Winery Name: ____

Contact Name/ Title: ____

Phone number: ____

Production:

Please list the total number of **gallons** produced in each month in **2005**:

RED Wine**:**

Jan ______ Feb ______ Mar ______ Apr ______ May ______ Jun ______

Jul ______ Aug ______ Sep ______ Oct ______ Nov ______ Dec ______

WHITE Wine**:**

Jan ______ Feb ______ Mar ______ Apr ______ May ______ Jun ______

Jul ______ Aug ______ Sep ______ Oct ______ Nov ______ Dec ______

Manufacturing Rate:

Please list the number of days that manufacturing activities took place (i.e.: 5 days per month, 4 months out of the year)

____

____

____

Please return by August 18, 2006 or ASAP
(Use AACOG-addressed envelope provided)

Area Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY AREA SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.02	1.07	0.27	0.00007	0.00409	0.00102
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.26	8.12	2.24	0.00019	0.01182	0.00194
Natural Gas, Commercial	2103006000	0.43	10.13	5.89	0.00093	0.02189	0.01273
Natural Gas, Industrial	2102006000	0.22	4.28	3.37	0.00060	0.01157	0.00911
LPG, Residential	2104007000	0.42	11.78	1.60	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.01	0.36	0.05	0.00003	0.00098	0.00013
LPG, Industrial	2102007000	0.01	0.29	0.07	0.00002	0.00094	0.00024
Wood, Residental	2104008000	226.33	8.21	661.86	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.01	0.00	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.02	0.00	0.00000	0.00006	0.00002
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	3.02	36.01	7.86	0.00829	0.09866	0.02153
Agricultural							
Defoliate	2461800000	0.21	0.00	0.00	0.00099	0.00000	0.00000
Fertilizer	2325050000	0.00	104.35	0.00	0.00000	0.26799	0.00000
Pesticide	2461800000	1.60	0.00	0.00	0.00668	0.00000	0.00000
Food Production							
Bakeries	2302050000	4.47	0.00	0.00	0.01224	0.00000	0.00000
Wineries	2302070005	0.00	0.00	0.00	0.00001	0.00000	0.00000
Breweries	2302070001	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	0.43	0.00	1.43	0.00118	0.00000	0.00393
Underfired Charbroilers	2302002200	2.71	0.00	8.86	0.00742	0.00000	0.02427
Deep-Fat Fryers	2302003000	0.37	0.00	0.00	0.00102	0.00000	0.00000
Flat Griddles	2302003100	0.39	0.00	0.80	0.00107	0.00000	0.00220
Clamshell Griddles	2302003200	0.01	0.00	0.00	0.00002	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	569.54	253.89	213.27	1.79251	0.69558	0.58429
Gas Production	2310020000	38.93	0.00	0.00	0.11562	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.61	46.64	72.11	0.00167	0.12777	0.19756
Gas Production - 2 stoke Compressors	20200252	1.25	20.26	3.69	0.00343	0.05551	0.01010
Oil/Gasoline Pipelines	2505040000	0.97	0.00	0.00	0.00265	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	13.78	43.98	0.00	0.03776	0.12050	0.00000
HDDV Truck Idling - Rest Areas	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	3.64	11.62	0.00	0.00997	0.03183	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	2.98	0.00	0.00	0.00817	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	28.90	0.00	0.00	0.07917	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	2.37	0.00	0.00	0.00649	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.01	0.00	0.00	0.00002	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.08	0.00	0.00	0.00022	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	0.22	0.00	0.00	0.00061	0.00000	0.00000

Area Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY AREA SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Aboveground Storage Tanks							
Gasoline	2501010120	43.19	0.00	0.00	0.14254	0.00000	0.00000
Aviation Gasoline	2501080050	1.13	0.00	0.00	0.00371	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	18.16	0.00	0.00	0.05591	0.00000	0.00000
Aviation Gasoline	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	20.97	0.00	0.00	0.09800	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	6.43	0.00	0.00	0.01978	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	3.13	0.00	0.00	0.00961	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	5.75	0.00	0.00	0.01768	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	3.01	0.00	0.00	0.00926	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	3.64	0.00	0.00	0.01120	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoaters	2401001011	1.22	0.00	0.00	0.00377	0.00000	0.0000
Stains - Semitransparent	2401001015	9.55	0.00	0.00	0.02937	0.00000	0.0000
Quick Dry - Enamels	2401001020	3.87	0.00	0.00	0.01191	0.00000	0.0000
Lacquers - Clear	2401001025	0.38	0.00	0.00	0.00118	0.00000	0.0000
All Other Architectural Categories	2401001050	24.93	0.00	0.00	0.07669	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch. Co	2401100001	10.23	0.00	0.00	0.03148	0.00000	0.0000
Auto Refinishing	2401005000	9.89	0.00	0.00	0.04241	0.00000	0.00000
Traffic Markings	2401008000	4.17	0.00	0.00	0.02227	0.00000	0.00000
Factory Finished Wood	2401015000	0.55	0.00	0.00	0.00210	0.00000	0.00000
Wood Furniture	2401020000	2.02	0.00	0.00	0.00778	0.00000	0.00000
Metal Furniture	2401025000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Machinery and Equipment	2401055000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Appliances	2401060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Marine	2401080000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	1.82	0.00	0.00	0.00700	0.00000	0.00000
Surface Cleaning Cold Cleaning - General	2415300000	0.00	0.00	0.00	0.07583	0.00000	0.00000
Graphic Arts	2425000000	0.22	0.00	0.00	0.00086	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	2.85	0.00	0.00	0.01034	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.22	0.00	0.00	0.00081	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	1.02	0.00	0.00	0.00369	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	33.38	0.00	0.00	0.15599	0.00000	0.00000
Emulsified Asphalt	2461022000	6.73	0.00	0.00	0.02701	0.00000	0.00000
Asphalt Roofing	2461023000	2.34	0.00	0.00	0.00896	0.00000	0.00000

Area Source Emissions - Atascosa County, 2005

ATASCOSA COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	27.93	0.00	0.00	0.07653	0.00000	0.00000
Household Solvents	2465200000	18.51	0.00	0.00	0.05071	0.00000	0.00000
Automotive Solvents	2465400000	11.95	0.00	0.00	0.03273	0.00000	0.00000
Adhesives Application: Industrial	2440020000	4.71	0.00	0.00	0.01291	0.00000	0.00000
FIFRA Solvents	2460890000	8.58	0.00	0.00	0.02351	0.00000	0.00000
Coating Solvents	2460520000	31.47	0.00	0.00	0.08621	0.00000	0.00000
Misc.Solvents	2460900000	10.10	0.00	0.00	0.02766	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	19.10	0.00	0.00	0.06223	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	41.64	0.00	0.00	0.11596	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	10.82	0.00	0.00	0.02965	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	0.81	0.00	0.00	0.00264	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	0.27	0.00	0.03	0.00073	0.00000	0.00009
Municipal Wastewater Treatment	2630000000	4.79	0.00	0.00	0.01253	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	31.49	5.62	202.86	0.00548	0.00402	0.06325
Manage Burning - Slash	2810005000	0.00	0.00	0.48	0.00000	0.00000	0.00132
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	150.61	22.95	2,305.67	0.18661	0.02844	2.85672
Structural Fires	2810030000	0.07	0.01	0.38	0.00019	0.00002	0.00104
Motor Vehicle Fires	2810050000	0.06	0.01	0.25	0.00018	0.00002	0.00068
Open Burning - Residential Household Waste	2610030000	54.65	10.93	154.85	0.14974	0.02995	0.42426
Open Burning - Yard Waste	2610000500	1.74	0.00	9.31	0.00476	0.00000	0.02552
Catastrophic/Accidental Releases	2830000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**1,554.31**	**600.55**	**3,657.20**	**3.86713**	**1.51165**	**4.24194**

Area Sources Emissions - Bandera County, 2005

BANDERA COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.01	0.37	0.09	0.00002	0.00142	0.00035
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.04	1.19	0.34	0.00003	0.00175	0.00029
Natural Gas, Commercial	2103006000	0.14	3.24	1.89	0.00030	0.00701	0.00408
Natural Gas, Industrial	2102006000	0.22	4.28	3.37	0.00060	0.01157	0.00911
LPG, Residential	2104007000	0.27	7.52	1.02	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.00	0.12	0.02	0.00001	0.00034	0.00005
LPG, Industrial	2102007000	0.00	0.09	0.02	0.00001	0.00030	0.00007
Wood, Residental	2104008000	282.07	10.24	824.88	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.02	0.00	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.01	0.00	0.00000	0.00002	0.00001
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	1.58	18.84	4.11	0.00434	0.05162	0.01126
Agricultural							
Defoliate	2461800000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fertilizer	2325050000	0.00	12.60	0.00	0.00000	0.02944	0.00000
Pesticide	2461800000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Food Production							
Bakeries	2302050000	3.21	0.00	0.00	0.00879	0.00000	0.00000
Wineries	2302070005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Breweries	2302070001	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	0.15	0.00	0.50	0.00041	0.00000	0.00138
Underfired Charbroilers	2302002200	0.90	0.00	2.95	0.00247	0.00000	0.00808
Deep-Fat Fryers	2302003000	0.12	0.00	0.00	0.00034	0.00000	0.00000
Flat Griddles	2302003100	0.12	0.00	0.26	0.00034	0.00000	0.00070
Clamshell Griddles	2302003200	0.00	0.00	0.00	0.00000	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	0.55	0.22	0.18	0.00172	0.00059	0.00050
Gas Production	2310020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 2 stoke Compressors	20200252	0.00	0.00	0.00	0.00000	0.00000	0.00000
Oil/Gasoline Pipelines	2505040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Rest Areas	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	2.16	0.00	0.00	0.00591	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	20.91	0.00	0.00	0.05728	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	1.71	0.00	0.00	0.00470	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	0.00	0.00	0.00	0.00000	0.00000	0.00000

Area Sources Emissions - Bandera County, 2005

BANDERA COUNTY AREA SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Aboveground Storage Tanks							
Gasoline	2501010120	5.48	0.00	0.00	0.01808	0.00000	0.00000
Aviation Gasoline	2501080050	0.23	0.00	0.00	0.00074	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	10.50	0.00	0.00	0.03232	0.00000	0.00000
Aviation Gasoline	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	2.97	0.00	0.00	0.00915	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	1.45	0.00	0.00	0.00445	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	2.66	0.00	0.00	0.00818	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	1.39	0.00	0.00	0.00428	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	1.68	0.00	0.00	0.00518	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoate	2401001011	0.57	0.00	0.00	0.00174	0.00000	0.0000
Stains - Semitransparent	2401001015	4.42	0.00	0.00	0.01358	0.00000	0.0000
Quick Dry - Enamels	2401001020	1.79	0.00	0.00	0.00551	0.00000	0.0000
Lacquers - Clear	2401001025	0.18	0.00	0.00	0.00054	0.00000	0.0000
All Other Architectural Categories	2401001050	11.53	0.00	0.00	0.03546	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch C	2401100001	4.73	0.00	0.00	0.01456	0.00000	0.0000
Auto Refinishing	2401005000	1.01	0.00	0.00	0.00434	0.00000	0.00000
Traffic Markings	2401008000	0.19	0.00	0.00	0.00088	0.00000	0.00000
Factory Finished Wood	2401015000	0.12	0.00	0.00	0.00047	0.00000	0.00000
Wood Furniture	2401020000	2.70	0.00	0.00	0.01557	0.00000	0.00000
Metal Furniture	2401025000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Machinery and Equipment	2401055000	0.06	0.00	0.00	0.00021	0.00000	0.00000
Appliances	2401060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Marine	2401080000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	0.29	0.00	0.00	0.00110	0.00000	0.00000
Surface Cleaning Cold Cleaning - General	2415300000	0.00	0.00	0.00	0.02103	0.00000	0.00000
Graphic Arts	2425000000	0.02	0.00	0.00	0.00008	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	0.18	0.00	0.00	0.00056	0.00000	0.00000
Emulsified Asphalt	2461022000	10.04	0.00	0.00	0.03672	0.00000	0.00000
Asphalt Roofing	2461023000	0.85	0.00	0.00	0.00325	0.00000	0.00000

Area Sources Emissions - Bandera County, 2005

BANDERA COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	14.61	0.00	0.00	0.04004	0.00000	0.00000
Household Solvents	2465200000	9.68	0.00	0.00	0.02653	0.00000	0.00000
Automotive Solvents	2465400000	6.25	0.00	0.00	0.01712	0.00000	0.00000
Adhesives Application: Industrial	2440020000	2.47	0.00	0.00	0.00675	0.00000	0.00000
FIFRA Solvents	2460890000	4.49	0.00	0.00	0.01230	0.00000	0.00000
Coating Solvents	2460520000	16.46	0.00	0.00	0.04510	0.00000	0.00000
Misc.Solvents	2460900000	5.28	0.00	0.00	0.01447	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	12.90	0.00	0.00	0.04202	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	21.79	0.00	0.00	0.06067	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	5.66	0.00	0.00	0.01551	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	0.42	0.00	0.00	0.00138	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Municipal Wastewater Treatment	2630000000	0.41	0.00	0.00	0.00109	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	4.35	0.80	28.19	0.00054	0.00061	0.00820
Manage Burning - Slash	2810005000	0.00	0.00	3.21	0.00000	0.00000	0.00879
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	132.69	20.01	2,035.86	0.16441	0.02479	2.52243
Structural Fires	2810030000	0.12	0.02	0.66	0.00033	0.00004	0.00180
Motor Vehicle Fires	2810050000	0.04	0.00	0.14	0.00010	0.00001	0.00039
Open Burning - Residential Household Waste	2610030000	50.97	10.19	144.41	0.13964	0.02793	0.39565
Open Burning - Yard Waste	2610000500	1.62	0.00	8.69	0.00444	0.00000	0.02380
Catastrophic/Accidental Releases	2830000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**669.42**	**89.75**	**3,060.80**	**0.91771**	**0.15744**	**2.99694**

Area Source Emissions - Bexar County, 2005

BEXAR COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	1.17	69.02	17.26	0.00450	0.26446	0.06612
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	22.99	712.79	194.89	0.01697	1.03523	0.16977
Natural Gas, Commercial	2103006000	18.17	426.50	248.03	0.03929	0.92202	0.53618
Natural Gas, Industrial	2102006000	49.98	967.63	761.96	0.13503	2.61429	2.05861
LPG, Residential	2104007000	1.70	47.70	6.47	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.82	23.08	3.13	0.00226	0.06324	0.00858
LPG, Industrial	2102007000	0.34	17.42	4.35	0.00110	0.05583	0.01395
Wood, Residental	2104008000	692.36	25.13	2,024.70	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.01	0.22	0.06	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.02	1.07	0.27	0.00007	0.00409	0.00102
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	79.74	979.63	209.91	0.21846	2.68392	0.57510
Agricultural							
Defoliate	2461800000	0.12	0.00	0.00	0.00058	0.00000	0.00000
Fertilizer	2325050000	0.00	144.97	0.00	0.00000	0.36822	0.00000
Pesticide	2461800000	4.34	0.00	0.00	0.01808	0.00000	0.00000
Food Production							
Bakeries	2302050000	290.98	0.00	0.00	0.79721	0.00000	0.00000
Wineries	2302070005	0.01	0.00	0.00	0.00004	0.00000	0.00000
Breweries	2302070001	0.25	0.00	0.00	0.00068	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	16.71	0.00	55.82	0.04579	0.00000	0.15292
Underfired Charbroilers	2302002200	86.10	0.00	281.66	0.23590	0.00000	0.77168
Deep-Fat Fryers	2302003000	12.55	0.00	0.00	0.03440	0.00000	0.00000
Flat Griddles	2302003100	12.14	0.00	25.07	0.03326	0.00000	0.06869
Clamshell Griddles	2302003200	0.23	0.00	0.00	0.00063	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	1,278.78	625.02	525.02	4.03898	1.71238	1.43840
Gas Production	2310020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 2 stoke Compressors	20200252	0.00	0.00	0.00	0.00000	0.00000	0.00000
Oil/Gasoline Pipelines	2505040000	3.06	0.00	0.00	0.00838	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	148.34	473.43	0.00	0.40641	1.29706	0.00000
HDDV Truck Idling - Rest Areas	2230070000	5.20	16.60	0.00	0.01425	0.04547	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	3.38	10.79	0.00	0.00926	0.02956	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	87.60	0.00	0.00	0.24001	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	848.77	0.00	0.00	2.32541	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	69.57	0.00	0.00	0.19062	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.30	0.00	0.00	0.00083	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	2.99	0.00	0.00	0.00820	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	8.45	0.00	0.00	0.02314	0.00000	0.00000

Area Source Emissions - Bexar County, 2005

BEXAR COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Aboveground Storage Tanks							
Gasoline	2501010120	166.91	0.00	0.00	0.48311	0.00000	0.00000
Aviation Gasoline	2501080050	81.13	0.00	0.00	0.25941	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00001	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.03	0.00	0.00	0.00011	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	324.11	0.00	0.00	0.86851	0.00000	0.00000
Aviation Gasoline	2501080050	2.41	0.00	0.00	0.00748	0.00000	0.00000
Jet Kerosene	2501010180	0.34	0.00	0.00	0.00057	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00001	0.00000	0.00000
New Oil	2501010060	0.02	0.00	0.00	0.00006	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.02	0.00	0.00	0.00005	0.00000	0.00000
Leaking Underground Tanks	2660000000	248.67	0.00	0.00	0.40600	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	225.93	0.00	0.00	0.69495	0.00000	0.00000
Nonflat Paints - Low Gloss	2401001005	109.79	0.00	0.00	0.33770	0.00000	0.00000
Nonflat Paints - Medium Gloss	2401001005	201.90	0.00	0.00	0.62103	0.00000	0.00000
Nonflat Paints - High Gloss	2401001006	105.73	0.00	0.00	0.32522	0.00000	0.00000
Primers, Sealers, and Undercoaters	2401001010	127.95	0.00	0.00	0.39357	0.00000	0.00000
Quick Dry - Primers, Sealers, and Undercoater	2401001011	43.02	0.00	0.00	0.13231	0.00000	0.00000
Stains - Semitransparent	2401001015	335.43	0.00	0.00	1.03176	0.00000	0.00000
Quick Dry - Enamels	2401001020	136.06	0.00	0.00	0.41852	0.00000	0.00000
Lacquers - Clear	2401001025	13.43	0.00	0.00	0.04130	0.00000	0.00000
All Other Architectural Categories	2401001050	875.80	0.00	0.00	2.69391	0.00000	0.00000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	359.50	0.00	0.00	1.10579	0.00000	0.00000
Auto Refinishing	2401005000	330.38	0.00	0.00	1.41665	0.00000	0.00000
Traffic Markings	2401008000	8.28	0.00	0.00	0.01981	0.00000	0.00000
Factory Finished Wood	2401015000	24.63	0.00	0.00	0.09472	0.00000	0.00000
Wood Furniture	2401020000	217.86	0.00	0.00	0.83794	0.00000	0.00000
Metal Furniture	2401025000	208.95	0.00	0.00	0.87801	0.00000	0.00000
Paper, Foil, And Film	2401030000	18.02	0.00	0.00	0.06932	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	155.05	0.00	0.00	0.70965	0.00000	0.00000
Machinery and Equipment	2401055000	34.56	0.00	0.00	0.13292	0.00000	0.00000
Appliances	2401060000	9.37	0.00	0.00	0.03604	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	60.11	0.00	0.00	0.23121	0.00000	0.00000
Aircraft	2401075000	60.27	0.00	0.00	0.23182	0.00000	0.00000
Marine	2401080000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	190.35	0.00	0.00	0.73171	0.00000	0.00000
Surface Cleaning Cold Cleaning - General	2415300000	413.41	0.00	0.00	1.32503	0.00000	0.00000
Graphic Arts	2425000000	137.63	0.00	0.00	0.52731	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	7.22	0.00	0.00	0.02621	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	227.04	0.00	0.00	0.82437	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	9.05	0.00	0.00	0.03303	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	8.93	0.00	0.00	0.03243	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	360.97	0.00	0.00	1.14120	0.00000	0.00000
Emulsified Asphalt	2461022000	155.49	0.00	0.00	0.43919	0.00000	0.00000
Asphalt Roofing	2461023000	111.76	0.00	0.00	0.42821	0.00000	0.00000

Area Source Emissions - Bexar County, 2005

BEXAR COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	1,004.26	0.00	0.00	2.75138	0.00000	0.00000
Household Solvents	2465200000	665.47	0.00	0.00	1.82321	0.00000	0.00000
Automotive Solvents	2465400000	429.53	0.00	0.00	1.17680	0.00000	0.00000
Adhesives Application: Industrial	2440020000	169.39	0.00	0.00	0.46409	0.00000	0.00000
FIFRA Solvents	2460890000	308.54	0.00	0.00	0.84531	0.00000	0.00000
Coating Solvents	2460520000	1,131.30	0.00	0.00	3.09945	0.00000	0.00000
Misc.Solvents	2460900000	362.98	0.00	0.00	0.99448	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	553.53	0.00	0.00	1.80326	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	1,497.12	0.00	0.00	4.16905	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	389.10	0.00	0.00	1.06602	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	29.18	0.00	0.00	0.09507	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	71.70	0.00	8.68	0.19643	0.00000	0.02377
Municipal Wastewater Treatment	2630000000	49.96	0.00	0.00	0.15003	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	29.77	6.63	203.81	0.01569	0.01158	0.18165
Manage Burning - Slash	2810005000	0.01	0.00	52.67	0.00002	0.00000	0.14431
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	96.24	14.52	1,476.38	0.11924	0.01799	1.82923
Structural Fires	2810030000	6.91	0.88	37.71	0.01894	0.00241	0.10331
Motor Vehicle Fires	2810050000	4.56	0.57	17.80	0.01248	0.00156	0.04876
Open Burning - Residential Household Waste	2610030000	93.85	18.77	265.90	0.25712	0.05142	0.72850
Open Burning - Yard Waste	2610000500	2.98	0.00	15.99	0.00817	0.00000	0.04382
Catastrophic/Accidental Releases	2830000000	8.55	1.57	0.00	0.03016	0.00736	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**16,759.66**	**4,583.94**	**6,437.53**	**47.93430**	**11.18808**	**8.96437**

Area Source Emissions - Comal County, 2005

COMAL COUNTY AREA SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.08	4.47	1.12	0.00029	0.01714	0.00428
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.56	16.82	4.70	0.00040	0.02458	0.00402
Natural Gas, Commercial	2103006000	1.72	40.26	23.41	0.00371	0.08703	0.05061
Natural Gas, Industrial	2102006000	2.72	52.61	41.43	0.00734	0.14214	0.11193
LPG, Residential	2104007000	0.52	14.45	1.96	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.05	1.50	0.20	0.00015	0.00410	0.00056
LPG, Industrial	2102007000	0.04	1.92	0.48	0.00012	0.00615	0.00154
Wood, Residental	2104008000	304.37	11.05	890.08	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.02	0.01	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.07	0.02	0.00000	0.00026	0.00007
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	4.91	60.32	12.92	0.01345	0.16525	0.03541
Agricultural							
Defoliate	2461800000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fertilizer	2325050000	0.00	25.00	0.00	0.00000	0.06179	0.00000
Pesticide	2461800000	0.61	0.00	0.00	0.00254	0.00000	0.00000
Food Production							
Bakeries	2302050000	10.21	0.00	0.00	0.02797	0.00000	0.00000
Wineries	2302070005	0.02	0.00	0.00	0.00009	0.00000	0.00000
Breweries	2302070001	0.03	0.00	0.00	0.00008	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	1.10	0.00	3.69	0.00302	0.00000	0.01010
Underfired Charbroilers	2302002200	5.98	0.00	19.57	0.01639	0.00000	0.05361
Deep-Fat Fryers	2302003000	0.80	0.00	0.00	0.00219	0.00000	0.00000
Flat Griddles	2302003100	0.02	0.00	1.73	0.00004	0.00000	0.00475
Clamshell Griddles	2302003200	0.01	0.00	0.00	0.00003	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production	2310020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 2 stoke Compressors	20200252	0.00	0.00	0.00	0.00000	0.00000	0.00000
Oil/Gasoline Pipelines	2505040000	0.23	0.00	0.00	0.00062	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	18.33	58.50	0.00	0.05022	0.16029	0.00000
HDDV Truck Idling - Rest Areas	2230070000	3.12	9.96	0.00	0.00855	0.02728	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	5.87	0.00	0.00	0.01609	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	56.92	0.00	0.00	0.15594	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	4.67	0.00	0.00	0.01278	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.06	0.00	0.00	0.00018	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.64	0.00	0.00	0.00174	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	1.79	0.00	0.00	0.00492	0.00000	0.00000

Area Source Emissions - Comal County, 2005

COMAL COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Aboveground Storage Tanks							
Gasoline	2501010120	27.19	0.00	0.00	0.07542	0.00000	0.00000
Aviation Gasoline	2501080050	2.48	0.00	0.00	0.00816	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.01	0.00	0.00	0.00004	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	18.39	0.00	0.00	0.04928	0.00000	0.00000
Aviation Gasoline	2501080050	0.80	0.00	0.00	0.00249	0.00000	0.00000
Jet Kerosene	2501010180	0.02	0.00	0.00	0.00004	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00001	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00001	0.00000	0.00000
Leaking Underground Tanks	2660000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	14.29	0.00	0.00	0.04395	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	6.94	0.00	0.00	0.02136	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	12.77	0.00	0.00	0.03927	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	6.69	0.00	0.00	0.00436	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	8.09	0.00	0.00	0.02489	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoater	2401001011	2.72	0.00	0.00	0.00837	0.00000	0.0000
Stains - Semitransparent	2401001015	21.21	0.00	0.00	0.06525	0.00000	0.0000
Quick Dry - Enamels	2401001020	8.60	0.00	0.00	0.02647	0.00000	0.0000
Lacquers - Clear	2401001025	0.85	0.00	0.00	0.00261	0.00000	0.0000
All Other Architectural Categories	2401001050	55.38	0.00	0.00	0.17036	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	22.73	0.00	0.00	0.06993	0.00000	0.0000
Auto Refinishing	2401005000	16.30	0.00	0.00	0.06991	0.00000	0.00000
Traffic Markings	2401008000	1.02	0.00	0.00	0.00321	0.00000	0.00000
Factory Finished Wood	2401015000	1.02	0.00	0.00	0.00391	0.00000	0.00000
Wood Furniture	2401020000	35.75	0.00	0.00	0.13749	0.00000	0.00000
Metal Furniture	2401025000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Machinery and Equipment	2401055000	2.12	0.00	0.00	0.00816	0.00000	0.00000
Appliances	2401060000	32.31	0.00	0.00	0.12427	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Marine	2401080000	0.29	0.00	0.00	0.00111	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	19.84	0.00	0.00	0.07632	0.00000	0.00000
					0.35126		
Surface Cleaning Cold Cleaning - General	2415300000	50.84	0.00	0.00	0.16294	0.00000	0.00000
Graphic Arts	2425000000	11.24	0.00	0.00	0.04307	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.22	0.00	0.00	0.00080	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	3.16	0.00	0.00	0.01149	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.95	0.00	0.00	0.00345	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	1.65	0.00	0.00	0.00599	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	17.04	0.00	0.00	0.03399	0.00000	0.00000
Emulsified Asphalt	2461022000	62.62	0.00	0.00	0.19777	0.00000	0.00000
Asphalt Roofing	2461023000	9.16	0.00	0.00	0.03509	0.00000	0.00000

Area Source Emissions - Comal County, 2005

COMAL COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	61.83	0.00	0.00	0.16940	0.00000	0.00000
Household Solvents	2465200000	40.97	0.00	0.00	0.11225	0.00000	0.00000
Automotive Solvents	2465400000	26.45	0.00	0.00	0.07246	0.00000	0.00000
Adhesives Application: Industrial	2440020000	10.43	0.00	0.00	0.02857	0.00000	0.00000
FIFRA Solvents	2460890000	19.00	0.00	0.00	0.05205	0.00000	0.00000
Coating Solvents	2460520000	69.65	0.00	0.00	0.19083	0.00000	0.00000
Misc.Solvents	2460900000	22.35	0.00	0.00	0.06123	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	69.03	0.00	0.00	0.22487	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	92.18	0.00	0.00	0.25669	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	23.96	0.00	0.00	0.06563	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	1.80	0.00	0.00	0.00585	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	37.51	0.00	4.54	0.10276	0.00000	0.01244
Municipal Wastewater Treatment	2630000000	20.31	0.00	0.00	0.05455	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	7.50	1.50	49.80	0.00221	0.00186	0.02768
Manage Burning - Slash	2810005000	0.01	0.00	21.62	0.00003	0.00000	0.05924
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	55.58	8.38	852.77	0.06886	0.01038	1.05658
Structural Fires	2810030000	0.68	0.09	3.73	0.00187	0.00024	0.01021
Motor Vehicle Fires	2810050000	0.30	0.04	1.17	0.00082	0.00010	0.00321
Open Burning - Residential Household Waste	2610030000	110.87	22.17	314.13	0.30375	0.06075	0.86063
Open Burning - Yard Waste	2610000500	3.52	0.00	18.90	0.00966	0.00000	0.05177
Catastrophic/Accidental Releases	2830000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**1,574.00**	**329.10**	**2,267.98**	**3.99569**	**0.76933**	**2.35864**

Area Source Emissions - Frio County, 2005

FRIO COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.01	0.33	0.08	0.00002	0.00126	0.00032
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.16	4.86	1.34	0.00012	0.00701	0.00115
Natural Gas, Commercial	2103006000	0.14	3.20	1.86	0.00029	0.00691	0.00402
Natural Gas, Industrial	2102006000	0.00	0.00	0.00	0.00000	0.00000	0.00000
LPG, Residential	2104007000	0.10	2.87	0.39	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.00	0.11	0.01	0.00001	0.00030	0.00004
LPG, Industrial	2102007000	0.00	0.07	0.02	0.00000	0.00024	0.00006
Wood, Residental	2104008000	85.85	3.12	251.05	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.01	0.00	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.01	0.00	0.00000	0.00002	0.00000
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	1.24	14.73	3.21	0.00339	0.04035	0.00881
Agricultural							
Defoliate	2461800000	0.37	0.00	0.00	0.00175	0.00000	0.00000
Fertilizer	2325050000	0.00	106.39	0.00	0.00000	0.30895	0.00000
Pesticide	2461800000	3.09	0.00	0.00	0.01286	0.00000	0.00000
Food Production							
Bakeries	2302050000	0.68	0.00	0.00	0.00187	0.00000	0.00000
Wineries	2302070005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Breweries	2302070001	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	0.16	0.00	0.54	0.00044	0.00000	0.00148
Underfired Charbroilers	2302002200	0.93	0.00	3.04	0.00254	0.00000	0.00832
Deep-Fat Fryers	2302003000	0.14	0.00	0.00	0.00038	0.00000	0.00000
Flat Griddles	2302003100	0.12	0.00	0.26	0.00034	0.00000	0.00070
Clamshell Griddles	2302003200	0.00	0.00	0.00	0.00001	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	272.63	114.44	96.13	0.85621	0.31354	0.26338
Gas Production	2310020000	27.01	0.00	0.00	0.07700	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.12	8.94	13.83	0.00032	0.02451	0.03789
Gas Production - 2 stoke Compressors	20200252	0.24	3.89	0.71	0.00066	0.01065	0.00194
Oil/Gasoline Pipelines	2505040000	0.67	0.00	0.00	0.00183	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	10.66	34.02	0.00	0.02921	0.09322	0.00000
HDDV Truck Idling - Rest Areas	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	4.16	13.28	0.00	0.01140	0.03638	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	1.14	0.00	0.00	0.00312	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	11.05	0.00	0.00	0.03027	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	0.91	0.00	0.00	0.00248	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.00	0.00	0.00	0.00001	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.03	0.00	0.00	0.00007	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	0.07	0.00	0.00	0.00020	0.00000	0.00000

Area Source Emissions - Frio County, 2005

FRIO COUNTY AREA SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Aboveground Storage Tanks							
Gasoline	2501010120	30.07	0.00	0.00	0.09924	0.00000	0.00000
Aviation Gasoline	2501080050	1.91	0.00	0.00	0.00631	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	2.54	0.00	0.00	0.00781	0.00000	0.00000
Aviation Gasoline	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	2.44	0.00	0.00	0.00750	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	1.18	0.00	0.00	0.00364	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	4.33	0.00	0.00	0.01331	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	1.14	0.00	0.00	0.00351	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	1.38	0.00	0.00	0.00425	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoater	2401001011	0.46	0.00	0.00	0.00143	0.00000	0.0000
Stains - Semitransparent	2401001015	3.62	0.00	0.00	0.01114	0.00000	0.0000
Quick Dry - Enamels	2401001020	1.47	0.00	0.00	0.00452	0.00000	0.0000
Lacquers - Clear	2401001025	0.14	0.00	0.00	0.00045	0.00000	0.0000
All Other Architectural Categories	2401001050	9.45	0.00	0.00	0.02907	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	3.88	0.00	0.00	0.01193	0.00000	0.0000
Auto Refinishing	2401005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Traffic Markings	2401008000	4.77	0.00	0.00	0.02803	0.00000	0.00000
Factory Finished Wood	2401015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood Furniture	2401020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Furniture	2401025000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Machinery and Equipment	2401055000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Appliances	2401060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Marine	2401080000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	0.26	0.00	0.00	0.00099	0.00000	0.00000
Surface Cleaning Cold Cleaning - General	2415300000	0.00	0.00	0.00	0.05344	0.00000	0.00000
Graphic Arts	2425000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.11	0.00	0.00	0.00040	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	0.00	0.00	0.00	0.00	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.00	0.00	0.00	0.00	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	0.00	0.00	0.00	0.00	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	281.58	0.00	0.00	0.58704	0.00000	0.00000
Emulsified Asphalt	2461022000	78.54	0.00	0.00	0.36700	0.00000	0.00000
Asphalt Roofing	2461023000	0.45	0.00	0.00	0.00172	0.00000	0.00000

Area Source Emissions - Frio County, 2005

FRIO COUNTY AREA SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	11.42	0.00	0.00	0.03130	0.00000	0.00000
Household Solvents	2465200000	7.57	0.00	0.00	0.02074	0.00000	0.00000
Automotive Solvents	2465400000	4.89	0.00	0.00	0.01339	0.00000	0.00000
Adhesives Application: Industrial	2440020000	1.93	0.00	0.00	0.00528	0.00000	0.00000
FIFRA Solvents	2460890000	3.51	0.00	0.00	0.00962	0.00000	0.00000
Coating Solvents	2460520000	12.87	0.00	0.00	0.03526	0.00000	0.00000
Misc.Solvents	2460900000	4.13	0.00	0.00	0.01131	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	7.53	0.00	0.00	0.02451	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	17.03	0.00	0.00	0.04743	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	4.43	0.00	0.00	0.01213	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	0.33	0.00	0.00	0.00108	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Municipal Wastewater Treatment	2630000000	4.31	0.00	0.00	0.01160	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	9.86	2.54	70.66	0.00960	0.00614	0.10235
Manage Burning - Slash	2810005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	216.77	32.68	3,325.93	0.26858	0.04049	4.12082
Structural Fires	2810030000	0.09	0.01	0.52	0.00026	0.00003	0.00142
Motor Vehicle Fires	2810050000	0.12	0.02	0.47	0.00033	0.00004	0.00128
Open Burning - Residential Household Waste	2610030000	41.79	8.36	118.40	0.11448	0.02290	0.32437
Open Burning - Yard Waste	2610000500	1.33	0.00	7.12	0.00364	0.00000	0.01951
Catastrophic/Accidental Releases	2830000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**1,201.31**	**353.86**	**3,895.57**	**2.90009**	**0.91293**	**4.89786**

Area Source Emissions - Gillespie County, 2005

GILLESPIE COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.02	1.17	0.29	0.00008	0.00450	0.00112
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.26	7.02	2.12	0.00017	0.01049	0.00171
Natural Gas, Commercial	2103006000	0.50	11.63	6.76	0.00107	0.02513	0.01462
Natural Gas, Industrial	2102006000	0.28	5.47	4.30	0.00076	0.01477	0.01163
LPG, Residential	2104007000	0.33	9.15	1.24	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.01	0.39	0.05	0.00004	0.00108	0.00015
LPG, Industrial	2102007000	0.01	0.32	0.08	0.00002	0.00102	0.00026
Wood, Residental	2104008000	392.45	14.24	1,147.65	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.04	0.01	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.02	0.00	0.00000	0.00007	0.00002
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	1.61	19.22	4.19	0.00442	0.05265	0.01149
Agricultural							
Defoliate	2461800000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fertilizer	2325050000	0.00	70.25	0.00	0.00000	0.16914	0.00000
Pesticide	2461800000	0.70	0.00	0.00	0.00294	0.00000	0.00000
Food Production							
Bakeries	2302050000	4.23	0.00	0.00	0.01159	0.00000	0.00000
Wineries	2302070005	0.09	0.00	0.00	0.00025	0.00000	0.00000
Breweries	2302070001	0.04	0.00	0.00	0.00011	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	0.32	0.00	1.07	0.00088	0.00000	0.00293
Underfired Charbroilers	2302002200	3.07	0.00	10.03	0.00840	0.00000	0.02748
Deep-Fat Fryers	2302003000	0.38	0.00	0.00	0.00105	0.00000	0.00000
Flat Griddles	2302003100	0.42	0.00	0.86	0.00114	0.00000	0.00235
Clamshell Griddles	2302003200	0.00	0.00	0.00	0.00001	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production	2310020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 2 stoke Compressors	20200252	0.00	0.00	0.00	0.00000	0.00000	0.00000
Oil/Gasoline Pipelines	2505040000	1.98	0.00	0.00	0.00543	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Rest Areas	2230070000	2.08	6.64	0.00	0.00570	0.01819	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	1.82	5.81	0.00	0.00499	0.01591	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	1.96	0.00	0.00	0.00536	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	18.96	0.00	0.00	0.05194	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	1.55	0.00	0.00	0.00426	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.02	0.00	0.00	0.00006	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.21	0.00	0.00	0.00058	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	0.60	0.00	0.00	0.00164	0.00000	0.00000

Area Source Emissions - Gillespie County, 2005

GILLESPIE COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Aboveground Storage Tanks							
Gasoline	2501010120	49.64	0.00	0.00	0.16383	0.00000	0.00000
Aviation Gasoline	2501080050	2.03	0.00	0.00	0.00668	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	36.47	0.00	0.00	0.11230	0.00000	0.00000
Aviation Gasoline	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	2.91	0.00	0.00	0.00896	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	1.42	0.00	0.00	0.00436	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	2.60	0.00	0.00	0.00801	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	1.36	0.00	0.00	0.00420	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	1.65	0.00	0.00	0.00508	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoaters	2401001011	0.55	0.00	0.00	0.00171	0.00000	0.0000
Stains - Semitransparent	2401001015	4.33	0.00	0.00	0.01331	0.00000	0.0000
Quick Dry - Enamels	2401001020	1.76	0.00	0.00	0.00540	0.00000	0.0000
Lacquers - Clear	2401001025	0.17	0.00	0.00	0.00053	0.00000	0.0000
All Other Architectural Categories	2401001050	11.30	0.00	0.00	0.03475	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	4.64	0.00	0.00	0.01426	0.00000	0.0000
Auto Refinishing	2401005000	5.44	0.00	0.00	0.02334	0.00000	0.00000
Traffic Markings	2401008000	1.08	0.00	0.00	0.00444	0.00000	0.00000
Factory Finished Wood	2401015000	0.17	0.00	0.00	0.00064	0.00000	0.00000
Wood Furniture	2401020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Furniture	2401025000	2.02	0.00	0.00	0.00777	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	13.95	0.00	0.00	0.05367	0.00000	0.00000
Machinery and Equipment	2401055000	2.48	0.00	0.00	0.00956	0.00000	0.00000
Appliances	2401060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.37	0.00	0.00	0.00142	0.00000	0.00000
Aircraft	2401075000	0.27	0.00	0.00	0.00106	0.00000	0.00000
Marine	2401080000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	4.17	0.00	0.00	0.01584	0.00000	0.00000
Surface Cleaning Cold Cleaning - General	2415300000	16.80	0.00	0.00	0.05384	0.00000	0.00000
Graphic Arts	2425000000	1.58	0.00	0.00	0.00606	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	3.18	0.00	0.00	0.01155	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Emulsified Asphalt	2461022000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt Roofing	2461023000	2.61	0.00	0.00	0.01002	0.00000	0.00000

Area Source Emissions - Gillespie County, 2005

GILLESPIE COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	14.91	0.00	0.00	0.04084	0.00000	0.00000
Household Solvents	2465200000	9.88	0.00	0.00	0.02706	0.00000	0.00000
Automotive Solvents	2465400000	6.38	0.00	0.00	0.01747	0.00000	0.00000
Adhesives Application: Industrial	2440020000	2.51	0.00	0.00	0.00689	0.00000	0.00000
FIFRA Solvents	2460890000	4.58	0.00	0.00	0.01255	0.00000	0.00000
Coating Solvents	2460520000	16.79	0.00	0.00	0.04601	0.00000	0.00000
Misc.Solvents	2460900000	5.39	0.00	0.00	0.01476	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	10.49	0.00	0.00	0.03418	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	22.22	0.00	0.00	0.06189	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	5.78	0.00	0.00	0.01582	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	0.43	0.00	0.00	0.00141	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	1.35	0.00	0.16	0.00371	0.00000	0.00045
Municipal Wastewater Treatment	2630000000	2.55	0.00	0.00	0.00618	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	18.22	3.85	122.91	0.00551	0.00549	0.07711
Manage Burning - Slash	2810005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	239.66	36.14	3,676.94	0.29694	0.04477	4.55572
Structural Fires	2810030000	0.14	0.02	0.76	0.00038	0.00005	0.00208
Motor Vehicle Fires	2810050000	0.07	0.01	0.27	0.00019	0.00002	0.00073
Open Burning - Residential Household Waste	2610030000	58.87	11.77	166.81	0.16130	0.03226	0.45702
Open Burning - Yard Waste	2610000500	1.87	0.00	10.03	0.00513	0.00000	0.02749
Catastrophic/Accidental Releases	2830000000	0.21	0.00	0.00	0.00096	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**1,031.20**	**203.16**	**5,156.55**	**1.45465**	**0.39555**	**5.19435**

Area Source Emissions - Gudalupe County, 2005

GUADALUPE COUNTY AREA SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.06	3.39	0.85	0.00022	0.01300	0.00325
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.55	16.72	4.63	0.00040	0.02434	0.00399
Natural Gas, Commercial	2103006000	1.43	33.67	19.58	0.00310	0.07280	0.04233
Natural Gas, Industrial	2102006000	7.19	139.12	109.55	0.01941	0.37586	0.29597
LPG, Residential	2104007000	0.56	15.55	2.11	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.04	1.13	0.15	0.00011	0.00311	0.00042
LPG, Industrial	2102007000	0.05	2.33	0.58	0.00015	0.00747	0.00187
Wood, Residental	2104008000	361.23	13.11	1,056.36	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.03	0.01	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.05	0.01	0.00000	0.00020	0.00005
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	5.37	66.04	14.15	0.01473	0.18092	0.03877
Agricultural							
Defoliate	2461800000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fertilizer	2325050000	0.00	221.06	0.00	0.00000	0.57308	0.00000
Pesticide	2461800000	9.15	0.00	0.00	0.03813	0.00000	0.00000
Food Production							
Bakeries	2302050000	7.54	0.00	0.00	0.02066	0.00000	0.00000
Wineries	2302070005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Breweries	2302070001	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	0.82	0.00	2.73	0.00224	0.00000	0.00747
Underfired Charbroilers	2302002200	4.65	0.00	15.21	0.01274	0.00000	0.04167
Deep-Fat Fryers	2302003000	0.65	0.00	0.00	0.00178	0.00000	0.00000
Flat Griddles	2302003100	0.58	0.00	1.20	0.00159	0.00000	0.00328
Clamshell Griddles	2302003200	0.01	0.00	0.00	0.00003	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	944.31	415.75	349.23	2.97065	1.13903	0.95678
Gas Production	2310020000	1.04	0.00	0.00	0.00336	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.01	0.77	1.18	0.00003	0.00210	0.00324
Gas Production - 2 stoke Compressors	20200252	0.02	0.33	0.06	0.00006	0.00091	0.00017
Oil/Gasoline Pipelines	2505040000	2.63	0.00	0.00	0.00721	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	2.99	9.54	0.00	0.00819	0.02615	0.00000
HDDV Truck Idling - Rest Areas	2230070000	10.53	33.61	0.00	0.02885	0.09208	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	4.16	13.28	0.00	0.01140	0.03638	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	5.68	0.00	0.00	0.01557	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	55.07	0.00	0.00	0.15087	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	4.51	0.00	0.00	0.01237	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.03	0.00	0.00	0.00008	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.29	0.00	0.00	0.00080	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	0.82	0.00	0.00	0.00225	0.00000	0.00000

Area Source Emissions - Gudalupe County, 2005

GUADALUPE COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Aboveground Storage Tanks							
Gasoline	2501010120	26.57	0.00	0.00	0.07369	0.00000	0.00000
Aviation Gasoline	2501080050	0.23	0.00	0.00	0.00074	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	16.01	0.00	0.00	0.04291	0.00000	0.00000
Aviation Gasoline	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	8.99	0.00	0.00	0.00000	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	15.33	0.00	0.00	0.04716	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	7.45	0.00	0.00	0.02292	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	13.70	0.00	0.00	0.04214	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	7.17	0.00	0.00	0.02207	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	8.68	0.00	0.00	0.02671	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoaters	2401001011	2.92	0.00	0.00	0.00898	0.00000	0.0000
Stains - Semitransparent	2401001015	22.76	0.00	0.00	0.07001	0.00000	0.0000
Quick Dry - Enamels	2401001020	9.23	0.00	0.00	0.02840	0.00000	0.0000
Lacquers - Clear	2401001025	0.91	0.00	0.00	0.00280	0.00000	0.0000
All Other Architectural Categories	2401001050	59.43	0.00	0.00	0.18280	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	24.39	0.00	0.00	0.07504	0.00000	0.0000
Auto Refinishing	2401005000	28.69	0.00	0.00	0.12302	0.00000	0.00000
Traffic Markings	2401008000	1.22	0.00	0.00	0.00438	0.00000	0.00000
Factory Finished Wood	2401015000	2.11	0.00	0.00	0.00811	0.00000	0.00000
Wood Furniture	2401020000	44.52	0.00	0.00	0.17122	0.00000	0.00000
Metal Furniture	2401025000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	4.41	0.00	0.00	0.01697	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Machinery and Equipment	2401055000	12.00	0.00	0.00	0.04617	0.00000	0.00000
Appliances	2401060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Marine	2401080000	0.43	0.00	0.00	0.00167	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	13.32	0.00	0.00	0.05124	0.00000	0.00000
					0.29537		
Surface Cleaning Cold Cleaning - General	2415300000	48.65	0.00	0.00	0.15594	0.00000	0.00000
Graphic Arts	2425000000	6.33	0.00	0.00	0.02424	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.44	0.00	0.00	0.00161	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.32	0.00	0.00	0.00116	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	72.19	0.00	0.00	0.29490	0.00000	0.00000
Emulsified Asphalt	2461022000	11.53	0.00	0.00	0.04042	0.00000	0.00000
Asphalt Roofing	2461023000	6.67	0.00	0.00	0.02554	0.00000	0.00000

Area Source Emissions - Gudalupe County, 2005

GUADALUPE COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	67.70	0.00	0.00	0.18547	0.00000	0.00000
Household Solvents	2465200000	44.86	0.00	0.00	0.12290	0.00000	0.00000
Automotive Solvents	2465400000	28.95	0.00	0.00	0.07933	0.00000	0.00000
Adhesives Application: Industrial	2440020000	11.42	0.00	0.00	0.03128	0.00000	0.00000
FIFRA Solvents	2460890000	20.80	0.00	0.00	0.05698	0.00000	0.00000
Coating Solvents	2460520000	76.26	0.00	0.00	0.20893	0.00000	0.00000
Misc.Solvents	2460900000	24.47	0.00	0.00	0.06704	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	63.52	0.00	0.00	0.20693	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	100.92	0.00	0.00	0.28103	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	26.23	0.00	0.00	0.07186	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	1.97	0.00	0.00	0.00641	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	0.12	0.00	0.02	0.00034	0.00000	0.00004
Municipal Wastewater Treatment	2630000000	12.07	0.00	0.00	0.03175	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	27.57	6.55	192.58	0.01588	0.01289	0.19468
Manage Burning - Slash	2810005000	0.00	0.00	5.82	0.00000	0.00000	0.01594
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	41.42	6.27	634.98	0.05132	0.00777	0.78674
Structural Fires	2810030000	0.46	0.06	2.52	0.00127	0.00016	0.00690
Motor Vehicle Fires	2810050000	0.24	0.03	0.94	0.00066	0.00008	0.00257
Open Burning - Residential Household Waste	2610030000	106.34	21.27	301.30	0.29135	0.05827	0.82549
Open Burning - Yard Waste	2610000500	3.38	0.00	18.12	0.00926	0.00000	0.04966
Catastrophic/Accidental Releases	2830000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**2,567.29**	**1,019.66**	**2,733.86**	**6.95526**	**2.62658**	**3.28127**

Area Source Emissions - Karnes County, 2005

KARNES COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.00	0.27	0.07	0.00002	0.00104	0.00026
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.18	5.43	1.52	0.00013	0.00795	0.00130
Natural Gas, Commercial	2103006000	0.11	2.56	1.49	0.00024	0.00553	0.00322
Natural Gas, Industrial	2102006000	0.05	1.02	0.80	0.00014	0.00274	0.00216
LPG, Residential	2104007000	0.13	3.73	0.51	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.00	0.09	0.01	0.00001	0.00025	0.00003
LPG, Industrial	2102007000	0.00	0.10	0.03	0.00001	0.00032	0.00008
Wood, Residental	2104008000	20.07	0.73	58.69	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.02	0.00	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.00	0.00	0.00000	0.00002	0.00000
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	1.17	13.89	3.03	0.00320	0.03805	0.00830
Agricultural							
Defoliate	2461800000	0.34	0.00	0.00	0.00162	0.00000	0.00000
Fertilizer	2325050000	0.00	130.02	0.00	0.00000	0.33023	0.00000
Pesticide	2461800000	4.96	0.00	0.00	0.02067	0.00000	0.00000
Food Production							
Bakeries	2302050000	0.57	0.00	0.00	0.00156	0.00000	0.00000
Wineries	2302070005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Breweries	2302070001	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	0.26	0.00	0.86	0.00070	0.00000	0.00235
Underfired Charbroilers	2302002200	1.25	0.00	4.27	0.00341	0.00000	0.01170
Deep-Fat Fryers	2302003000	0.19	0.00	0.00	0.00053	0.00000	0.00000
Flat Griddles	2302003100	0.17	0.00	0.36	0.00048	0.00000	0.00098
Clamshell Griddles	2302003200	0.00	0.00	0.00	0.00001	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	67.00	23.28	19.55	0.20915	0.06377	0.05357
Gas Production	2310020000	92.79	0.00	0.00	0.29055	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.85	65.07	100.61	0.00232	0.17827	0.27564
Gas Production - 2 stoke Compressors	20200252	1.75	28.27	5.14	0.00479	0.07745	0.01409
Oil/Gasoline Pipelines	2505040000	2.41	0.00	0.00	0.00659	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Rest Areas	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	1.12	0.00	0.00	0.00307	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	10.86	0.00	0.00	0.02977	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	0.89	0.00	0.00	0.00244	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.00	0.00	0.00	0.00001	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.03	0.00	0.00	0.00007	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	0.07	0.00	0.00	0.00020	0.00000	0.00000

Area Source Emissions - Karnes County, 2005

KARNES COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Aboveground Storage Tanks							
Gasoline	2501010120	46.13	0.00	0.00	0.12793	0.00000	0.00000
Aviation Gasoline	2501080050	0.37	0.00	0.00	0.00122	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	10.82	0.00	0.00	0.02899	0.00000	0.00000
Aviation Gasoline	2501080050	0.94	0.00	0.00	0.00291	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	2.28	0.00	0.00	0.00703	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	1.11	0.00	0.00	0.00341	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	2.04	0.00	0.00	0.00628	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	1.07	0.00	0.00	0.00329	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	1.29	0.00	0.00	0.00398	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoaters	2401001011	0.43	0.00	0.00	0.00134	0.00000	0.0000
Stains - Semitransparent	2401001015	3.39	0.00	0.00	0.01043	0.00000	0.0000
Quick Dry - Enamels	2401001020	1.38	0.00	0.00	0.00423	0.00000	0.0000
Lacquers - Clear	2401001025	0.14	0.00	0.00	0.00042	0.00000	0.0000
All Other Architectural Categories	2401001050	8.85	0.00	0.00	0.02724	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	3.63	0.00	0.00	0.01118	0.00000	0.0000
Auto Refinishing	2401005000	0.99	0.00	0.00	0.00422	0.00000	0.00000
Traffic Markings	2401008000	1.08	0.00	0.00	0.00445	0.00000	0.00000
Factory Finished Wood	2401015000	0.02	0.00	0.00	0.00006	0.00000	0.00000
Wood Furniture	2401020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Furniture	2401025000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Machinery and Equipment	2401055000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Appliances	2401060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Marine	2401080000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	2.00	0.00	0.00	0.00767	0.00000	0.00000
Surface Cleaning Cold Cleaning - General	2415300000	5.72	0.00	0.00	0.01835	0.00000	0.00000
Graphic Arts	2425000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	2.53	0.00	0.00	0.00919	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Emulsified Asphalt	2461022000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt Roofing	2461023000	0.24	0.00	0.00	0.00093	0.00000	0.00000

Area Source Emissions - Karnes County, 2005

KARNES COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	10.77	0.00	0.00	0.02951	0.00000	0.00000
Household Solvents	2465200000	7.14	0.00	0.00	0.01956	0.00000	0.00000
Automotive Solvents	2465400000	4.61	0.00	0.00	0.01262	0.00000	0.00000
Adhesives Application: Industrial	2440020000	1.82	0.00	0.00	0.00498	0.00000	0.00000
FIFRA Solvents	2460890000	3.31	0.00	0.00	0.00907	0.00000	0.00000
Coating Solvents	2460520000	12.14	0.00	0.00	0.03325	0.00000	0.00000
Misc.Solvents	2460900000	3.89	0.00	0.00	0.01067	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	8.84	0.00	0.00	0.02880	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	16.06	0.00	0.00	0.04472	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	4.17	0.00	0.00	0.01143	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	0.31	0.00	0.00	0.00102	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Municipal Wastewater Treatment	2630000000	7.59	0.00	0.00	0.02108	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	26.39	5.23	174.77	0.00819	0.00638	0.09792
Manage Burning - Slash	2810005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	64.90	9.89	993.63	0.08041	0.01225	1.23110
Structural Fires	2810030000	0.03	0.00	0.14	0.00007	0.00001	0.00038
Motor Vehicle Fires	2810050000	0.03	0.00	0.13	0.00009	0.00001	0.00034
Open Burning - Residential Household Waste	2610030000	39.15	7.83	110.91	0.10725	0.02145	0.30387
Open Burning - Yard Waste	2610000500	1.24	0.00	6.67	0.00341	0.00000	0.01828
Catastrophic/Accidental Releases	2830000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**516.07**	**297.43**	**1,483.18**	**1.29256**	**0.74572**	**2.02559**

Area Source Emissions - Kendall County, 2005

KENDALL COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.025	1.45	0.36	0.00009	0.00557	0.00139
Fuel Oil-Distillate, Industrial	2102004000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.100	2.76	0.81	0.00007	0.00409	0.00067
Natural Gas, Commercial	2103006000	0.531	12.47	7.25	0.00115	0.02697	0.01568
Natural Gas, Industrial	2102006000	7.105	137.57	108.33	0.01920	0.37169	0.29268
LPG, Residential	2104007000	0.209	5.85	0.79	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.017	0.49	0.07	0.00005	0.00133	0.00018
LPG, Industrial	2102007000	0.009	0.43	0.11	0.00003	0.00138	0.00035
Wood, Residental	2104008000	179.502	6.51	524.92	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.001	0.03	0.01	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.000	0.02	0.01	0.00000	0.00009	0.00002
Kerosene, Industrial	2102011000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	2.138	25.45	5.55	0.00586	0.06973	0.01522
Agricultural							
Defoliate	2461800000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Fertilizer	2325050000	0.000	20.79	0.00	0.00000	0.04857	0.00000
Pesticide	2461800000	0.0001	0.00	0.00	0.00000	0.00000	0.00000
Food Production							
Bakeries	2302050000	6.097	0.00	0.00	0.01670	0.00000	0.00000
Wineries	2302070005	0.010	0.00	0.00	0.00003	0.00000	0.00000
Breweries	2302070001	0.006	0.00	0.00	0.00002	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	2.580	0.00	1.38	0.00113	0.00000	0.00378
Underfired Charbroilers	2302002200	0.304	0.00	8.44	0.00707	0.00000	0.02312
Deep-Fat Fryers	2302003000	0.347	0.00	0.00	0.00095	0.00000	0.00000
Flat Griddles	2302003100	0.349	0.00	0.72	0.00096	0.00000	0.00198
Clamshell Griddles	2302003200	0.005	0.00	0.00	0.00001	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Gas Production	2310020000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.000	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 2 stoke Compressors	20200252	0.000	0.00	0.00	0.00000	0.00000	0.00000
Oil/Gasoline Pipelines	2505040000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	1.430	4.56	0.00	0.00392	0.01250	0.00000
HDDV Truck Idling - Rest Areas	2230070000	0.000	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	3.640	11.62	0.00	0.00997	0.03183	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	2.023	0.00	0.00	0.00554	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	19.598	0.00	0.00	0.05369	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	1.606	0.00	0.00	0.00440	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.030	0.00	0.00	0.00008	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.291	0.00	0.00	0.00080	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	0.822	0.00	0.00	0.00225	0.00000	0.00000

Area Source Emissions - Kendall County, 2005

KENDALL COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Aboveground Storage Tanks							
Gasoline	2501010120	29.456	0.00	0.00	0.08169	0.00000	0.00000
Aviation Gasoline	2501080050	0.000	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.000	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.000	0.00	0.00	0.00000	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.000	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	0.000	0.00	0.00	0.00000	0.00000	0.00000
Aviation Gasoline	2501080050	0.000	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.000	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.001	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.000	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.000	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.000	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	8.988	0.00	0.00	0.00000	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	4.257	0.00	0.00	0.01309	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	2.068	0.00	0.00	0.00636	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	3.804	0.00	0.00	0.01170	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	1.992	0.00	0.00	0.00613	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	2.411	0.00	0.00	0.00742	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoaters	2401001011	0.810	0.00	0.00	0.00249	0.00000	0.0000
Stains - Semitransparent	2401001015	6.320	0.00	0.00	0.01944	0.00000	0.0000
Quick Dry - Enamels	2401001020	2.563	0.00	0.00	0.00789	0.00000	0.0000
Lacquers - Clear	2401001025	0.253	0.00	0.00	0.00078	0.00000	0.0000
All Other Architectural Categories	2401001050	16.501	0.00	0.00	0.05075	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	6.773	0.00	0.00	0.02083	0.00000	0.0000
Auto Refinishing	2401005000	4.056	0.00	0.00	0.01739	0.00000	0.00000
Traffic Markings	2401008000	0.001	0.00	0.00	0.00000	0.00000	0.00000
Factory Finished Wood	2401015000	0.849	0.00	0.00	0.00327	0.00000	0.00000
Wood Furniture	2401020000	8.094	0.00	0.00	0.03113	0.00000	0.00000
Metal Furniture	2401025000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	155.050	0.00	0.00	0.59635	0.00000	0.00000
Machinery and Equipment	2401055000	1.731	0.00	0.00	0.00666	0.00000	0.00000
Appliances	2401060000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Marine	2401080000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	5.508	0.00	0.00	0.02118	0.00000	0.00000
Surface Cleaning Cold Cleaning - General	2415300000	65.317	0.00	0.00	0.20935	0.00000	0.00000
Graphic Arts	2425000000	3.532	0.00	0.00	0.01353	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.637	0.00	0.00	0.00231	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	7.275	0.00	0.00	0.02642	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	0.434	0.00	0.00	0.00158	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	23.332	0.00	0.00	0.10903	0.00000	0.00000
Emulsified Asphalt	2461022000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Asphalt Roofing	2461023000	2.008	0.00	0.00	0.00770	0.00000	0.00000

Area Source Emissions - Kendall County, 2005

KENDALL COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	19.742	0.00	0.00	0.05409	0.00000	0.00000
Household Solvents	2465200000	13.082	0.00	0.00	0.03584	0.00000	0.00000
Automotive Solvents	2465400000	8.444	0.00	0.00	0.02313	0.00000	0.00000
Adhesives Application: Industrial	2440020000	3.330	0.00	0.00	0.00912	0.00000	0.00000
FIFRA Solvents	2460890000	6.065	0.00	0.00	0.01662	0.00000	0.00000
Coating Solvents	2460520000	22.239	0.00	0.00	0.06093	0.00000	0.00000
Misc.Solvents	2460900000	7.136	0.00	0.00	0.01955	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	11.562	0.00	0.00	0.03766	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	29.431	0.00	0.00	0.08196	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	7.649	0.00	0.00	0.02096	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	0.574	0.00	0.00	0.00187	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Municipal Wastewater Treatment	2630000000	3.184	0.00	0.00	0.00784	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	8.467	1.61	55.45	0.00133	0.00152	0.02036
Manage Burning - Slash	2810005000	0.000	0.00	1.57	0.00000	0.00000	0.00431
Prescribed Burning - Forest Management	2810015000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	118.834	17.92	1,823.20	0.14723	0.02220	2.25894
Structural Fires	2810030000	0.139	0.02	0.76	0.00038	0.00005	0.00208
Motor Vehicle Fires	2810050000	0.088	0.01	0.34	0.00024	0.00003	0.00094
Open Burning - Residential Household Waste	2610030000	72.948	14.59	206.69	0.19986	0.03997	0.56626
Open Burning - Yard Waste	2610000500	2.319	0.00	12.43	0.00635	0.00000	0.03406
Catastrophic/Accidental Releases	2830000000	0.000	0.00	0.00	0.00000	0.00000	0.00000
Explosive Detonation	2311000030	0.000	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.000	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**928.027**	**264.15**	**2,759.21**	**2.13340**	**0.63751**	**3.24203**

Area Source Emissions - Kerr County, 2005

KERR COUNTY AREA SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.04	2.11	0.53	0.00014	0.00807	0.00202
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.43	11.42	3.47	0.00028	0.01709	0.00281
Natural Gas, Commercial	2103006000	0.77	18.17	10.57	0.00167	0.03928	0.02284
Natural Gas, Industrial	2102006000	0.03	0.55	0.44	0.00008	0.00150	0.00118
LPG, Residential	2104007000	0.35	9.90	1.34	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.03	0.70	0.10	0.00007	0.00193	0.00026
LPG, Industrial	2102007000	0.01	0.66	0.16	0.00004	0.00210	0.00053
Wood, Residental	2104008000	450.43	16.35	1,317.19	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.03	0.01	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.03	0.01	0.00000	0.00012	0.00003
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	3.34	39.76	8.68	0.00915	0.10894	0.02377
Agricultural							
Defoliate	2461800000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fertilizer	2325050000	0.00	19.53	0.00	0.00000	0.04564	0.00000
Pesticide	2461800000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Food Production							
Bakeries	2302050000	2.62	0.00	0.00	0.00717	0.00000	0.00000
Wineries	2302070005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Breweries	2302070001	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	0.48	0.00	1.60	0.00131	0.00000	0.00438
Underfired Charbroilers	2302002200	2.25	0.00	7.35	0.00616	0.00000	0.02015
Deep-Fat Fryers	2302003000	0.34	0.00	0.00	0.00092	0.00000	0.00000
Flat Griddles	2302003100	0.32	0.00	0.67	0.00089	0.00000	0.00183
Clamshell Griddles	2302003200	0.00	0.00	0.00	0.00001	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	0.51	0.22	0.18	0.00162	0.00059	0.00050
Gas Production	2310020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Production - 2 stoke Compressors	20200252	0.00	0.00	0.00	0.00000	0.00000	0.00000
Oil/Gasoline Pipelines	2505040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Rest Areas	2230070000	4.68	14.94	0.00	0.01282	0.04092	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	0.91	2.90	0.00	0.00249	0.00796	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	3.96	0.00	0.00	0.01085	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	38.37	0.00	0.00	0.10513	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	3.15	0.00	0.00	0.00862	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.05	0.00	0.00	0.00013	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.48	0.00	0.00	0.00131	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	1.35	0.00	0.00	0.00369	0.00000	0.00000

Area Source Emissions - Kerr County, 2005

KERR COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Aboveground Storage Tanks							
Gasoline	2501010120	25.71	0.00	0.00	0.08485	0.00000	0.00000
Aviation Gasoline	2501080050	1.13	0.00	0.00	0.00371	0.00000	0.00000
Jet Kerosene	2501010180	0.01	0.00	0.00	0.00004	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00001	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	9.52	0.00	0.00	0.02932	0.00000	0.00000
Aviation Gasoline	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	8.99	0.00	0.00	0.04200	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	6.92	0.00	0.00	0.02128	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	3.36	0.00	0.00	0.01034	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	6.18	0.00	0.00	0.01902	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	3.24	0.00	0.00	0.00996	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	3.92	0.00	0.00	0.01205	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoaters	2401001011	1.32	0.00	0.00	0.00405	0.00000	0.0000
Stains - Semitransparent	2401001015	10.27	0.00	0.00	0.03159	0.00000	0.0000
Quick Dry - Enamels	2401001020	4.17	0.00	0.00	0.01282	0.00000	0.0000
Lacquers - Clear	2401001025	0.41	0.00	0.00	0.00126	0.00000	0.0000
All Other Architectural Categories	2401001050	26.82	0.00	0.00	0.08249	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	11.01	0.00	0.00	0.03386	0.00000	0.0000
Auto Refinishing	2401005000	15.94	0.00	0.00	0.06836	0.00000	0.00000
Traffic Markings	2401008000	0.27	0.00	0.00	0.00146	0.00000	0.00000
Factory Finished Wood	2401015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood Furniture	2401020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Furniture	2401025000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Machinery and Equipment	2401055000	0.06	0.00	0.00	0.00021	0.00000	0.00000
Appliances	2401060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	9.16	0.00	0.00	0.03523	0.00000	0.00000
Marine	2401080000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	1.07	0.00	0.00	0.00410	0.00000	0.00000
Surface Cleaning Cold Cleaning - General	2415300000	24.43	0.00	0.00	0.07829	0.00000	0.00000
Graphic Arts	2425000000	3.46	0.00	0.00	0.01325	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	6.36	0.00	0.00	0.02309	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.35	0.00	0.00	0.00127	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	16.48	0.00	0.00	0.07699	0.00000	0.00000
Emulsified Asphalt	2461022000	5.87	0.00	0.00	0.02589	0.00000	0.00000
Asphalt Roofing	2461023000	9.28	0.00	0.00	0.03556	0.00000	0.00000

Area Source Emissions - Kerr County, 2005

KERR COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	30.84	0.00	0.00	0.08450	0.00000	0.00000
Household Solvents	2465200000	20.44	0.00	0.00	0.05600	0.00000	0.00000
Automotive Solvents	2465400000	13.19	0.00	0.00	0.03614	0.00000	0.00000
Adhesives Application: Industrial	2440020000	5.20	0.00	0.00	0.01425	0.00000	0.00000
FIFRA Solvents	2460890000	9.48	0.00	0.00	0.02596	0.00000	0.00000
Coating Solvents	2460520000	34.75	0.00	0.00	0.09519	0.00000	0.00000
Misc.Solvents	2460900000	11.15	0.00	0.00	0.03054	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	24.28	0.00	0.00	0.07911	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	45.98	0.00	0.00	0.12804	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	11.95	0.00	0.00	0.03274	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	0.90	0.00	0.00	0.00292	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	4.50	0.00	0.54	0.01232	0.00000	0.00149
Municipal Wastewater Treatment	2630000000	4.53	0.00	0.00	0.01089	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	6.11	0.96	38.14	0.00006	0.00001	0.00037
Manage Burning - Slash	2810005000	0.00	0.00	0.30	0.00000	0.00000	0.00081
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	217.35	32.77	3,334.62	0.26929	0.04061	4.13159
Structural Fires	2810030000	0.12	0.02	0.66	0.00033	0.00004	0.00180
Motor Vehicle Fires	2810050000	0.05	0.01	0.20	0.00014	0.00002	0.00056
Open Burning - Residential Household Waste	2610030000	57.75	11.55	163.63	0.15823	0.03165	0.44831
Open Burning - Yard Waste	2610000500	1.84	0.00	9.84	0.00503	0.00000	0.02697
Catastrophic/Accidental Releases	2830000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**1,230.98**	**182.58**	**4,900.23**	**1.97861**	**0.34647**	**4.69218**

Area Source Emissions - Medina County, 2005

MEDINA COUNTY AREA SOURCES	SCC Code	VOC tons/year	NOx tons/year	CO tons/year	VOC tons/day (Mon. - Fri.)	NOx tons/day (Mon. - Fri.)	CO tons/day (Mon. - Fri.)
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.02	0.91	0.23	0.00006	0.00348	0.00087
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.37	10.88	3.11	0.00026	0.01598	0.00263
Natural Gas, Commercial	2103006000	0.36	8.42	4.90	0.00078	0.01821	0.01059
Natural Gas, Industrial	2102006000	2.01	38.87	30.61	0.00542	0.10502	0.08270
LPG, Residential	2104007000	0.37	10.31	1.40	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.01	0.30	0.04	0.00003	0.00083	0.00011
LPG, Industrial	2102007000	0.01	0.29	0.07	0.00002	0.00092	0.00023
Wood, Residental	2104008000	210.72	7.65	616.21	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.04	0.01	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.01	0.00	0.00000	0.00005	0.00001
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	3.09	36.80	8.03	0.00847	0.10082	0.02200
Agricultural							
Defoliate	2461800000	1.04	0.00	0.00	0.00495	0.00000	0.00000
Fertilizer	2325050000	0.00	258.04	0.00	0.00000	0.68769	0.00000
Pesticide	2461800000	12.99	0.00	0.00	0.05413	0.00000	0.00000
Food Production							
Bakeries	2302050000	1.41	0.00	0.00	0.00386	0.00000	0.00000
Wineries	2302070005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Breweries	2302070001	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	0.43	0.00	1.45	0.00119	0.00000	0.00397
Underfired Charbroilers	2302002200	2.18	0.00	7.13	0.00597	0.00000	0.01953
Deep-Fat Fryers	2302003000	0.33	0.00	0.00	0.00090	0.00000	0.00000
Flat Griddles	2302003100	0.30	0.00	0.63	0.00083	0.00000	0.00171
Clamshell Griddles	2302003200	0.01	0.00	0.00	0.00002	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	670.14	326.73	274.46	2.11640	0.89516	0.75194
Gas Production	2310020000	0.83	0.00	0.00	0.00227	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.00	0.08	0.13	0.00000	0.00023	0.00035
Gas Production - 2 stoke Compressors	20200252	0.00	0.04	0.01	0.00001	0.00010	0.00002
Oil/Gasoline Pipelines	2505040000	2.26	0.00	0.00	0.00619	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	0.65	2.07	0.00	0.00178	0.00568	0.00000
HDDV Truck Idling - Rest Areas	2230070000	7.15	22.82	0.00	0.01959	0.06252	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	0.78	2.49	0.00	0.00214	0.00682	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	2.92	0.00	0.00	0.00801	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	28.33	0.00	0.00	0.07762	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	2.32	0.00	0.00	0.00636	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.01	0.00	0.00	0.00003	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.11	0.00	0.00	0.00029	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	0.30	0.00	0.00	0.00082	0.00000	0.00000

Area Source Emissions - Medina County, 2005

MEDINA COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Aboveground Storage Tanks							
Gasoline	2501010120	54.69	0.00	0.00	0.18051	0.00000	0.00000
Aviation Gasoline	2501080050	2.45	0.00	0.00	0.00809	0.00000	0.00000
Jet Kerosene	2501010180	0.02	0.00	0.00	0.00005	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00002	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	17.24	0.00	0.00	0.05308	0.00000	0.00000
Aviation Gasoline	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	6.40	0.00	0.00	0.01969	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	3.11	0.00	0.00	0.00957	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	5.72	0.00	0.00	0.01760	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	3.00	0.00	0.00	0.00922	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	3.63	0.00	0.00	0.01115	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoaters	2401001011	1.22	0.00	0.00	0.00375	0.00000	0.0000
Stains - Semitransparent	2401001015	9.51	0.00	0.00	0.02924	0.00000	0.0000
Quick Dry - Enamels	2401001020	3.86	0.00	0.00	0.01186	0.00000	0.0000
Lacquers - Clear	2401001025	0.38	0.00	0.00	0.00117	0.00000	0.0000
All Other Architectural Categories	2401001050	24.82	0.00	0.00	0.07634	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	10.19	0.00	0.00	0.03134	0.00000	0.0000
Auto Refinishing	2401005000	1.77	0.00	0.00	0.00757	0.00000	0.00000
Traffic Markings	2401008000	0.99	0.00	0.00	0.00359	0.00000	0.00000
Factory Finished Wood	2401015000	0.32	0.00	0.00	0.00122	0.00000	0.00000
Wood Furniture	2401020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Furniture	2401025000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	31.01	0.00	0.00	0.11927	0.00000	0.00000
Machinery and Equipment	2401055000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Appliances	2401060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Marine	2401080000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	3.98	0.00	0.00	0.01531	0.00000	0.00000
Surface Cleaning Cold Cleaning - General	2415300000	34.06	0.00	0.00	0.00000	0.00000	0.00000
Graphic Arts	2425000000	0.02	0.00	0.00	0.00008	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Petroleum	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - DF-2000 Solvent	2420000000	0.76	0.00	0.00	0.00276	0.00000	0.00000
Dry Cleaning - Ecosolve Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Asphalt							
Cutback Asphalt	2461021000	124.23	0.00	0.00	0.32646	0.00000	0.00000
Emulsified Asphalt	2461022000	19.96	0.00	0.00	0.04445	0.00000	0.00000
Asphalt Roofing	2461023000	1.32	0.00	0.00	0.00504	0.00000	0.00000

Area Source Emissions - Medina County, 2005

MEDINA COUNTY AREA SOURCES	SCC Code	VOC	NOx	CO	VOC	NOx	CO
		tons/year			tons/day (Mon. - Fri.)		
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	28.55	0.00	0.00	0.07821	0.00000	0.00000
Household Solvents	2465200000	18.92	0.00	0.00	0.05182	0.00000	0.00000
Automotive Solvents	2465400000	12.21	0.00	0.00	0.03345	0.00000	0.00000
Adhesives Application: Industrial	2440020000	4.81	0.00	0.00	0.01319	0.00000	0.00000
FIFRA Solvents	2460890000	8.77	0.00	0.00	0.02403	0.00000	0.00000
Coating Solvents	2460520000	32.16	0.00	0.00	0.08810	0.00000	0.00000
Misc.Solvents	2460900000	10.32	0.00	0.00	0.02827	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	24.11	0.00	0.00	0.07853	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	42.55	0.00	0.00	0.11850	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	11.06	0.00	0.00	0.03030	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	0.83	0.00	0.00	0.00270	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	1.30	0.00	0.16	0.00357	0.00000	0.00043
Municipal Wastewater Treatment	2630000000	5.11	0.00	0.00	0.01374	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	22.29	5.56	157.92	0.02550	0.01363	0.24681
Manage Burning - Slash	2810005000	0.00	0.00	2.72	0.00000	0.00000	0.00746
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	218.27	32.94	3,348.11	0.27043	0.04082	4.14831
Structural Fires	2810030000	0.15	0.02	0.79	0.00040	0.00005	0.00217
Motor Vehicle Fires	2810050000	0.10	0.01	0.41	0.00028	0.00004	0.00111
Open Burning - Residential Household Waste	2610030000	59.63	11.93	168.95	0.16337	0.03267	0.46287
Open Burning - Yard Waste	2610000500	1.90	0.00	10.16	0.00519	0.00000	0.02784
Catastrophic/Accidental Releases	2830000000	0.12	0.00	0.00	0.00056	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**1,819.23**	**777.22**	**4,637.63**	**4.34698**	**1.99072**	**5.79368**

Area Source Emissions - Wilson County, 2005

WILSON COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Combustion							
Fuel Oil-Distillate, Residential	2104004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Distillate, Commercial	2103004000	0.01	0.51	0.13	0.00003	0.00195	0.00049
Fuel Oil-Distillate, Industrial	2102004000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Residential	2104005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Commercial	2103005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Fuel Oil-Residual, Industrial	2102005000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Natural Gas, Residential	2104006000	0.19	5.52	1.58	0.00013	0.00812	0.00133
Natural Gas, Commercial	2103006000	0.20	4.76	2.77	0.00044	0.01029	0.00598
Natural Gas, Industrial	2102006000	0.12	2.31	1.82	0.00032	0.00625	0.00492
LPG, Residential	2104007000	0.45	12.54	1.70	0.00000	0.00000	0.00000
LPG, Commercial	2103007000	0.01	0.17	0.02	0.00002	0.00047	0.00006
LPG, Industrial	2102007000	0.00	0.19	0.05	0.00001	0.00060	0.00015
Wood, Residental	2104008000	117.07	4.25	342.34	0.00000	0.00000	0.00000
Wood, Commercial	2103008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood, Industrial	2102008000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene, Residental	2104011000	0.00	0.01	0.00	0.00000	0.00000	0.00000
Kerosene, Commercial	2103011000	0.00	0.01	0.00	0.00000	0.00003	0.00001
Kerosene, Industrial	2102011000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Stationary Diesel Generators	20200102	2.75	32.74	7.14	0.00753	0.08969	0.01957
Agricultural							
Defoliate	2461800000	0.18	0.00	0.00	0.00085	0.00000	0.00000
Fertilizer	2325050000	0.00	165.90	0.00	0.00000	0.42890	0.00000
Pesticide	2461800000	10.35	0.00	0.00	0.04314	0.00000	0.00000
Food Production							
Bakeries	2302050000	0.80	0.00	0.00	0.00220	0.00000	0.00000
Wineries	2302070005	0.00	0.00	0.00	0.00000	0.00000	0.00000
Breweries	2302070001	0.00	0.00	0.00	0.00000	0.00000	0.00000
Commercial Cooking							
Chain-Driven Charbroilers	2302002100	0.36	0.00	1.22	0.00100	0.00000	0.00333
Underfired Charbroilers	2302002200	1.71	0.00	5.58	0.00468	0.00000	0.01529
Deep-Fat Fryers	2302003000	0.26	0.00	0.00	0.00071	0.00000	0.00000
Flat Griddles	2302003100	0.27	0.00	0.55	0.00073	0.00000	0.00150
Clamshell Griddles	2302003200	0.00	0.00	0.00	0.00001	0.00000	0.00000
Oil and Gas Production							
Oil Production	2310010000	291.68	133.41	112.06	0.91889	0.36550	0.30702
Gas Production	2310020000	0.94	0.00	0.00	0.00308	0.00000	0.00000
Gas Production - 4 stoke Compressors	20200253	0.00	0.21	0.33	0.00001	0.00058	0.00090
Gas Production - 2 stoke Compressors	20200252	0.01	0.09	0.02	0.00002	0.00025	0.00005
Oil/Gasoline Pipelines	2505040000	1.33	0.00	0.00	0.00364	0.00000	0.00000
Truck Idling							
HDDV Truck Idling - Truck Stops	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Rest Areas	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
HDDV Truck Idling - Picnic Areas	2230070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Gas Cans							
Residential Gas Cans - Permeation	2501000120	1.97	0.00	0.00	0.00540	0.00000	0.00000
Residential Gas Cans - Diurnal	2501000120	19.09	0.00	0.00	0.05229	0.00000	0.00000
Residential Gas Cans - Transport Spillage	2505000120	1.56	0.00	0.00	0.00429	0.00000	0.00000
Commericial Gas Cans - Permeation	2501010120	0.01	0.00	0.00	0.00003	0.00000	0.00000
Commercial Gas Cans - Diurnal	2501010120	0.11	0.00	0.00	0.00029	0.00000	0.00000
Commercial Gas Cans - Transport Spillage	2505010120	0.30	0.00	0.00	0.00082	0.00000	0.00000

Area Source Emissions - Wilson County, 2005

WILSON COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Aboveground Storage Tanks							
Gasoline	2501010120	35.14	0.00	0.00	0.09745	0.00000	0.00000
Aviation Gasoline	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Distillate Fuel Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Underground Storage Tanks							
Gasoline	2501010120	26.21	0.00	0.00	0.07022	0.00000	0.00000
Aviation Gasoline	2501080050	0.00	0.00	0.00	0.00000	0.00000	0.00000
Jet Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Kerosene	2501010180	0.00	0.00	0.00	0.00000	0.00000	0.00000
Used Oil	2501010030	0.00	0.00	0.00	0.00000	0.00000	0.00000
New Oil	2501010060	0.00	0.00	0.00	0.00000	0.00000	0.00000
Hydraulic Lift Oil	2501010090	0.00	0.00	0.00	0.00000	0.00000	0.00000
Leaking Underground Tanks	2660000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Coating (Painting) Operations							
Flat Paints	2401001001	5.58	0.00	0.00	0.01718	0.00000	0.0000
Nonflat Paints - Low Gloss	2401001005	2.71	0.00	0.00	0.00835	0.00000	0.0000
Nonflat Paints - Medium Gloss	2401001005	4.99	0.00	0.00	0.01535	0.00000	0.0000
Nonflat Paints - High Gloss	2401001006	2.61	0.00	0.00	0.00804	0.00000	0.0000
Primers, Sealers, and Undercoaters	2401001010	3.16	0.00	0.00	0.00973	0.00000	0.0000
Quick Dry - Primers, Sealers, and Undercoaters	2401001011	1.06	0.00	0.00	0.00327	0.00000	0.0000
Stains - Semitransparent	2401001015	8.29	0.00	0.00	0.02550	0.00000	0.0000
Quick Dry - Enamels	2401001020	3.36	0.00	0.00	0.01034	0.00000	0.0000
Lacquers - Clear	2401001025	0.33	0.00	0.00	0.00102	0.00000	0.0000
All Other Architectural Categories	2401001050	21.65	0.00	0.00	0.06658	0.00000	0.0000
Thinning & Clean-up of Solvent-Based Arch Co	2401100001	8.89	0.00	0.00	0.02733	0.00000	0.0000
Auto Refinishing	2401005000	3.66	0.00	0.00	0.01570	0.00000	0.00000
Traffic Markings	2401008000	1.55	0.00	0.00	0.00870	0.00000	0.00000
Factory Finished Wood	2401015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Wood Furniture	2401020000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Furniture	2401025000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Paper, Foil, And Film	2401030000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Metal Cans	2401040000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Sheet, Strip, and Coil	2401045000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Machinery and Equipment	2401055000	1.26	0.00	0.00	0.00483	0.00000	0.00000
Appliances	2401060000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Electronic and Other Electrical	2401065000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Motor Vehicles	2401070000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Aircraft	2401075000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Marine	2401080000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Railroad	2401085000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Miscellaneous Manufacturing	2401090000	2.40	0.00	0.00	0.00502	0.00000	0.00000
					0.00985		
Surface Cleaning Cold Cleaning - General	2415300000	6.17	0.00	0.00	0.01977	0.00000	0.00000
Graphic Arts	2425000000	0.22	0.00	0.00	0.00086	0.00000	0.00000
Dry Cleaning							
Dry Cleaning - Perchloroethylene	2420000000	0.00	0.00	0.00	0.00	0.00	0.00
Dry Cleaning - Petroleum	2420000000	0.00	0.00	0.00	0.00	0.00	0.00
Dry Cleaning - DF-2000 Solvent	2420000000	0.00	0.00	0.00	0.00	0.00	0.00
Dry Cleaning - Ecosolve Solvent	2420000000	0.00	0.00	0.00	0.00	0.00	0.00
Dry Cleaning - Dri-rite Solvent	2420000000	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt							
Cutback Asphalt	2461021000	205.37	0.00	0.00	0.67251	0.00000	0.00000
Emulsified Asphalt	2461022000	50.80	0.00	0.00	0.05995	0.00000	0.00000
Asphalt Roofing	2461023000	1.07	0.00	0.00	0.00411	0.00000	0.00000

Area Source Emissions - Wilson County, 2005

WILSON COUNTY AREA SOURCES	SCC Code	VOC (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/day (Mon. - Fri.))	NOx (tons/day (Mon. - Fri.))	CO (tons/day (Mon. - Fri.))
Consumer/Commercial Solvent Use							
Personal Care Solvents	2465100000	25.39	0.00	0.00	0.06957	0.00000	0.00000
Household Solvents	2465200000	16.83	0.00	0.00	0.04610	0.00000	0.00000
Automotive Solvents	2465400000	10.86	0.00	0.00	0.02976	0.00000	0.00000
Adhesives Application: Industrial	2440020000	4.28	0.00	0.00	0.01173	0.00000	0.00000
FIFRA Solvents	2460890000	7.80	0.00	0.00	0.02137	0.00000	0.00000
Coating Solvents	2460520000	28.61	0.00	0.00	0.07837	0.00000	0.00000
Misc.Solvents	2460900000	9.18	0.00	0.00	0.02515	0.00000	0.00000
Service Stations							
Service Stations - Tank Truck Unloading	2501060053	37.60	0.00	0.00	0.12250	0.00000	0.00000
Service Stations - Vehicle Refueling	2501060100	37.86	0.00	0.00	0.10542	0.00000	0.00000
Service Stations - Tank Breathing Loss	2501060201	9.84	0.00	0.00	0.02696	0.00000	0.00000
Service Stations - Tank Trucks in Transit	2505030120	0.74	0.00	0.00	0.00240	0.00000	0.00000
Waste Disposal							
Municipal Waste Landfills	2620000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Municipal Wastewater Treatment	2630000000	2.46	0.00	0.00	0.00684	0.00000	0.00000
Fires							
Open Burning - Agricultural	2801500000	33.54	5.82	214.44	0.00439	0.00326	0.05102
Manage Burning - Slash	2810005000	0.00	0.00	3.59	0.00000	0.00000	0.00985
Prescribed Burning - Forest Management	2810015000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Prescribed Burning - Rangeland	2810020000	50.43	7.64	773.05	0.06248	0.00946	0.95781
Structural Fires	2810030000	0.08	0.01	0.45	0.00023	0.00003	0.00123
Motor Vehicle Fires	2810050000	0.04	0.00	0.14	0.00010	0.00001	0.00039
Open Burning - Residential Household Waste	2610030000	65.52	13.10	185.64	0.17951	0.03590	0.50860
Open Burning - Yard Waste	2610000500	2.08	0.00	11.17	0.00571	0.00000	0.03059
Catastrophic/Accidental Releases	2830000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
Explosive Detonation	2311000030	0.00	0.00	0.00	0.00000	0.00000	0.00000
Autobody Incineration	2601000000	0.00	0.00	0.00	0.00000	0.00000	0.00000
TOTAL AREA SOURCES		**1,191.37**	**389.20**	**1,665.80**	**3.01081**	**0.96129**	**1.92011**

CHAPTER 5 – BIOGENIC EMISSIONS

Introduction

Emissions from natural sources such as vegetation and microbial activity are categorized as biogenic sources. This emission source is the only source that is entirely a non-anthropogenic related source. Some examples include trees and grasses, as well as emissions from activities of microbes in soil.

The 2005 AACOG region's biogenic emissions are the same as the 2002 Emission Inventory and are estimated using the BEIS3.12 model. Also used in generating of the biogenic estimates, were the 2001 annual meteorology, the recently revised BEIS3.12 emission factors, and the BELD3 land use data that was aggregated to a 36-km grid system. The mesoscale model (MM5 model[1]) and the MCIP preprocessor to the CMAQ model were applied to compute the meteorology data. The BEIS3.12 model uses the following data from the MCIP's outputs: air temperature at 10 meters, surface pressure, solar radiation reaching the surface, convective precipitation, soil temperature in the top centimeter, volumetric soil moisture in the top centimeter, and soil texture type by USDA.[2] This method provided annual biogenic emissions.

The data provided by the TCEQ included annual, monthly and daily ozone season biogenic emissions. This data was presented in an Excel spreadsheet format[3]. From the annual emissions, monthly emissions were calculated which were then used to estimate average ozone season daily emissions. Daily emissions were determined by adding the monthly totals for June, July, and August and then dividing the total for three months by 92. This number represents the number of days in the three months. Table 5-1 details the annual and daily biogenic emissions for the AACOG region.

Table 5-1. 2005 Annual and Daily Tonnage of Biogenic Emissions in AACOG Region

County	Tons/Year			Tons/Day		
	VOC	NOx	CO	VOC	NOx	CO
Atascosa	14,740.5	1,572.8	4,213.0	72.57	5.40	19.54
Bandera	14,491.2	758.1	2,734.8	80.97	2.71	13.70
Bexar	12,356.0	1,063.4	3,229.3	63.60	3.74	15.43
Comal	7,936.1	441.4	1,979.6	42.04	1.59	9.75
Frio	17,114.3	1,616.2	4,509.7	85.37	5.60	21.06
Gillespie	9,014.7	951.0	2,631.3	49.32	3.44	13.61
Guadalupe	7,716.2	831.8	2,255.2	38.83	2.98	10.65
Karnes	10,449.9	1,074.6	2,753.8	51.52	3.72	12.56
Kendall	9,137.7	616.0	2,287.4	49.42	2.23	11.50
Kerr	11,261.1	1,033.5	3,051.5	61.10	3.76	15.56
Medina	18,302.1	1,460.0	4,452.9	95.32	5.13	21.41
Wilson	9,744.8	1,112.0	2,766.7	48.36	3.89	12.86

[1] Pennsylvania State University / National Center for Atmospheric Research (PSU/NCAR), mesoscale model (MM5), available at: http://www.mmm.ucar.edu/mm5/, 2/4/2008

[2] Texas Commission on Environmental Quality, June 2004. "County and month specific biogenic emissions defaults for CERR submittal", Austin, Texas.

[3] Rubick, C., Texas Commission on Environmental Quality. Email: "Re: Request for Biogenic Emission Data." Received June 2, 2004.

CHAPTER 6 - POINT SOURCE EMISSIONS

Introduction
The point source inventory is comprised of stationary sources engaging in industrial or commercial activities. The owner or operator of an account or source in the State of Texas that emits or has the potential to emit 100 tons per year or more of any contaminant has to submit emissions inventories and/or related data.[1]

Methodology
The point source emissions for the AACOG region were estimated with the assistance of the Texas Commission on Environmental Quality (TCEQ) and City Public Service (CPS) gas and electric utility company, which is owned by the City of San Antonio. TCEQ provided a list of point source emitters in each of the twelve counties within the AACOG region. This list is a section of the Point Sources Database (PSDB) maintained for the entire state of Texas. The list contains annual and daily emission estimates of VOC, NOx, and CO by county.

CPS provided emission estimates for its power plants within Bexar County.[2] These estimates were used to replace the data originally provided by the TCEQ. The figures were then aggregated for each pollutant to arrive at annual and daily tonnage of emissions.

[1] Texas Administrative Code, December 23, 1999. Title 30, Part 1, Chapter 101, Subchapter A, Rule §101.10 Emissions Inventory Requirements. Available online:
Available online http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=2&ti=30
[2] Levesque, Cynthia A. 2005. Email Communication, City Public Service: San Antonio, Texas.

MAJOR POINT SOURCES IN THE AACOG REGION

ATASCOSA COUNTY	VOC ton/yr.	NOx ton/yr.	CO ton/yr.	VOC ton/day	NOx ton/day	CO ton/day
EOG RESOURCES INC	1.244	7.088	11.092	0.00062	0.02878	0.04447
PUEBLO MIDSTREAM GAS CORP	49.289	252.388	171.0364	0.02464	0.69339	0.46988
SAN MIGUEL ELCTRC COOPERATIVE INC	37.019	6702.000	1089.000	0.01851	20.62154	3.35077
TOTAL	**87.552**	**6961.476**	**1271.129**	**0.02527**	**0.72217**	**0.51435**

BANDERA COUNTY	VOC ton/yr.	NOx ton/yr.	CO ton/yr.	VOC ton/day	NOx ton/day	CO ton/day
EPGT TEXAS PIPELINE CO, L.P.	13.857	1050.432	784.643	0.00693	2.77050	2.13882
TOTAL	**13.857**	**1050.432**	**784.643**	**0.00693**	**2.77050**	**2.13882**

BEXAR COUNTY	VOC ton/yr.	NOx ton/yr.	CO ton/yr.	VOC ton/day	NOx ton/day	CO ton/day
AGE REFINING INC	50.8746	13.7703	2.6016	0.0254	0.0376	0.0064
ALAMO CEMENT CO LTD	33.1096	2,514.6450	1,112.8000	0.0166	6.8894	3.0488
ALCOA INC	49.0879	101.7982	60.8376	0.0245	0.2789	0.1667
BESSER-APPCO FABRICATION	23.8800	0.0000	0.0000	0.0119	0.0000	0.0000
BFI WASTE SYSTEMS OF NORTH AMERICA	13.5860	9.9730	33.2440	0.0068	0.0273	0.0911
BIO ENERGY (AUSTIN) LLC	2.9220	10.5360	35.1720	0.0015	0.0000	0.0000
CAPITOL AGGREGATES LTD	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAPITOL CEMENT DIV CAPITOL AGGREGATE	135.5989	2,153.5397	648.0374	0.0678	5.9001	1.7754
CARDELL CABINETS INC	142.2100	2.4200	2.4200	0.0711	0.0066	0.0066
CITGO PETROLEUM CORP	59.3788	0.0000	0.0000	0.0297	0.0000	0.0000
CITY PUBLIC SERVICE - SOMMERS DEELY SPRUCE	159.0301	0.0000	2,020.4900	0.4381	0.0000	6.4204
CITY PUBLIC SERVICE - V H BRAUNIG	16.3291	830.6980	121.1000	0.4381	2.2759	0.5490
CITY PUBLIC SERVICE - W B TUTTLE	1.0408	0.0000	26.0100	0.0450	0.0000	0.2315
CITY PUBLIC SERVICE BOARD - LEON CREEK	0.0000	0.0000	0.0000	0.0029	0.0000	0.0000
CITY PUBLIC SERVICE BOARD - MISSION	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MAJOR POINT SOURCES IN THE AACOG REGION

COLONIAL CAKE CO	53.6945	3.2673	2.7948	0.0268	0.0128	0.0108
COLUMBIA INDUSTRIES INC	6.4097	0.6570	0.0134	0.0032	0.0018	0.0004
DEE HOWARD AIRCRAFT MAINTENANCE LP	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EARTH GRAINS BAKING CO	31.2537	1.3279	1.1153	0.0156	0.0045	0.0038
EL PASO HYDROCARBONS	17.8062	155.4649	17.7431	0.0089	0.4312	0.0525
EXXONMOBIL CORPORATION 6	28.7461	0.1679	0.4197	0.0144	0.0005	0.0011
KO STEEL FOUNDRY AND MACHINE CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MARTIN MARIETTA MATERIALS	46.6919	18.8200	66.3900	0.0233	0.0607	0.2229
MOTIVA ENTERPRISES, L.L.C.	40.4595	4.5427	10.3347	0.0202	0.0119	0.0271
PERKINELMER AUTOMOTIVE RESEARCH INC	22.2666	24.2571	131.0361	0.0111	0.0665	0.3590
RANDOLPH AIR FORCE BASE	52.8448	11.4410	24.6336	0.0264	0.0314	0.0675
SAN ANTONIO WATER SYSTEM	0.4400	7.4800	6.5500	0.0002	0.0144	0.0121
SAS SHOEMAKERS, INC.	10.5502	0.0000	0.0000	0.0053	0.0000	0.0000
SONY SEMICONDUCTOR CO OF AMERICA	10.6796	6.6743	7.8535	0.0053	0.0055	0.0043
SOUTHWEST RESEARCH INSTITUTE	58.5900	255.8800	172.1910	0.0293	0.7010	0.4718
THE BOEING COMPANY	38.3950	1.7687	1.3400	0.0192	0.0074	0.0043
US AIR FORCE	46.2037	356.0581	172.3990	0.0231	1.2747	0.6251
US ARMY FORT SAM HOUSTON	6.4637	29.3451	20.3249	0.0032	0.0432	0.0243
USAA	3.5144	63.2716	52.2587	0.0018	0.1733	0.1432
USNR DBA FRIEDRICH AIR CONDITIONING	18.2988	0.0294	0.0269	0.0091	0.0001	0.0001
VALERO LOGISTICS OPERATION LP	73.1861	1.1124	6.0530	0.0366	0.0023	0.0123
VALERO MARKETING & SUPPLY CO	40.1633	3.7242	5.6958	0.0201	0.0102	0.0156
VERTIS INCORPORATED	29.7200	5.4920	3.8080	0.0149	0.0115	0.0104
WASTE MANAGEMENT OF TEXAS, INC.	43.0890	9.0100	63.1900	0.0215	0.0250	0.1782
WIN-SAM INC	5.0374	33.1357	14.3573	0.0025	0.1589	0.0709
ZEE MANUFACTURING CO	8.1338	0.6140	0.5157	0.0041	0.0000	0.0000
ZEE MANUFACTURING LTD	107.5971	0.0285	0.0219	0.0538	0.0000	0.0000
TOTAL	**1487.283**	**6630.950**	**4843.779**	**0.08673**	**7.23324**	**3.31288**

COMAL COUNTY	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
	ton/yr.	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**
SUNBELT ASPHALT AND MATERIALS, INC.	0.0192	0.0000	0.0000	0.0000	0.0000	0.0000
TXI OPERATIONS, L.P.	59.4169	1,319.8381	709.9924	0.0297	3.6160	1.9452
CHEMICAL LIME	2.2610	581.1000	248.9400	0.0011	1.6047	0.7090

MAJOR POINT SOURCES IN THE AACOG REGION

CEMEX CEMENT OF TEXAS, LP	43.4300	2,268.4500	1,549.0700	0.0217	6.2150	4.2440
NEW BRAUNFELS GENERAL STORE INTL	20.4615	0.0000	0.0000	0.0102	0.0000	0.0000
FLEXTRONICS ENCLOSURES, INC.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TOTAL	**125.589**	**4169.388**	**2508.002**	**0.063**	**11.436**	**6.898**

FRIO COUNTY	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
	ton/yr.	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**
J L DAVIS	15.687	54.347	83.724	0.00784	0.16177	0.24911
MEDINA ELECTRIC COOPERATIVE INC	1.754	89.317	26.795	0.00088	0.36589	0.12426
TOTAL	**17.441**	**143.664**	**110.519**	**0.00872**	**0.52766**	**0.37337**

GILLESPIE COUNTY	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
	ton/yr.	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**
	n/a	n/a	n/a	n/a	n/a	n/a
TOTAL	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

GUADALUPE COUNTY	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
	ton/yr.	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**
ACME BRICK COMPANY	5.600	16.660	75.160	0.00280	0.04564	0.20592
DUKE ENERGY FIELD SERVICES, L.P.	15.630	40.940	14.040	0.00782	0.11216	0.03846
GUADALUPE POWER PARTNERS LP	4.103	570.500	33.884	0.00205	1.92231	0.11417
MOTOROLA, INCORPORATED	0.000	0.000	0.000	0.00000	0.00000	0.00000
RIO NOGALES POWER PROJECT L P	1.510	133.010	9.330	0.00076	1.18513	0.31403
STANDARD GYPSUM LLC	44.820	61.200	49.550	0.02241	0.16636	0.13464
STRUCTURAL METALS INC	119.188	205.759	716.790	0.05959	0.57837	2.03937
XERXES CORPORATION	52.400	0.000	0.000	0.02620	0.00000	0.00000
TOTAL	**171.588**	**205.759**	**716.790**	**0.08579**	**0.57837**	**2.03937**

MAJOR POINT SOURCES IN THE AACOG REGION

KARNES COUNTY	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
	ton/yr.	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**
DUKE ENERGY FIELD SERVICES	29.1450	71.9080	13.5805	0.0360	0.0068	0.0000
EPGT TEXAS PIPELINE LP	22.9680	210.9800	120.8300	0.1055	0.0604	0.4075
GULF ENERGY GATHERING AND PROCESSING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
INDUSTRIAL PIPE & PLASTICS	1.7043	0.0000	0.0000	0.0000	0.0000	0.0000
INDUSTRIAL PIPE AND PLASTICS	5.3700	0.0000	0.0000	0.0000	0.0000	0.0000
PERSON-PANNA MARIA LLC	10.0111	32.0800	5.6900	0.0160	0.0028	0.0156
RED EWALD INC	29.6900	0.0000	0.0000	0.0000	0.0000	0.0000
TOTAL	**98.888**	**314.968**	**140.101**	**0.15748**	**0.07005**	**0.42310**

KENDALL COUNTY	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
	ton/yr.	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**
OASIS PIPELINE COMPANY TEXAS LP	1.560	0.050	0.020	0.00078	0.00000	0.00000
TOTAL	**1.560**	**0.050**	**0.020**	**0.00078**	**0.00000**	**0.00000**

KERR COUNTY	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
	ton/yr.	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**
TOTAL	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

MEDINA COUNTY	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
	ton/yr.	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**
TOTAL	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

WILSON COUNTY	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
	ton/yr.	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**

MAJOR POINT SOURCES IN THE AACOG REGION

PULLIN LEASE SERVICE INC	2.900	0.000	0.000	0.00145	0.00000	0.00000
TOTAL	**2.900**	**0.000**	**0.000**	**0.00145**	**0.00000**	**0.00000**

	VOC	**NOx**	**CO**	**VOC**	**NOx**	**CO**
AACOG Region	**ton/yr.**	**ton/yr.**	**ton/yr.**	**ton/day**	**ton/day**	**ton/day**
TOTAL	**2042.489**	**19887.842**	**10465.964**	**1.20950**	**40.97987**	**23.42921**

CHAPTER 7 – ON-ROAD EMISSIONS

Introduction

The vehicles, cars, trucks, buses, and motorcycles, traveling the regional roads and highways, generate on-road emissions. In the AACOG region, on-road sources contribute VOC, NOx, and CO anthropogenic emissions.

Methodology

To estimate on-road emissions for the Alamo Area, the Texas Transportation Institute (TTI) used MOBILE6.2 to calculate emissions for the San Antonio Early Action Compact (EAC) area containing Bexar, Comal, Guadalupe, and Wilson counties. The other eight counties, Atascosa, Bandera, Frio, Gillespie, Karnes, Kendall, Kerr, and Medina, are included in the rural county report.

The following technical notes document the methods used in developing and estimating the on-road mobile source emissions, including ozone season weekday and annual estimates.

2005 Three-Year Cycle, On-Road Mobile Source Actual Annual, and Summer Season Weekday Emissions Inventories For the San Antonio EAC Counties

2005 Three-Year Cycle, On-Road Mobile Source Actual Annual, and Summer Season Weekday Emissions Inventories For 216 Attainment Counties in Texas

DRAFT

2005 Three-Year Cycle, On-Road Mobile Source Actual Annual, and Summer Season Weekday Emissions Inventories For the San Antonio EAC Counties

DRAFT

2005 Three-Year Cycle, On-Road Mobile Source Actual Annual, and Summer Season Weekday Emissions Inventories For 216 Attainment Counties in Texas

Texas Transportation Institute

2005 Three-Year Cycle, On-Road Mobile Source Actual Annual, and Summer Season Weekday Emissions Inventories For the San Antonio EAC Counties

TEXAS TRANSPORTATION INSTITUTE
THE TEXAS A&M UNIVERSITY SYSTEM
COLLEGE STATION, TEXAS

Sponsored by the
Texas Commission
On Environmental Quality
August 2006

DEVELOPMENT OF 2005 THREE-YEAR CYCLE, ON-ROAD MOBILE SOURCE ACTUAL ANNUAL, AND SUMMER SEASON WEEKDAY EMISSIONS INVENTORIES FOR THE SAN ANTONIO EARLY ACTION COMPACT AREA COUNTIES

Prepared for the
Texas Commission on Environmental Quality

Prepared by the Texas Transportation Institute
TTI Study No.: 402231-02
Study Title: Air Quality Research Assistance 2006
(Umbrella Contract 70880-06-02)

August 2006

TEXAS TRANSPORTATION INSTITUTE
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College Station, Texas 77843-3135

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INTRODUCTION

The Texas Commission on Environmental Quality (TCEQ) works with local planning districts, the Texas Department of Transportation (TxDOT), and the Texas Transportation Institute (TTI) to provide on-road mobile source emissions inventories of air quality pollutants. TxDOT typically funds transportation conformity determinations required under 40 CFR part 93, and TCEQ typically funds mobile source inventory work in support of the Federal Clean Air Act requirements for attainment of the National Ambient Air Quality Standards (NAAQS, 42 USCA 7409).

Accurate emissions inventories are critical if state, local, and federal agencies are to attain and then maintain the NAAQS that the U.S. Environmental Protection Agency (EPA) has established for criteria pollutants such as ozone, particulate matter, and carbon monoxide. EPA has recently combined the Periodic Emission Inventory (PEI) and the National Emission Inventory (NEI) requirements into a single emission inventory (EI) requirement, which is detailed in a Federal Register and called the Consolidated Emission Reporting Rule (CERR).

The CERR was published in the Federal Register on Monday, June 10, 2002 (FR Volume 67, Number 111, pp 39602 - 39616). EPA's action simplifies and consolidates EI reporting requirements by placing them in a single location within the Code of Federal Regulations (CFR), establishes new reporting requirements related to PM-2.5 and regional haze, and establishes new requirements for the statewide reporting of area source and mobile source emissions.

Background

Under the CERR, states are required to prepare a comprehensive statewide inventory every three years. The EPA has reviewed and finalized the Texas 2002 CERR EIs. The 2005 CERR EIs are due to the EPA by June 2007. The EPA requires specific quality assurance (QA) procedures and consolidation of all source categories into a single submission. TCEQ needs the time between August 2006 and June 2007 to perform the consolidation and QA procedures. The purpose of this task is to provide the requisite on-road mobile source 2005 evaluation year EIs needed for Texas under the CERR.

This is the same set of on-road mobile source EIs that Texas developed for the previous (1993, 1996, 1999, and 2002) three-year cycle evaluation years, which included estimates of annual emissions and seasonal weekday emissions (i.e., summer, peak ozone, or peak carbon monoxide [CO] season, depending on county) for each Texas county. These evaluation year EIs through 1999 were developed to fulfill the Clean Air Act Amendment (CAAA) PEI requirements for Texas nonattainment counties and to update the Texas portion of the EPA's NEI; and the 2002 EIs were developed to fulfill the CERR requirements that replaced the PEI and NEI. The seasonal weekday EIs were developed using the detailed, link-based time-of-day methodology for the ozone and CO nonattainment counties (and beginning with the 2002 evaluation, Early Action Compact [EAC] counties with complete travel models); and the Highway Performance Monitoring System (HPMS)-based methodology was used for the remaining Texas counties.

Noted differences for this 2005 evaluation, in comparison to the 2002 evaluation year product, were the use of emissions factors modeled with EPA's latest release of MOBILE6

(MOBILE6.2.03, September 2003), whereas the October 2002 official version was previously used; and emissions were estimated at the MOBILE6 pollutant sub-component level. There are no major methodological or geographical differences between the 2002 and the 2005 CERR inventory development. However, local activity, meteorological, fuels, fleet characteristics, and other inputs were updated for the 2005 evaluation. Additionally, a refinement of the annual emissions methodology was incorporated, which used meteorological and fuels input estimates for 12 (monthly) periods as opposed to the previous use of two (summer and winter) seasonal periods.

The 2005 CERR EIs were produced based on the methods consistent with the prior 2002 CERR EI analysis, the pertinent EPA requirements, and as agreed upon and in consultation with the TCEQ Project Manager. Guidance on the development of actual EIs also came from the *User's Guide to MOBILE6.1 and MOBILE6.2*, EPA, August 2003; *Technical Guidance on the Use of MOBIL6.2 for Emission Inventory Preparation*, EPA, August 2004; *Procedures for Emission Inventory Preparation, Volume IV, Mobile Sources*, EPA, 1992; and *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations*, EPA, August 2005.

Task Description

This task developed the 2005 summer (ozone) season weekday emissions estimates for all counties and winter (CO) season weekday estimates for the El Paso CO nonattainment county. The estimates were developed using the travel demand model (TDM) network link-based methodology for nonattainment and EAC counties, where such counties had complete TDM networks, and the HPMS virtual link-based method was used for the remaining Texas counties. This task also developed the 2005 annual emissions estimates using a method and data that take into account seasonal variation in source activity, climate, and fuel parameters. (Exception: Dallas/Fort Worth (DFW) Consolidated Metropolitan Statistical Area (CMSA) County EIs, as specified by TCEQ, were to be developed by the North Central Texas Council of Governments (NCTCOG) and were excluded from this task.)

With the exception of the DFW CMSA counties, this task included the estimation, documentation, and reporting of 2005 emissions on a summer (ozone) season weekday basis and annual basis for each Texas county, as well as a winter (CO) season weekday estimate for El Paso County. The following task activities were completed:

- prepare emissions estimates for each county by roadway type and vehicle type;

- prepare emissions estimate summary files for each county by vehicle type and roadway type, vehicle miles traveled (VMT), average speed weighted by VMT, and emissions estimate totals for volatile organic compounds (VOC), oxides of nitrogen (NOx), CO, lead (Pb), particulate matter of both 10 microns or less and 2.5 microns or less in diameter (PM-10 and PM-2.5), ammonia (NH_3), and sulfur dioxide (SO_2);

- prepare documentation, complete and self contained, including electronic data files, consistent in format and level of detail in the latest TTI emissions estimation reports; and

- prepare electronic EI data reporting files as specified in the latest EPA electronic data reporting format guidance, and in coordination with the TCEQ Project Manager.

This Technical Note for the San Antonio EAC counties is one of seven reports (by geographic area) documenting development of the 2005 CERR on-road mobile source EIs for 242 Texas counties (all Texas counties except for the 12 DFW CMSA counties). Separate EI analyses were performed and documented for seven areas — six nonattainment or EAC areas comprising 26 counties, and the seventh area consisting of the remaining 216 Texas counties. The analysis includes both summer weekday and annual emissions estimates for VOC, CO, NOx, NH_3, SO_2, PM-10, and PM-2.5 (including summaries by the pollutant sub-components available in MOBILE6). The results were also included in EPA's NEI version 3.0 (NIFv3.0) reporting format.

The six nonattainment and EAC areas in the analysis are: the Beaumont/Port Arthur (BPA), Houston/Galveston (HGB), and El Paso (ELP) ozone nonattainment areas; and the Austin (AUS), San Antonio (SAN), and Northeast Texas (TLM) EAC areas. (CO season weekday estimates were also developed for El Paso.) Analysis for these six areas consists of 18 TDM link-based counties and eight HPMS-based counties (see Table 1).

Table 1
Delineation of County-Level Emissions Analyses by Region and Activity Basis

Area	Counties[1]	Activity Basis
1. Houston/Galveston Nonattainment Area	Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller	TDM
2. Beaumont/Port Arthur Nonattainment Area	Jefferson, Hardin, Orange	TDM
3. El Paso Nonattainment Area	El Paso	TDM
4. Austin EAC Area	Hays, Travis, Williamson Bastrop, Caldwell	TDM HPMS
5. San Antonio EAC Area	Bexar Comal, Guadalupe, Wilson	TDM HPMS
6 Northeast Texas EAC Area	Gregg, Smith Harrison, Rusk, Upshur	TDM HPMS
7. Remainder of Texas	216 counties	HPMS
Totals by Activity Basis	18 224	TDM HPMS

[1] DFW CMSA was excluded (Collin, Dallas, Denton, Ellis, Henderson, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, and Tarrant).

Documented in this technical note are the methods relating to calculating inventory elements including VMT, speeds, VMT mix, MOBILE6 emissions factors, and weekday and annual emissions estimates.

ACKNOWLEDGMENTS
Dennis Perkinson, Ph.D., and Martin Boardman, of TTI, contributed to the development of the MOBILE6 emissions factors input data parameter values. L.D. White, of TTI, developed computer program routines for various elements of the data-processing requirements. Dr. Perkinson developed the summer weekday VMT control totals, hourly VMT distributions, and VMT mix. White and Boardman processed the VMT and modeled operational speeds, and Boardman performed the emissions factors and emissions analyses. Gary Lobaugh, of TTI, was responsible for editing, design, and production of this Technical Note. Debbie Spillane of TTI provided editorial comment. Each member of the assigned TTI staff, including Teresa Qu, P.E., contributed to the quality assurance of the EI elements. Dr. Perkinson was the principle investigator for this project. This work was performed by TTI under contract to TCEQ. Mary McGarry-Barber was the TCEQ Project Manager.

Deliverables
Interim deliverables are an informal Technical Note (a narrative in memorandum format that explains the task, the approaches used, and the findings) provided to the Project Manager in WordPerfect format, and supported by electronic document files. All pertinent data are being submitted in specified electronic format. (There is no FORTRAN source code or executable files developed under this task.) CD-ROM or other electronic media is used to record the final data and supporting documentation. TTI is providing five copies of the final report. One of the copies is an unbound original suitable for copying. Electronic copies of all materials related to the task report to document results and conclusions (e.g., data, work files, text files, etc.), or developed as work products under this contract are provided as requested by the TCEQ staff.

The electronic data submittal (described in Appendix A) is included on an accompanying CD-ROM. The electronic data submittal was for all 242 counties in the analysis and includes the detailed emissions data summaries, emissions factors input and output files, annualization factors, climate and fuel parameter inputs and worksheets, and NIFv3.0 emissions files and descriptions.

SUMMARY RESULTS
VOC, CO, NOx, SO_2, NH_3, PM-10, and PM-2.5 emissions estimates at the vehicle type and road type level were estimated for the San Antonio EAC area counties for a typical 2005 ozone season weekday and for the year. Tables 2 and 3 show the 2005 county-level estimates of VMT and emissions (pollutant totals) for these periods. Appendix A describes the detailed EI data summaries (i.e., by vehicle type, road type, and pollutant sub-component), as provided on CD-ROM.

Table 2
San Antonio EAC Area 2005 Summer Weekday Emissions (pounds)

County	VMT	Speed	VOC	CO	NOx	SO_2	NH_3	PM-10	PM-2.5
Bexar	39,485,897	31.5	81,602.0	899,426.2	180,573.1	2,222.2	8,066.4	4,649.7	3,169.7
Comal	3,688,891	46.3	6,788.9	89,264.7	18,223.2	204.4	754.7	428.8	291.4
Guadalupe	3,354,207	44.6	6,546.6	83,773.9	16,552.8	184.2	686.1	387.7	263.1
Wilson	992,552	42.0	1,994.3	23,626.6	3,660.3	50.8	203.9	109.1	73.1
Total	**47,521,547**		**96,931.8**	**1,096,091.4**	**219,009.4**	**2,663.6**	**9,714.1**	**5,565.3**	**3,794.8**

Table 3
San Antonio EAC Area 2005 Annual Emissions (tons)

County	VMT	Speed	VOC	CO	NOx	SO_2	NH_3	PM-10	PM-2.5
Bexar	13,238,008,859	31.5	15,214.8	184,105.1	31,313.3	356.0	1,352.4	780.5	532.2
Comal	1,236,734,264	46.3	1,249.0	17,850.0	3,167.8	32.7	126.5	72.0	48.9
Guadalupe	1,124,528,588	44.6	1,201.9	16,733.4	2,875.9	29.5	115.0	65.1	44.2
Wilson	332,762,116	42.0	366.8	4,763.5	632.3	8.1	34.2	18.3	12.3
Total	**15,932,033,827**		**18,032.5**	**223,452.0**	**37,989.3**	**428.3**	**1,631.1**	**925.9**	**635.1**

Details on the development of the EI results are organized in the following seven main sections: overview of methodology, estimation of summer weekday VMT, estimation of link speeds, estimation of VMT mix, estimation of summer weekday emissions factors, estimation of annualization factors, and emissions calculations.

OVERVIEW OF METHODOLOGY

Developing the on-road mobile source 2005 EIs required using two basic methods — one for the summer weekday emissions estimates and one for the annual estimates.

For the summer weekday emissions estimates, the directional, roadway network link-based, hourly methodology was used. The emissions basis for each county was further distinguished as either link or virtual link, depending on whether a complete TDM was available. Emissions were calculated for each hour of the average summer weekday (June through August, Monday through Friday) by TDM network link for Bexar County, and by virtual link, or HPMS functional class/area type combination, for Comal, Guadalupe, and Wilson counties. In general, emissions were calculated as the product of source (on-road fleet) VMT, vehicle class VMT fraction, and vehicle class emissions factors in units of grams per mile (g/mi). These hourly emissions estimates were summed across hours to produce the 24-hour summer weekday emissions by vehicle type, road type, pollutant, and emissions type (sub-component, e.g., exhaust running, start, evaporatives).

Annual emissions were then produced as a conversion of the 24-hour summer weekday emissions summaries, using annualization factors consisting of two components — VMT and emissions rates. Multiplying county 24-hour summer weekday emissions by the appropriate VMT and emissions rate annualization factors (accounting for seasonal variation in activity, meteorology, fuels, and fleet makeup) produced the annual emissions estimates.

The summer weekday, hourly, link-based analysis required development of three major elements — hourly emissions factors, hourly vehicle fleet link VMT and speeds, and 24-hour VMT mix (VMT fractions by the 28 MOBILE6 vehicle classes). TTI developed the emissions factors using MOBILE6 as incorporated in TTI's POLFAC utility, which outputs results in the form of lookup tables (indexed by speed, hour, road type, vehicle type, pollutant, and emissions type) for input to the emissions calculations. TTI developed link-VMT estimates by forecasting county annual average daily traffic (AADT) VMT (actual estimates were not yet available), making necessary adjustments/allocations, and disaggregating to the virtual-link level. Adjustment and allocation factors developed and applied (based on traffic count, vehicle classification count, and other data) include seasonal, directional, time-of-day (hourly), and VMT mix. Link level average operational fleet speeds were estimated using the Dallas speed model (verified for use in other areas), which in general estimates and applies delay (based on link traffic volumes and roadway capacities) to link freeflow (uncongested) speed estimates.

The annual emissions analysis required three major elements — county 24-hour summer weekday emissions, county VMT annualization factor (one for all vehicle types and road types), and county emissions rate annualization factors (one per pollutant, emissions type, and vehicle type). In general, using daily rates, the emissions rate annualization factor is the quotient with annual emissions rate as the numerator (i.e., combined monthly 24-hour average emissions factors to account for seasonal effects) and summer weekday rate as the denominator.

TTI developed and maintains a series of computer programs to calculate and summarize detailed on-road mobile source EIs in various formats, including the EPA's NIFv3.0 format (National Emissions Inventory reporting format, Version 3, EPA, November 2003). Appendix B describes these applications.

ESTIMATION OF SUMMER WEEKDAY VMT

The 2005 VMT estimates, consistent with summer weekday (i.e., average June through August, Monday through Friday) travel, were needed in hourly, directional form, by link (TDM network link or HPMS virtual link) for the summer weekday emissions calculations. The latest available Bexar County 2005 TDM with added intrazonal links, HPMS data, and post-processing factors developed from several other data sources were used with the TRANSVMT (for TDM counties) or VirtualLinkVMT (for non-TDM counties) program to produce hourly VMT (see program descriptions in Appendix B). (Annual VMT estimates from the annual emissions calculations are discussed later in the section on annualization factors.)

For historical (actual) EIs, historical HPMS VMT is used (in the case of TDM-based analyses, to adjust model VMT), however, since the 2005 historical HPMS data were not yet available, forecasts were made for this analysis. Development of the county total VMT forecasts included using annual historical HPMS VMT and population data.

Data Sources

Other than the TDM data sets for the Bexar County analysis, there were two major traffic data sources used for developing the link VMT (and volume) estimates and their adjustment and allocation factors. These are automatic traffic recorder (ATR) counts and HPMS VMT estimates. Both are collected and developed by TxDOT on an on-going basis as part of the larger HPMS data collection program. In addition to these data, U.S. Census and Texas State Data Center (TSDC) county population statistics and projections were used in the 2005 VMT forecasts.

The latest available San Antonio 2005 24-hour, non-directional TDM network traffic assignment, trip matrices, and zonal radii (provided by TxDOT) were used to estimate the Bexar County hourly VMT and volumes by network link (TRANPLAN network assignment May 17, 2000, converted to TRANSCAD May 5, 2003). Since intrazonal VMT are not accounted for in the TDMs, the intrazonal VMT were estimated using the TDM’s trip matrix and zonal radii, and included with added intrazonal links.

HPMS VMT estimates are based on traffic count data collected according to a statistical sampling procedure specified by the Federal Highway Administration (FHWA) for estimating VMT. TxDOT compiles Texas HPMS data in its annual Roadway Inventory Functional Classification Record [RIFCREC] reports. A range of traffic data is collected under the HPMS program. For this study, county total HPMS Annual Average Daily Traffic (AADT) VMT were used. (EPA and FHWA have endorsed HPMS as the appropriate source of VMT and require that VMT used to construct on-road mobile EIs be consistent with that reported through HPMS.)

TxDOT collects ATR vehicle counts at selected locations on a continuous basis throughout Texas. These counts are available by season, month, and day type, as well as on an annual average daily basis (i.e., AADT). Since they are continuous, they are well suited for making seasonal, day-of-week, and time-of-day comparisons (i.e., adjustment factors), even though there may be relatively few ATR data collection locations in any given area.

HPMS VMT estimates are available by county. ATR data are available for most but not all counties. Consequently, the ATR data were aggregated to the TxDOT district level to provide adequate data coverage.

VMT Adjustments

The Bexar County TDM link VMT (originally in average non-summer weekday traffic form, or ANSWT) and Comal, Guadalupe, and Wilson county HPMS virtual link VMT (in AADT form) were adjusted to summer weekday form using summer weekday 2005 county VMT control totals. Hourly travel factors were also developed and used along with directional factors to distribute the VMT by hour-of-day and direction of travel.

VMT Control Totals and Link VMT Adjustment Factors
The summer weekday control totals for each county were produced as the product of the 2005 AADT VMT and the summer weekday factor. The ratio of each county VMT control total to county total unadjusted VMT was used to convert link level unadjusted VMT to summer weekday form.

2005 AADT VMT Forecasts - TTI used its HPMS and population-based method to forecast aggregate county AADT VMT estimates for 2005. The AADT VMT forecast is produced as the combination of two interim forecasts — one based on population, and the other based on the historical, actual HPMS VMT trend.

The VMT per-capita-based forecasts were developed using VMT-to-population ratios (based on 2004 population and 2004 VMT) applied to official TSDC population projections. The growth trend VMT forecasts were developed using traditional regression analyses on historical HPMS AADT VMT data (i.e., from 1990 through 2004). Population-based forecasts (i.e., VMT per capita) tend to under estimate future VMT, especially in small counties adjacent to large urban areas. Conversely, historical-based (i.e., growth trend) forecasts tend to over estimate future VMT, especially in areas where there has been recent atypical rapid growth. These two forecast streams, however, form the range of credible results. The HPMS and population-based VMT forecasting method calls for combining the population-based and historical VMT-based forecast streams with equal weight, and then calibrating the combined forecast result to the latest HPMS historical VMT (2004) data using a step-function adjustment.

Summer Weekday Factor - Since the 2005 VMT forecasts were initially developed in AADT form, a seasonal factor was required to convert from AADT to traffic characteristic of the summer weekday.

Multiple years of TxDOT San Antonio District ATR vehicle counts (i.e., 1999 through 2004) were aggregated to develop an average summer weekday VMT adjustment factor to use with the county AADT VMT estimates. The summer weekday conversion factors, listed in Table 4, were calculated as the ratio of average summer weekday volumes to the AADT volumes.

Table 4
Summer Weekday Factor[1]

District	Adjustment Factor
San Antonio	1.08871

[1] Converts AADT to average June through August, Monday through Friday weekday traffic.

2005 VMT Control Totals and Link VMT Adjustments - Each county AADT VMT forecast was multiplied by its summer weekday factor to produce the county 2005 VMT control totals. For each county, the link VMT adjustment factor was calculated as control total VMT divided by total TDM link VMT. Table 5 lists the total unadjusted TDM VMT, summer weekday VMT control totals, and resulting link VMT adjustment factors.

Table 5
County VMT Totals and Link VMT Adjustment Factors

County	Unadjusted VMT[1]	2005 Summer Weekday VMT	VMT Adjustment Factor
Bexar	38,173,476.210	39,485,897	1.03438044
Comal	3,293,741.306	3,688,891	1.11996986
Guadalupe	3,008,670.409	3,354,207	1.11484694
Wilson	888,052.084	992,552	1.11767318

[1] Bexar County: 2005 TDM network assignment plus intrazonal ANSWT VMT estimate from Bexar links; Comal, Guadalupe, and Wilson counties: latest available (2004) HPMS AADT VMT totals (from TxDOT RIFCREC Report).

For each Bexar County link in the TDM, the volume (VMT for the added intrazonal links) was multiplied by the Bexar County VMT adjustment factor. The adjusted link volumes were then multiplied by the associated link lengths to produce the 2005 link-level HPMS consistent, summer weekday VMT estimates for Bexar County. For the virtual link-based counties, the county VMT on each virtual link in the latest available (2004) RIFCREC data set was multiplied by the associated county VMT adjustment factor.

Hourly and Directional Factors
Hourly and directional travel factors were needed to distribute the 24-hour, non-directional link VMT (and traffic volume) estimates by hour-of-day and by direction of travel (i.e., peak, or dominant direction, and the opposite direction).

Hourly Factors - TTI developed the hourly factors (used to distribute the 24-hour summer weekday VMT and volumes for all counties to each hour of the day) using the multi-year, TxDOT San Antonio District summer weekday ATR data. Using the summer weekday volumes, these factors (24) are the ratio of each hourly volume to the 24-hour volume. Winter weekday travel fractions were developed, using winter weekday volumes (December, January, February) from the same multi-year ATR data, for use in the annual emissions analysis. Appendix C shows the hourly travel factors.

Directional Factors - Directional factors were needed to produce traffic volumes for estimating operational fleet speeds, discussed in the next section, that vary by direction of travel. These directional split factors were multiplied by the link volumes, for the TDM county analysis, or by the virtual link VMT, for HPMS-based counties (for which volume, VMT/centerline miles, is a subsequent calculation). Application of the directional splits resulted in the eventual estimate of both VMT and volume in each direction, with one record for the peak (or dominant) direction, and a second record for the opposite direction.

For the HPMS virtual link-based analyses, the standard 60/40 directional split ratio was applied based on aggregate observed values. The directional splits used for the TDM-based counties varied by network functional classification and area type and by peak and off-peak travel periods. Appendix D lists the TDM directional splits by functional class and area type combination and by time period.

Hourly and 24-hour county VMT summaries (by road type and vehicle type) were produced with the emissions summaries provided in the EI data submittal (see inventory data file descriptions in Appendix A).

ESTIMATION OF LINK SPEEDS

To estimate a link's directional, time-of-day congested speed, a speed model involving the link's estimated freeflow speed and directional delay as a function of the link's volume and capacity estimates was used. This model was used for each link (with the exception of the TDM centroid connector and special intrazonal links) after all VMT or volume adjustments were made, based on the link's area type and facility type combination, for each time period and each direction. The congested speed was calculated as follows:

$$Congested\ Speed = \frac{60}{\dfrac{60}{Freeflow\ Speed} + Delay}$$

The delay in the congested speed model (in minutes per mile) was calculated using the volume/delay equation:

$$Delay = Min\left[A\,e^{\,B(\frac{V}{C})}, M \right]$$

Where:

Delay	=	congestion delay (in minutes/mile);
A & B	=	volume/delay equation coefficients;
M	=	maximum minutes of delay per mile; and
V/C	=	time-of-day directional volume-to-capacity (v/c) ratio.

The delay model parameters (A, B, and M) were developed for the Dallas/Fort Worth area and verified by application in other Texas urban areas. Table 6 shows these parameters.

Table 6
Volume/Delay Equation Parameters

Facility Category	A	B	M[1]
High-Capacity Facilities (e.g., Interstates and Freeways)	0.015	3.5	5
Low-Capacity Facilities (e.g., Arterials, Collectors, and Locals)	0.05	3	10

[1] For HPMS, virtual link-based analyses, M values are 3.0 and 5.0 for High-Capacity and Low-Capacity facilities, respectively.

The capacity level designations for application of volume/delay equation parameters by San Antonio TDM functional class (see list in Appendix E) are High-Capacity for the Circumferential and Radial Freeways and Parkways, and Low-Capacity for the remaining functional classes. The capacity level designations by HPMS functional class (see list in Table 7) are High-Capacity for Interstates and Freeways, and Low-Capacity for the remaining functional classes.

Development of the link VMT/volume estimates was described in the previous section. The following sections discuss link capacity and freeflow speed estimates for HPMS virtual links (functional class and area type) and San Antonio TDM network links, followed by the method for estimating the TDM centroid connector and special intrazonal link speeds.

Capacities and Freeflow Speeds for the HPMS-Based Analysis
The capacities and freeflow speeds used for the HPMS virtual link-based speed modeling methodology all come from the Highway Capacity Manual (HCM 1994). The procedures for selection and development of the freeflow speed and lane capacity estimates by the HPMS functional classifications using the HCM are in *Rural County Methodology Review, Refinement, and Update*, TTI, August 2003.

Table 7 shows the hourly lane capacities for all functional classes and area types.

Table 7
Hourly Lane Capacities (vehicles per hour per lane [vphpl])

HPMS Area Type[1]	HPMS Roadway Functional Classification						
	Interstate	Freeway	Other Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local
Rural	2,200	2,100	1,003	920	836	669	502
Small Urban	2,200	2,100	878	805	732	585	439
Urban	2,200	2,100	673	617	561	448	336

[1] HPMS categories: Rural Miles (population 1 - 4,999); Small Urban Miles (population 5,000 - 49,999); and Urban Miles (population 50,000 - 199,999 and population 200,000+ combined).

Similarly, freeflow speeds are provided for each of the three area types and seven roadway functional classifications (or 21-HPMS virtual links). Table 8 shows the freeflow speeds.

Table 8
Freeflow Speeds (mph)

HPMS Area Type[1]	HPMS Roadway Functional Classification						
	Interstate	Freeway	Other Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local
Rural	70	65	55	50	40	35	30
Small Urban	70	65	45	40	35	30	30
Urban	70	65	40	35	30	30	30

[1] HPMS categories: Rural Miles (population 1 - 4,999); Small Urban Miles (population 5,000 - 49,999); and Urban Miles (population 50,000 - 199,999 and population 200,000+ combined).

V/C ratios were generated for each combination of time period, roadway functional classification, area type, and direction using these capacities (Table 7) and the VMT estimates described in the section on estimating VMT. The following describes the calculation for volume and capacity at the required level.

- Volume: VMT was multiplied by each 24 hourly time period factor yielding VMT for each hour. VMT per hour was divided by centerline miles, yielding volume for each hour. This procedure was performed for each combination of hour, roadway functional classification, area type, and direction.

- Capacity: Lane miles were divided by centerline miles to produce lanes. Lanes were multiplied by the lane capacities (i.e., adjusted saturation flows) generated by the process described above, producing hourly lane capacities. Hourly lane capacities were multiplied by the number of hours in the time period to produce time period capacities. This procedure was performed for each combination of time period, roadway functional classification, and area type. (Capacity is the same for each direction.)

The speed model was applied for each combination of time period, functional classification, area type, and direction using these estimated volumes, capacities, freeflow speeds, and delay equation constants, yielding the estimated operational link speeds (speeds adjusted for the impact of congestion-related delay) for the HPMS-based emissions analyses.

Capacities and Freeflow Speeds for the TDM-Based Analysis
The capacity factors and speed factors used to process the TDM link capacities and speeds are the same factors used in the 2002 San Antonio three-year cycle EI analysis.

The San Antonio TDM network 24-hour equilibrium assignment were performed using nondirectional 24-hour capacities. Time-of-day (i.e., hourly) capacity factors were applied to nondirectional capacity (or service volume) for the 24-hour assignment time period. In calculating the directional v/c ratio for estimating the directional speeds, the 50-50 directional split for capacity was used. The network was processed to calculate the average capacity per lane by functional classification and area type. Appendix E summarizes the capacity factors, which are calculated as follows:

$$Capacity\ Factor = \frac{(Hourly\ Capacity\ per\ Lane)(Length\ of\ the\ Time\ Period)}{24\text{-}hour\ Capacity\ per\ Lane}$$

Freeflow speed factors were used to convert the TDM input speed for each link to the estimated freeflow speed. The freeflow speed factors were calculated for each TDM functional class and area type combination, by dividing the freeflow speed by the associated TDM input speed (both speed data sets were categorized by functional class and area type). The freeflow speeds were determined using the HCM with suitable assumptions to relate the HCM data to the functional classes used in the TDM. Appendix E shows the freeflow speed factors used for each TDM functional class/area type combination.

The capacity and speed factors were applied to TDM network links by functional class and area type, for each hour and direction, to calculate the link freeflow speeds and capacities input to the speed model. The speed model was applied by network link for each hour and direction using the estimated volumes (as described in VMT estimation section), capacities, freeflow speeds, and delay equation constants, producing the estimated operational link speeds (speeds adjusted for the impact of congestion-related delay) for the TDM-based emissions analysis.

TDM Centroid Connector and Intrazonal Speeds

For the centroid connector links and added intrazonal links, capacity data are not used. The TDM centroid connector input speeds were used as the centroid connector operational speeds estimates. Operational speeds for the intrazonal trips category were estimated by zone as the average of the zone's centroid connector speeds.

The hourly and 24-hour VMT weighted speed summaries by county and road type are included in the set of data files provided on CD-ROM (see Appendix A for electronic data descriptions). Tables 2 and 3 summarize the San Antonio EAC area county 24-hour average speeds calculated as total VMT divided by total vehicle hours of travel (VHT).

ESTIMATION OF SUMMER WEEKDAY EMISSIONS FACTORS

TTI produced the on-road mobile source emissions factors by county using MOBILE6 as incorporated in TTI's utility for processing detailed MOBILE6 data into the form needed in the emissions calculations. For the 2005 summer weekday emissions analysis, hourly average summer weekday emissions factors were needed, and for the 2005 annual emissions analysis, both 24-hour average monthly and 24-hour average summer weekday rates were needed to produce emissions rate annualization factors (discussed in a later section).

MOBILE6 emissions factors (g/mi) were developed using a utility (see POLFAC62_3 description in Appendix B), which runs MOBILE6 producing the detailed, by-model-year emissions factor data; combines the emissions factors across model years into average vehicle class form; and organizes the results in lookup tables. The emissions factors are indexed by speed, pollutant, emissions type, hour (daily rates were specified for separate output), road type (drive cycle), and vehicle class. The pollutants included are VOC, CO, NOx, SO_2, NH_3, and the PM pollutants available in MOBILE6: SO_4, OCARBON, ECARBON, GASPM, LEAD, BRAKE, and TIRE, in both PM-10 and PM-2.5 particle size categories. Because MOBILE6 will only calculate one PM size cutoff at a time, separate runs were needed for PM-10 and PM-2.5.

The MOBILE6 model is equipped with national default modeling values for a wide range of conditions that affect emissions factors. Many of the default modeling parameters may be overridden using particular MOBILE6 commands and their associated inputs/options. Wherever possible, MOBILE6 defaults were replaced by local input values. MOBILE6 commands were set and local inputs were developed and used to produce the county emissions factors characteristic of the particular 2005 period (e.g., summer weekday, or monthly weekday for annual analysis). The model functions and associated command/input options are divided into the following categories:

- Pollutants and Emissions Rates;
- External Conditions;
- Vehicle Fleet Characteristics;
- Activity;
- State Programs;
- Fuels; and
- Alternative Emissions Regulations and Control Measures.

The following discussion includes these sections: summary of control programs modeled, MOBILE6 emissions factor aggregation levels, MOBILE6 commands and input parameters (by model section list above), and development of locality-specific inputs. All of the MOBILE6 (command and external data) input files and output files are provided on CD-ROM as described in Appendix A.

Summary of Control Programs Modeled

All of the federal motor vehicle control programs (FMVCP) included in MOBILE6 were modeled (this is the MOBILE6 default). Also modeled were the federal programs to offset heavy-duty diesel vehicle (HDDV) defeat device effects — the low emissions rebuild program (using the alternate rebuild rate estimate), and the HDDV 2004 standard pull-ahead program (using the MOBILE6 default). Fuel program effects were modeled using the MOBILE6 fuels commands and associated inputs. These were developed from the 2005 summer and winter Texas gasoline survey summaries and the 2005 summer highway diesel survey summary data.

MOBILE6 Emissions Factor Aggregation Levels

The by-model-year emissions factors from the MOBILE6 detailed data were condensed into average fleet emissions factors by vehicle class. This was performed (using POLFAC62_3) by multiplying each by-model-year emissions factor by its corresponding travel fraction and summing the resulting products. For daily emissions factors, the hourly emissions factors were further compressed using the hourly VMT factors. The resulting emissions factor tables provide the MOBILE6 emissions factors, for each analyst-specified pollutant, by:

- 28 vehicle types;
- 4 road types;
- 14 speeds (except for Local and Ramp MOBILE6 road types, each with one average speed);
- 24 hourly time periods (unless daily values are specified); and
- the emissions types associated with each selected pollutant.

Tables 9 through 12 describe the MOBILE6 vehicle type, emissions type, pollutant categories, and roadway type classifications. Tables 13 and 14 show the average speeds and the sequence for the hourly time periods, respectively.

Table 9 shows the 28 MOBILE6 vehicle types as defined by fuel-type (gasoline or diesel) and GVWR category in sequence by MOBILE6 vehicle type number.

Table 9
MOBILE6 Vehicle Classifications

Number	Abbreviation	Description
1	LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
2	LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. loaded vehicle weight (LVW)
3	LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. adjusted loaded vehicle weight (ALVW[1])
5	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater
6	HDGV2b	Class 2b Heavy-Duty Gasoline Vehicles (8,501-10,000 lbs. GVWR)
7	HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
8	HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
9	HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
10	HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
11	HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
12	HDGV8a	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
13	HDGV8b	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
14	LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
15	LDDT12	Light-Duty Diesel Trucks 1 and 2 (0-6,000 lbs. GVWR)
16	HDDV2b	Class 2b Heavy-Duty Diesel Vehicles (8,501-10,000 lbs. GVWR)
17	HDDV3	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
18	HDDV4	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
19	HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
20	HDDV6	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
21	HDDV7	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
22	HDDV8a	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
23	HDDV8b	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
24	MC	Motorcycles (Gasoline)
25	HDGB	Gasoline Buses (School, Transit, and Urban)
26	HDDBT	Diesel Transit and Urban Buses
27	HDDBS	Diesel School Buses
28	LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

[1] The ALVW is the numerical average of the vehicle curb weight and the GVWR.

Table 10 shows the 10 MOBILE6 emissions type classifications and their availability by pollutant category (see Table 11 for pollutants list). In addition to the individual emissions types, POLFAC62_3 emissions factor tables contain composite emissions factors (i.e., the total emissions factor for each pollutant with multiple emissions types). When modeling particulates, POLFAC62_3 tables also contain the total PM emissions factor, which is the sum of the primary PM emissions factor components. The refueling emissions factor component is generally considered an area source category emissions factor and is not included in the on-road mobile source emissions analysis.

Table 10
MOBILE6 Emissions Type Classifications

Number	Abbreviation	Description[1]	Pollutants	Vehicle Classes
1	Running	Exhaust Running Emissions	All except tire and brake wear	All
2	Start	Exhaust Engine Start Emissions (trip start)	Hydrocarbon (HC), CO, NOx, Air Toxics[2]	All light-duty plus motorcycles (MC)
3	Hot Soak	Evaporative Hot Soak Emissions (trip end)	HC, BENZ, MTBE	Gasoline, including MC
4	Diurnal	Evaporative Diurnal Emissions (heat rise)	HC, BENZ, MTBE	Gasoline, including MC
5	Resting	Evaporative Resting Loss Emissions (leaks and seepage)	HC, BENZ, MTBE	Gasoline, including MC
6	Run Loss	Evaporative Running Loss Emissions	HC, BENZ, MTBE	Gasoline, less MC
7	Crankcase	Evaporative Crankcase Emissions (blow-by)	HC	Gasoline, including MC
8	Refueling	Evaporative Refueling Emissions (fuel displacement and spillage)	HC, BENZ, MTBE	Gasoline, less MC
9	Brake Wear	PM from brake component wear	Brake wear particulate	All
10	Tire Wear	PM from tire wear	Tire wear particulate	All

[1] POLFAC62_3 additionally calculates and tabulates MOBILE6 composite emissions factors for those pollutants with sub-components (e.g., start, exhaust, etc.).
[2] Air Toxics (see Table 11) are BENZ, MTBE, BUTA, FORM, ACET, and ACRO.

Table 11
MOBILE6 Pollutant Categories[1]

Abbreviation	Description
HC	Hydrocarbons (gaseous)
CO	Carbon Monoxide (gaseous)
NOx	Oxides of Nitrogen (gaseous)
CO_2	Carbon Dioxide (gaseous)
SO_4	Sulfate Portion of Exhaust Particulate
OCARBON	Organic Carbon Portion of Diesel Exhaust Particulate
ECARBON	Elemental Carbon Portion of Diesel Exhaust Particulate
GASPM	Total Carbon Portion of Gasoline Exhaust Particulate
Lead	Lead Portion of Exhaust Particulate
SO_2	Sulfur Dioxide (gaseous)
NH_3	Ammonia (gaseous)
Brake	Brake Wear Particulate
Tire	Tire Wear Particulate
BENZ	Benzene
MTBE	Methyl Tertiary Butyl Ether
BUTA	1,3-Butadiene
FORM	Formaldehyde
ACET	Acetaldehyde
ACRO	Acrolein

[1] The PM pollutants, SO_4, OCARBON, ECARBON, GASPM, LEAD, BRAKE, and TIRE may be modeled at particulate size cutoffs from 1.0 to 10.0 micrometers.

MOBILE6 calculates emissions factors reflective of driving cycles observed on four roadway types (for the light-duty vehicle classes, and in the case of the heavier heavy-duty vehicles, to include the varying degrees of NOx off-cycle effects, dependent on road type). Also calculated are emissions factors for those emissions types that are not directly applicable to the driving cycles (e.g., start and the evaporative components excluding running losses). Table 12 shows the driving cycle (or roadway type) descriptions. The fifth category, not actually a road type, is labeled by MOBILE6 as “None.” “None” (roadway type 5) is the index for the emissions types that do not apply to the driving cycles, and thus do not vary by roadway type or speed.

POLFAC62_3, however, categorizes all of the pollutant-specific emissions types by MOBILE6 roadway types one through four — Freeway, Arterial, Local, and Ramp. In POLFAC62_3, the MOBILE6 g/mi emissions factors corresponding to the “None” roadway type are calculated for each of the four actual roadway types. This allocation is performed in POLFAC62_3 so that all emissions, regardless of type, may be spatially allocated by the functional class-coded (or roadway type-coded) network links.

Table 12
MOBILE6 Roadway Classifications

Number	Abbreviation	Description
1	Freeway	High-speed, limited-access roadways
2	Arterial	Arterial and collector roadways
3	Local	Urban local roadways
4	Fwy Ramp	Freeway on and off ramps
5[1]	None	Not applicable (for start and some evaporative emissions)

[1] In POLFAC62_3, the MOBILE6 g/mi start and non-running evaporative emissions factor components are associated with each of the four MOBILE6 roadway categories for subsequent link level emissions calculations.

Table 13 lists the 14 speeds for calculating the MOBILE6 Freeway and Arterial emissions factors that are tabulated in the POLFAC emissions factor tables. Later in the emissions estimation process, emissions factors for average operational speeds that are not in the 14 speeds are estimated by interpolation (except for those speeds outside of the MOBILE6 speed range, in which case the emissions factors corresponding to the appropriate bounding speed are used). The MOBILE6 Local and Ramp road type emissions factors are not speed sensitive and are each characterized by one average speed.

Table 13
MOBILE6 Freeway and Arterial Average Speed Bin Speeds
Used in POLFAC62_3 Emissions Factors[1] Tables

Speed Bin	Speed
1	2.5 mph
2	5 mph
3	10 mph
4	15 mph
5	20 mph
6	25 mph
7	30 mph
8	35 mph
9	40 mph
10	45 mph
11	50 mph
12	55 mph
13	60 mph
14	65 mph

[1] Also included in the POLFAC tables are the MOBILE6 Local and Ramp drive cycle emissions factors, whose fixed speeds are 12.9 and 34.6 mph, respectively.

MOBILE6 uses several hourly input parameters (e.g., hourly temperatures, hourly VMT fractions, etc.) to model hourly emissions factors. MOBILE6 requires that hourly input parameters be sequenced beginning from the 6 a.m. hour. In some cases, however, particular overnight hours are grouped together as a single time period. Table 14 shows the MOBILE6 sequence for hourly inputs. In the POLFAC emissions factor table output, the hourly emissions factors are sequenced beginning with the midnight to 1:00 a.m. hour.

Table 14
General Sequence for Calendar Day Hourly[1] Inputs to MOBILE6

Sequence	Abbreviation	Description
1	6 a.m.	6 a.m. through 6:59 a.m.
2	7 a.m.	7 a.m. through 7:59 a.m.
3	8 a.m.	8 a.m. through 8:59 a.m.
4	9 a.m.	9 a.m. through 9:59 a.m.
5	10 a.m.	10 a.m. through 10:59 a.m.
6	11 a.m.	11 a.m. through 11:59 a.m.
7	12 Noon	12 p.m. through 12:59 p.m.
8	1 p.m.	1 p.m. through 1:59 p.m.
9	2 p.m.	2 p.m. through 2:59 p.m.
10	3 p.m.	3 p.m. through 3:59 p.m.
11	4 p.m.	4 p.m. through 4:59 p.m.
12	5 p.m.	5 p.m. through 5:59 p.m.
13	6 p.m.	6 p.m. through 6:59 p.m.
14	7 p.m.	7 p.m. through 7:59 p.m.
15	8 p.m.	8 p.m. through 8:59 p.m.
16	9 p.m.	9 p.m. through 9:59 p.m.
17	10 p.m.	10 p.m. through 10:59 p.m.
18	11 p.m.	11 p.m. through 11:59 p.m.
19	12 Midnight	12 a.m. through 12:59 a.m.
20	1 a.m.	1 a.m. through 1:59 a.m.
21	2 a.m.	2 a.m. through 2:59 a.m.
22	3 a.m.	3 a.m. through 3:59 a.m.
23	4 a.m.	4 a.m. through 4:59 a.m.
24	5 a.m.	5 a.m. through 5:59 a.m.

[1] For some MOBILE6 hourly input parameters, overnight hours are grouped. Hourly inputs are representative of the same day, but are reordered for input to MOBILE6 to begin at 6 a.m. POLFAC sequences the modeled emissions factor output beginning with midnight hour.

MOBILE6 Commands and Input Parameters

Tables 15 through 21 describe the MOBILE6 commands/parameters usage for the average summer weekday analysis (tabulated information) and for the annual analysis (average monthly weekday information in table footnotes). These tables are MOBILE6: Pollutants and Emission Rates, External Conditions, Vehicle Fleet Characteristics, Activity, State Programs, Fuels, and Alternative Emissions Regulations and Control Measures.

Unless otherwise noted, input parameter values were used in both Run 1 (PM-10) and Run 2 (PM-2.5). For locality-specific inputs, the source of the data is given. Where particular MOBILE6 defaults were used, technical report references (electronic file names available on the EPA MOBILE website [http://www.epa.gov/otaq/models/mobile6/m6tech.htm]) are provided.

The procedures used to develop the locality-specific inputs to MOBILE6 are detailed following the MOBILE6 input category tables.

Table 15
MOBILE6 Pollutants and Emissions Rates

Command	Function/Description	Input Parameter Source/Value
POLLUTANTS	Defines the basic set of pollutants to report.	Run 1 – HC, CO, NOX; Run 2 – (None).
PARTICULATES	Enables the calculation of PM and related emissions factors.	Run 1 – SO2, NH3, SO4, OCARBON, ECARBON, GASPM, LEAD, BRAKE, TIRE; Run 2 – SO4, OCARBON, ECARBON, GASPM, LEAD, BRAKE, TIRE.
PARTICULATE EF	Specifies location of files that contain the particulate emissions factors when PARTICULATES command is used.	MOBILE6 defaults.
PARTICLE SIZE	Specifies the maximum particulate size cutoff value in micrometers used by MOBILE.	Run 1 – 2.5; Run 2 – 10.0.
EXPRESS HC AS VOC	One of five possible commands which allow the user to specify the particular HC species (non-methane HC [NMHC], non-methane organic gases [NMOG], total HC [THC], total organic gases [TOG], and VOC) to report in the exhaust emissions output.	"VOC" command used.
NO REFUELING	Directs MOBILE6 not to calculate refueling emissions factors.	APPLIED.
AIR TOXICS	Enables the calculation of air toxic emissions factors (six explicit pollutants) and specifies which to calculate.	NOT APPLIED.
ADDITIONAL HAPS	Allows entry of emissions factors or air toxic ratios for calculation of additional user-defined air toxic pollutant emissions factors.	NOT APPLIED.
MPG ESTIMATES	Allows entry of alternate fuel economy performance data by vehicle class and model year.	NOT APPLIED. (MOBILE6 default values used.)

Table 16
MOBILE6 External Conditions

Command	Function/Description	Input Parameter Source/Value
CALENDAR YEAR[1]	Calendar year for which emissions factors are to be calculated. (Needed to run model).	2005.
EVALUATION MONTH[1]	Provides option of calculating January 1 or July 1 emissions factors for calendar year.	7 (July), for summer season.
MIN/MAX TEMPERATURE	Sets minimum and maximum daily temperatures.	NOT APPLIED.
HOURLY TEMPERATURES[2]	Allows temperatures input for each hour-of-day. (Required to run model if MIN/ MAX TEMPERATURE command is not used.)	Used hourly averages consistent with San Antonio weather data for 10 maximum eight-hour ozone days from June through August, 2000 through 2002 (originally used in 2002 San Antonio CERR EIs, TTI, August 2003). See Appendix F.
ALTITUDE	Specifies high- or low-altitude for modeling area.	NOT APPLIED. (MOBILE6 default, low altitude, was used).
ABSOLUTE HUMIDITY	Used to specify daily average humidity (directly affects NOx). MOBILE6 also converts absolute humidity to heat index, which affects HC and CO for the portion of the fleet that MOBILE6 determines is using air conditioning.	NOT APPLIED.
Environmental Effects on Air Conditioning:	Commands used by MOBILE6 to model the extent of vehicle air-conditioning usage.	
CLOUD COVER	Specifies average percent cloud cover for given day.	NOT APPLIED. (MOBILE6 default was used.)
PEAK SUN	Specifies mid-day hours with peak sun intensity.	NOT APPLIED. (MOBILE6 default was used.)
SUNRISE/ SUNSET	Allows user to specify time of sunrise and sunset.	NOT APPLIED. (MOBILE6 default was used.)
RELATIVE HUMIDITY[2]	Specifies use of 24 hourly relative humidity values entered by user; performs hour-specific calculations with hourly values rather than using single daily default absolute humidity value.	Used hourly averages consistent with San Antonio ozone exceedence day-based data from the 2002 San Antonio CERR EI analysis, August 2003. See Appendix F.
BAROMETRIC PRES[2]	Specifies use of user input daily average barometric pressure for use with hourly relative humidity to calculate hourly absolute humidity.	Used 24-hour average consistent with San Antonio ozone exceedence day-based data from the 2002 San Antonio CERR EI analysis, August 2003. See Appendix F.

[1] To model changes from fleet turnover for annual analysis, these year/month combinations were used for monthly runs: January through March, 2005/1; April through September, 2005/7; and October through December, 2006/1.
[2] TTI developed and used 2005 monthly average inputs (from San Antonio International Airport weather station data) to account for seasonal climate variation in the annual analysis.

Table 17
MOBILE6 Vehicle Fleet Characteristics

Command	Function/Description	Input Parameter Source/Value
REG DIST	Allows the user to supply registration distributions by age for any of the 16 composite (combined gasoline and diesel) vehicle types.	Locality-Specific/MOBILE6 default, developed by TTI. Mid-year 2005 county-level registrations data for light-duty classes and San Antonio EAC area-level aggregate registrations data for heavy-duty classes, except MOBILE6 defaults for buses. See Appendix G.
DIESEL FRACTIONS	Permits user to supply locality-specific diesel fractions for 14 of the 16 composite vehicle categories by age.	Locality-Specific/MOBILE6 default, developed by TTI. Mid-year 2005 TxDOT statewide registrations were used to develop the HDV diesel fractions, MOBILE6 defaults were used for LDV, LDT, MC, and bus. See Appendix G.
MILE ACCUM RATE	Allows the user to supply the annual mileage accumulation rates by vehicle type and age.	NOT APPLIED. (MOBILE6 defaults used — see technical report M6FLT.007.)
NGV FRACTION	Lets user specify percent of natural gas vehicles (NGV) in the fleet by type and age certified to operate on either compressed or liquefied natural gas.	NOT APPLIED. (The MOBILE6 default percentage of NGV vehicles in the fleet, zero, was used.)
NGV EF	Permits the user to enter alternate NGV emissions factors for each of the 28 vehicle types, for running and start emissions.	NOT APPLIED. (The MOBILE6 default, none, was used.)

Table 18
MOBILE6 Activity

Command	Function/Description	Input Parameter Source/Value
VMT FRACTIONS	Used in MOBILE6 to weight the emissions of various vehicle types into average rates for groupings of vehicle classes.	NOT APPLIED. (VMT mix was used externally in the emissions calculations.)
VMT BY FACILITY	VMT fractions by MOBILE6 road type combine the four road type emissions factors into the "all road types" emissions factors.	NOT APPLIED. (Not applicable to detailed disaggregate analyses.)
VMT BY HOUR[1]	Allows VMT fractions allocation by hour-of-day; applied in conversion of grams per hour (g/hr) to g/mi, as well as in weighting of hourly g/mi rates to obtain daily emissions factors.	Based on the hourly VMT distributions reflected in the hourly link-VMT estimates for each county (see Appendix C).
SPEED VMT	Allows user to allocate VMT by average speed (14 pre-selected: 2.5 and 5 through 65 at 5 mph increments) for arterials and freeways for each hour of the day.	Generic input. Same for all counties. Inputs were set up to calculate emissions factors by the 14 MOBILE6 speed bin average speeds for MOBILE6 freeway and arterial road types.
AVERAGE SPEED	Allows a single average speed for combined freeways and arterials for the entire day.	NOT APPLIED.
STARTS PER DAY	Lets user specify the average number of engine starts per vehicle per day by vehicle types for weekend days and weekdays.	NOT APPLIED. (MOBILE6 weekday defaults used — see technical report M6FLT.003.)
START DIST	Allows user to allocate engine starts by hour of the day for weekend days and weekdays.	NOT APPLIED. (MOBILE6 weekday defaults used — see technical report M6FLT.003.)
SOAK DISTRIBUTION	Allows use of alternate vehicle soak duration distributions for weekend days and weekdays.	NOT APPLIED. (MOBILE6 weekday defaults used — see technical reports M6FLT.003 and 004.)
HOT SOAK ACTIVITY	Allows users to specify a hot soak duration distribution for each of 14 daily time periods for weekend days and for weekdays.	NOT APPLIED. (MOBILE6 weekday defaults used — see technical reports M6FLT.003 and 004.)
DIURN SOAK ACTIVITY	Allows user set diurnal soak time distributions for each of 18 daily time periods.	NOT APPLIED. (MOBILE6 defaults used — see technical report M6FLT.006.)
WE DA TRI LEN DI	Specifies alternate fractions of VMT that occur during trips of various durations at each hour of the average weekday.	NOT APPLIED.
WE EN TRI LEN DI	Specifies hourly alternate fractions of VMT for trips of various lengths for weekend days.	NOT APPLIED.
WE VEH US	Directs MOBILE6 to use weekend activity data for calculating emissions factors.	NOT APPLIED.

[1] TxDOT San Antonio District summer and winter hourly VMT distributions were used by month for annual analysis as follows: Summer/April through September; and Winter/January through March and October through December.

Table 19
MOBILE6 State Programs

Command	Function/Description	Input Parameter Source/Value
STAGE II REFUELING	Allows modeling of at-the-pump refueling emissions.	NOT APPLIED. Accounted for as an area source category.
ANTI-TAMP PROG	Allows user to model impacts of an anti-tampering program (ATP).	NOT APPLIED. (Although Texas administers a statewide ATP, credit is only taken in counties that also administer an enforced inspection/maintenance [I/M] program.)
I/M Program Commands	Various exhaust/evaporative I/M program required or optional commands for modeling I/M programs.	NOT APPLIED.

Table 20
MOBILE6 Fuels

Command	Function/Description	Input Parameter Source/Value
FUEL PROGRAM[1]	Allows specification of one of four options: 1) Conventional Gasoline (CG) East Tier2 sulfur phase-in (includes Texas); 2) Reformulated Gasoline (RFG); 3) CG West Tier2 sulfur geographical phase-in area schedule; or 4) Sulfur content for gasoline after 1999.	Option 4 with user supplied gasoline sulfur content values, based on TCEQ summer 2005 Texas statewide fuel sample survey, 25 district-level summary. Used San Antonio District input data.
SULFUR CONTENT	Allows conventional gasoline alternate sulfur content for calendar years through 1999.	NOT APPLIED.
DIESEL SULFUR[1,2]	Allows use of average diesel fuel sulfur level for all calendar years. Required if PARTICULATES command is used. No affect on HC, CO, NOx, or air toxics (except if calculated as ratio to PM).	Used 2005 diesel sulfur content estimates based on TCEQ summer 2005 Texas fuel sample survey, 25 district-level summary. Used San Antonio District input data.
OXYGENATED FUELS[1]	Allows modeling of oxygenated gasoline effects on exhaust for all gasoline-fueled vehicle types. Not for use with AIR TOXICS command.	Used 2005 oxygenated fuel parameters based on TCEQ summer 2005 Texas fuel sample survey, 25 district-level summary. Used San Antonio District input data.
FUEL RVP[1]	Allows user to specify gasoline RVP for area being modeled (required for running the model).	Used 2005 RVP estimates based on TCEQ summer 2005 Texas statewide fuel sample survey, 25 district-level summary. Used San Antonio District input data.
SEASON	Identifies effective season for RFG calculation regardless of month modeled.	NOT APPLIED.
GAS AROMATIC%	Only when AIR TOXICS command is used.	NOT APPLIED.
GAS OLEFIN%	Only when AIR TOXICS command is used.	NOT APPLIED.
GAS BENZENE%	Only when AIR TOXICS command is used.	NOT APPLIED.
E200	Only when AIR TOXICS command is used.	NOT APPLIED.
E300	Only when AIR TOXICS command is used.	NOT APPLIED.
OXYGENATE	Only when AIR TOXICS command is used.	NOT APPLIED.
RVP OXY WAIVER	Only when AIR TOXICS command is used.	NOT APPLIED.

[1] TTI developed and applied summer and winter fuels inputs with interpolated values for "shoulder months" (using TCEQ summer 2005 and NGMS winter 2004-05 surveys) for developing monthly rates for the annual emissions analysis. See Tables 27 and 28 summer and winter values and Appendix A (Part 4) for a description of the Excel file of county/month values.
[2] Due to lack of availability of Texas winter diesel fuel survey data and low variability between summer and winter diesel sulfur content, TTI used the TCEQ summer 2005 fuel study sulfur content estimates for all months.

Table 21
MOBILE6 Alternative Emissions Regulations and Control Measures

Command	Function/Description	Input Parameter Source/Value
NO CLEAN AIR ACT	Models vehicle emissions as if the Federal Clean Air Act Amendments of 1990 had not been implemented.	NOT APPLIED.
HDDV NOx Off-Cycle Emissions Effects:		
NO DEFEAT DEVICE	Turns off the effects of the HDD vehicle NOx off-cycle emissions effects (defeat device emissions).	NOT APPLIED.
NO NOX PULL AHEAD	Turns off HDD NOx emissions reduction effects of pull- ahead program.	NOT APPLIED.
NO REBUILD	Turns off HDD NOx emissions reduction effects of rebuild program.	NOT APPLIED.
REBUILD EFFECTS[1]	Allows user change rebuild program effectiveness rate.	User input, actual 2005 estimate (9.5 percent) developed by TTI based on data used in prior analyses.
Tier 2 Emission Standards and Fuel Requirements:	Allow the overriding of the default Tier 2 emissions standards and fuel requirements settings.	NOT APPLIED.
NO TIER2	Disables Tier 2 requirements.	
T2 EXH PHASE-IN	Allows alternate Tier 2 exhaust standard phase-in schedules.	
T2 EVAP PHASE-IN	Allows alternate Tier 2 evaporative standard phase-in schedules.	
T2 CERT	Allows user to specify alternate Tier 2 50,000-mile certification standards.	
94+ LDG IMPLEMENTATON	Allows use of alternate 1994 and later fleet penetration fractions for LDGVs under the Tier 1, NLEV (or California LEV 1), and Tier 2 emissions standard programs.	NOT APPLIED.
NO 2007 HDDV RULE	Disables 2007 HDV emissions standards.	NOT APPLIED.

[1] TTI extrapolated values for January 1, 2005, July 1, 2005, and January 1, 2006 (8.5 percent, 9.5 percent, and 10.6 percent, respectively) and used by month for annual analysis as follows: early value - January through March; middle value - April through September; late value - October through December.

Development of Locality-Specific Inputs

External Conditions

For the ozone season weekday analysis, TTI applied meteorological input data developed for the prior San Antonio three-year cycle EIs. For the annual emissions analysis, TTI produced the 2005 average monthly meteorological inputs and used them in the average monthly weekday 24-hour rates needed for producing the emissions rate annualization factors, discussed later. The input parameters are hourly average temperature, hourly average relative humidity, and daily barometric pressure.

For the summer weekday analysis, the MOBILE6 meteorological inputs used were consistent with the inputs developed and used in the 2002 CERR EI analysis (*2002 Three-Year Cycle Emissions Inventory Methodology for the San Antonio Early Action Compact Counties*, TTI, August 2003), except that the time system used was adjusted to correctly reflect local time (i.e., central daylight time [CDT] during summer). TTI developed the input values based on 10 maximum eight-hour standard ozone exceedence days for the June through August summer periods during 2000 through 2002, based on guidance in *Procedures for Emissions Inventory Preparation, Vol. IV, Mobile Source*, EPA 1992, and 2000 through 2002 San Antonio area ozone data provided by TCEQ. TTI used weather data from these 10 days to calculate the averages for the meteorological input parameters reflective of the ozone season conditions. Appendix F shows the input values used.

For the annual analysis, TTI developed the average meteorological inputs by month using 2005 hourly observations data. The hourly weather data used are from the San Antonio International Airport weather station (SAT) in Bexar County. The same inputs were used for all San Antonio EAC area counties. All of the inputs were based on local time.

Temperature and Relative Humidity - The input values, using the data described above, were calculated by averaging the value within each hour over the given period (e.g., month, 10 exceedence days). The HOURLY TEMPERATURES and RELATIVE HUMIDITY commands were used to specify hourly temperature (degrees Fahrenheit) and hourly relative humidity input, respectively. The temperature and humidity values, MOBILE6 command file input, were sequenced as required beginning with the 6 a.m. hour. The temperatures are a MOBILE6 command file input; the MOBILE6 command files are provided on CD-ROM (see Appendix A). Appendix F lists the hourly temperature and humidity values used.

Barometric Pressure - The input values, using the data described above, were calculated by averaging observations within each hour, then across hours for the given period (e.g., month, 10 exceedence days). The BAROMETRIC PRES command was used to specify the 24-hour average barometric pressure input value. The barometric pressure (units is inches of Mercury) is input in the MOBILE6 command file. MOBILE6 input files are provided on CD-ROM as described in Appendix A. Appendix F lists the barometric pressure input values.

Vehicle Fleet Characteristics

TTI developed the vehicle registration (age) distributions and diesel fractions inputs to MOBILE6 using mid-year 2005 TxDOT registrations data sets. MOBILE6 default age distributions, and diesel fractions inputs were used for the particular vehicle classes for which the TxDOT registrations data were not available.

County-level registrations data were used to develop the light-duty class vehicle age distributions, San Antonio EAC area county-level registrations data were used to develop the heavy-duty vehicle age distributions and state-level registrations data were used for developing diesel fractions. These standard SIP analysis aggregation levels prevent sample size problems that can occur, especially for rural counties, for vehicle classes with minimal registrations.

Vehicle Registration Distributions - The user-supplied vehicle registration distributions input to MOBILE6, specified by using the *REG DIST* command, are by vehicle age for any of the 16 composite (combined gasoline and diesel) vehicle types, as shown in Table 22. EPA default distributions are internally applied by MOBILE6 for vehicle classes for which the analyst does not provide alternate values.

The input values for each vehicle class are 25 age fractions representing the fraction of vehicles by age for that particular vehicle class as of July of the evaluation year. These age fractions begin with the evaluation year as the first age fraction and work back in annual increments to end with the 25th fraction, which represents the fraction of vehicles of age 25 years and older. The fractions were calculated as the model-year-specific registrations in a class divided by the total vehicles registered in that class. Table 22 shows the data source and aggregation level by vehicle type.

Table 22
Composite Vehicle Classes and Data Sources for MOBILE6 Age Distributions Input

Number[1]	Abbreviation	Description	Source of Distributions[2]
1	LDV	Light-Duty Vehicles	TxDOT Mid-Year County Registrations
2	LDT1	Light-Duty Trucks 1	TxDOT Mid-Year County Registrations
3	LDT2	Light-Duty Trucks 2	TxDOT Mid-Year County Registrations
4	LDT3	Light-Duty Trucks 3	TxDOT Mid-Year County Registrations
5	LDT4	Light-Duty Trucks 4	TxDOT Mid-Year County Registrations
6	HDV2B	Class 2b Heavy-Duty Vehicles	TxDOT Mid-Year Region Registrations
7	HDV3	Class 3 Heavy-Duty Vehicles	TxDOT Mid-Year Region Registrations
8	HDV4	Class 4 Heavy-Duty Vehicles	TxDOT Mid-Year Region Registrations
9	HDV5	Class 5 Heavy-Duty Vehicles	TxDOT Mid-Year Region Registrations
10	HDV6	Class 6 Heavy-Duty Vehicles	TxDOT Mid-Year Region Registrations
11	HDV7	Class 7 Heavy-Duty Vehicles	TxDOT Mid-Year Region Registrations
12	HDV8A	Class 8a Heavy-Duty Vehicles	TxDOT Mid-Year Region Registrations
13	HDV8B	Class 8b Heavy-Duty Vehicles	TxDOT Mid-Year Region Registrations
14	HDBS	School Buses	MOBILE6 Default
15	HDBT	Transit and Urban Buses	MOBILE6 Default
16	MC	Motorcycles	TxDOT Mid-Year County Registrations

[1] MOBILE6 vehicle class index number for age distributions input.
[2] TxDOT registrations data are from the mid-year 2005 registrations data extracts.

TTI developed MOBILE6 age distributions fractions input from TxDOT data for all vehicle types except for the two bus categories, for which the MOBILE6 defaults were used (TxDOT data does not specify buses). To develop these distributions, TTI used two county-level data sets provided by TxDOT — one including the combined gasoline-powered and diesel-powered light-duty vehicle, light-duty truck, and motorcycle registrations, and the other containing the individual gasoline-powered and individual diesel-powered heavy-duty vehicle registrations by the eight MOBILE6 heavy-duty weight categories. Each data set provides registrations as of the extract date for 26 model years plus a 27th category for vehicles older than the 26th model year.

The mid-year county level registrations data extracts provided by TxDOT are:

- combined gasoline and diesel: LDV, LDT12, LDT34, and MC; and

- individual gasoline and individual diesel: HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, and HDV8B.

The LDT12 and LDT34 classes of the combined gasoline and diesel registrations data set correspond to the MOBILE6 LDT1 and LDT2 classes, and the LDT3 and LDT4 classes, respectively.

The following steps were performed using county data to develop the MOBILE6 registration distributions input for the vehicle weight classes available in the TxDOT data:

- for each of the eight HDV subcategories, county registrations were aggregated to the San Antonio EAC area region level, and individual gasoline and diesel registrations were combined;

- for each weight class, model year registrations for vehicles 25 years old and older were summed to form the “25 years old and older” age group;

- registrations were converted from numbers of vehicles registered to fractions registered by age (class registrations for each age divided by class total registrations);

- age distributions were expanded from 12 to 14 classes using the LDT12 distributions for both LDT1 and LDT2, and using the LDT34 distributions for both LDT3 and LDT4; and

- San Antonio EAC area regional HDV age distributions were combined with the light-duty distributions for each county to produce the external data input file for each county.

In some cases the age distributions fractions do not sum to one due to insignificant rounding error. In such cases, MOBILE6 normalizes the age distribution fractions. Appendix G shows the age distributions input. The MOBILE6 age distributions external data input files are provided on CD-ROM as described in Appendix A.

Diesel Fractions - The DIESEL FRACTIONS command allows the analyst to specify diesel fractions for 14 of the 16 composite (gasoline and diesel) vehicle categories by model year. MOBILE6 assumes that urban/transit buses are diesel fueled, and that motorcycles are all gasoline fueled, so these two categories do not require diesel fractions. The diesel fractions represent the portion of diesel vehicles in a composite (gasoline and diesel) vehicle class for each vehicle age. When the analyst enters diesel fractions, all 14 sets of fractions are required. Each set of fractions contains the diesel fractions for 25 model years, beginning with the evaluation year as the first model year, and going back in annual increments to the 25^{th}, or earliest model year fraction.

TTI developed the analysis year diesel fractions input data sets using a combination of estimated TxDOT statewide diesel fractions (based on the mid-year 2005 registrations data) and MOBILE6 default diesel fractions. Table 23 shows the MOBILE6 diesel fractions input sequence and categories with corresponding data sources.

Table 23
Source of Diesel Fractions for Composite Vehicle Types

Number[1]	Abbreviation	Description	Source of Fractions[2]
1	LDV	Light-Duty Vehicles	EPA MOBILE6 Evaluation Year Default
2	LDT1	Light-Duty Trucks 1	EPA MOBILE6 Evaluation Year Default
3	LDT2	Light-Duty Trucks 2	EPA MOBILE6 Evaluation Year Default
4	LDT3	Light-Duty Trucks 3	EPA MOBILE6 Evaluation Year Default
5	LDT4	Light-Duty Trucks 4	EPA MOBILE6 Evaluation Year Default
6	HDV2B	Class 2b Heavy-Duty Vehicles	TxDOT Mid-Year Statewide Registrations
7	HDV3	Class 3 Heavy-Duty Vehicles	TxDOT Mid-Year Statewide Registrations
8	HDV4	Class 4 Heavy-Duty Vehicles	TxDOT Mid-Year Statewide Registrations
9	HDV5	Class 5 Heavy-Duty Vehicles	TxDOT Mid-Year Statewide Registrations
10	HDV6	Class 6 Heavy-Duty Vehicles	TxDOT Mid-Year Statewide Registrations
11	HDV7	Class 7 Heavy-Duty Vehicles	TxDOT Mid-Year Statewide Registrations
12	HDV8A	Class 8a Heavy-Duty Vehicles	TxDOT Mid-Year Statewide Registrations
13	HDV8B	Class 8b Heavy-Duty Vehicles	TxDOT Mid-Year Statewide Registrations
14	HDBS	School Buses	EPA MOBILE6 Evaluation Year Default

[1] Required MOBILE6 input sequence.
[2] TxDOT registrations data are from the mid-year 2005 registrations data extracts.

The statewide diesel fractions estimates were calculated using individual diesel and gasoline vehicle statewide registrations data for the eight HDV weight classes. To produce the individual HDV diesel fractions by model year, the model-year-specific individual HDV class diesel registrations were divided by the sum of the gasoline and diesel registrations for that vehicle class and model year. This procedure was performed for each HDV class and model year.

The available by-model-year diesel fractions data (MOBILE6 defaults and Texas statewide fractions) do not completely match the 25 model-year input data series specific to the calendar year of evaluation. For example, the MOBILE6 diesel fractions vary by age for model years 1972 through 1996. MOBILE6 thus assumes that the diesel fractions for the 1971 and earlier model years are the same as the 1972 model year diesel fraction, and that the diesel fractions for the 1997 and later model years are the same as the 1996 model year diesel fraction. This procedure was also applied, as necessary, to the Texas diesel fractions data to complete the model-year input series required. Model-year fractions extending beyond the earliest required input model year diesel fractions were dropped from the input data set.

The estimated analysis year HDV diesel fractions were combined with the corresponding MOBILE6 default diesel fractions for the remaining vehicle classes (LDV, LDT1, LDT2, LDT3, LDT4, and HDBS) to produce the input data set. The diesel fractions, MOBILE6 command file input data, are provided on CD-ROM (see Appendix A). Appendix G also includes the diesel fractions inputs.

Activity

Locality-specific summer weekday hourly fleet VMT fractions, and additionally, generic, hourly fractions of VMT by speed (i.e., the14 MOBILE6 speed bin speeds) for Arterials and Freeways were used for modeling emissions factors incrementally by speed.

VMT Fractions (Also Known as VMT Mix) - These sets of fractions (VMT fractions attributable to individual vehicle classes) are an input to MOBILE6; however, the method for this study required the external application of the VMT mix (or mixes) later in the emissions calculation process. VMT mix development is discussed in the next main section.

Total VMT by Hour - The San Antonio District summer weekday travel factors, as used to estimate hourly VMT (see “Estimation of VMT” section), were used as MOBILE6 fleet hourly VMT input for all counties for the summer weekday analysis.

Additionally, according to the same method as used for summer weekday, TxDOT San Antonio District winter (December, January, February) weekday hourly travel factors were produced and used as input for the average monthly weekday rates used in the annual emissions analysis. Use of summer and winter factors by month were: Summer/April through September; and Winter/January through March and October through December.

The hourly VMT fractions are input to MOBILE6 as an external data file. The data files are provided on CD-ROM, as described in Appendix A. Appendix C shows the hourly VMT fractions.

VMT Distribution by Average Speed - The VMT distributions by average speed inputs are called by the SPEED VMT command, but are accommodated internally by the POLFAC62_3 program (that is, no user speed input commands or data parameter values were required when producing MOBILE6 emissions factors tables with POLFAC62_3). POLFAC62_3 uses the SPEED VMT inputs to produce the individual Freeway and Arterial emissions factors indexed by the 14 MOBILE6 speed bin speeds.

There are 14 scenarios, each set up with 100 percent of Freeway and Arterial VMT for one of the 14 MOBILE speed bin speeds. Each scenario produced a set of Arterial and Freeway emissions factors corresponding to one of the 14 speeds.

State Programs
There were no MOBILE6 State Programs modeled in the analysis (i.e., no I/M programs, no ATP programs, and no Stage II refueling programs). Although Texas administers a statewide ATP, the ATP (from which compliance rates are not readily available) is only modeled for those areas that also administer and enforce I/M programs (none of the San Antonio EAC area counties) from which the compliance rate may be assumed.

Fuels
TTI used two major data sources (summer and winter fuel surveys) to produce the seasonal fuel parameter inputs to MOBILE6. For each seasonal data set, the fuels input data were used directly or calculated as needed, mapped from sample city-to-county (or county group) level, and distributed to each month of the year including transitional months (between summer and winter) by interpolation of the seasonal values. The following discussion encompasses the process as performed for all Texas counties.

Data Sources – An extensive Texas summer 2005 fuels survey summary data set (TCEQ Texas Summer 2005 Fuel Survey) was available for use in this analysis, *Sampling and Laboratory Analysis of Retail Gasoline and Diesel Fuel from Selected Texas Cities — Summer 2005*, ERG for TCEQ, August 31, 2005. The survey provided summaries of average gasoline and diesel parameters for input to MOBILE6 for the 25 TxDOT Districts (i.e., retail outlet fuel samples were taken from cities within districts, average properties were calculated within each district and mapped straight to district counties). Such extensive data were not available for the winter season/s. TTI acquired the winter fuel survey *Motor Gasolines, Winter 2004-05 for Texas Cities*, Northrop Grumman Mission Systems (NGMS), which included raw fuel data for five Texas cities. Both the TCEQ and NGMS surveys included gasoline samples for the premium and regular grades only.

Data Processing – Both data sets, TCEQ survey summary data and NGMS raw sample data, required some processing to convert all of the average fuel property values into the numerical form and units required for input to MOBILE6. The fuel parameter inputs to MOBILE6 used in this analysis included:

- gasoline sulfur content (parts per million [ppm]);
- gasoline RVP (psi);
- ether-blend gasoline oxygen content (weight percent, as a decimal fraction);
- alcohol-blend gasoline oxygen content (weight percent, as a decimal fraction);
- ether blend market share (decimal fraction);
- alcohol blend market share (decimal fraction);
- whether or not a waiver was granted allowing splash blending of oxygenates; and
- diesel sulfur content (ppm).

Since the NGMS winter gasoline sample survey data were in individual sample form, TTI averaged the results for each fuel grade. The results were then combined using the same weighting factors as used to produce the average gasoline properties across fuel grades in the TCEQ fuel study (0.929 for regular and 0.071 for premium based on Texas fuel sales data from *Petroleum Marketing Annual 2004*, Energy Information Administration [EIA], August 2005). (Since EIA data showed that only 6.1 percent of the 2003 total Texas fuel sales were mid-grade, mid-grade was dropped from the TCEQ sampling protocol for more effective use of resources.)

The TCEQ survey summary values for each district were provided in the units required for input to MOBILE6, except that the district average oxygenate content values (which included ether-based TAME, MTBE, and ETBE only) were in units of volume percent (form required for toxics emissions runs). This was also the case for the NGMS oxygenate content values. For use with criteria pollutant runs, oxygen content is required in units of percent by weight. TTI converted all of the oxygenate content value averages (with conversion factors found in section 2.8.10.7.f of the *User's Guide to MOBILE6.1 and MOBILE6.2*, EPA, August 2003) to oxygen content in percent by weight, then summed the results to obtain total oxygen content for each district or sample city average gasoline. Tables 24 and 25 show the average winter and summer season fuel property inputs to MOBILE6.

Table 24
Winter 2005 Average Gasoline Properties[1] by Sample City

			Oxygenate Content (volume %)				Oxygen Content by Individual Oxygenate (weight %)[3]				
Sample City	**RVP (psi)**	**Sulfur[2] (ppm)**	**MTBE**	**ETBE**	**TAME**	**ETOH**	**MTBE**	**ETBE**	**TAME**	**ETOH**	**Total/100**
Amarillo	12.28	11.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000
Dallas	12.13	25.3	9.04	0.00	0.65	0.00	1.61	0.00	0.11	0.00	0.017
El Paso	12.34	58.8	0.00	0.00	0.00	7.04	0.00	0.00	0.00	2.43	0.024
Houston	12.01	13.8	9.28	0.00	0.96	0.00	1.66	0.00	0.16	0.00	0.018
San Antonio	12.52	19.0	0.18	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.000

[1] Based on NGMS Winter 2004-05 raw gasoline sample survey data.
[2] Minimum input value allowed in MOBILE6 is 30.0 ppm.
[3] Converted from oxygenate content using factors found in *User's Guide to MOBILE6.1 and MOBILE6.2*, EPA, August 2003; oxygen weight percent total divided by 100 is MOBILE6 numerical input specification (e.g., 2.43 oxygen percent by weight is input in decimal fraction form to the thousandth, or 0.024). Oxygen content totals are separated for ether and alcohol blends.

Table 25
Summer 2005 Average Fuel Properties by TxDOT District Sample Cities[1]

					Oxygenate Content (volume %)			Oxygen Content (weight %)[2]			
District	Sample-City Gas Rule	Diesel Sulfur[3] (ppm)	RVP (psi)	Gas Sulfur[4] (ppm)	MTBE	ETBE	TAME	MTBE	ETBE	TAME	Total/100
Abilene	9.0 RVP	385.0	8.38	158.3	0.16	2.01	0.00	0.028	0.308	0.000	0.003
Amarillo	9.0 RVP	374.7	8.17	110.8	0.08	3.52	0.00	0.015	0.539	0.000	0.006
Atlanta	7.8 RVP	330.3	7.41	104.5	0.18	2.29	0.00	0.031	0.350	0.000	0.004
Austin	7.8 RVP	412.0	7.52	80.7	0.21	2.07	0.00	0.038	0.317	0.000	0.004
Beaumont	7.8 RVP	268.0	7.45	113.9	0.43	2.22	0.00	0.077	0.340	0.000	0.004
Brownwood	9.0 RVP	358.7	7.44	73.3	1.57	2.31	0.11	0.280	0.354	0.017	0.007
Bryan	7.8 RVP	267.3	7.43	90.7	0.57	2.45	0.00	0.101	0.376	0.000	0.005
Childress	9.0 RVP	330.3	8.15	50.4	0.07	3.72	0.03	0.012	0.570	0.000	0.006
Corpus Christi	7.8 RVP	345.8	7.44	77.2	0.90	2.19	0.03	0.161	0.336	0.000	0.005
Dallas	RFG	358.0	6.87	74.9	9.47	2.50	0.26	1.691	0.383	0.042	0.021
El Paso	7.0 RVP	357.3	6.65	158.1	0.09	3.32	0.00	0.017	0.510	0.000	0.005
Fort Worth	RFG	351.0	6.96	81.1	8.47	2.82	2.49	1.512	0.432	0.408	0.024
Houston	RFG	370.1	6.76	62.6	10.05	2.72	0.60	1.794	0.417	0.098	0.023
Laredo	9.0 RVP	144.3	7.31	26.2	0.09	2.24	0.00	0.016	0.343	0.000	0.004
Lubbock	9.0 RVP	337.0	8.26	171.3	0.10	3.51	0.00	0.018	0.539	0.000	0.006
Lufkin	7.8 RVP	269.3	7.42	92.8	0.41	2.24	0.00	0.073	0.343	0.000	0.004
Odessa	9.0 RVP	374.0	8.28	165.5	0.14	1.99	0.00	0.025	0.304	0.000	0.003
Paris	7.8 RVP	270.0	7.45	144.0	0.28	2.41	0.00	0.049	0.369	0.000	0.004
Pharr	9.0 RVP	214.7	8.44	59.1	0.40	2.96	0.01	0.071	0.453	0.000	0.005
San Angelo	9.0 RVP	391.7	8.46	86.4	0.18	1.93	0.00	0.033	0.296	0.000	0.003
San Antonio	7.8 RVP	197.8	7.42	38.5	0.09	2.40	0.00	0.016	0.368	0.000	0.004
Tyler	7.8 RVP	369.0	7.46	154.9	0.12	2.45	0.00	0.021	0.376	0.000	0.004
Waco	7.8 RVP	409.3	7.44	70.3	0.19	1.62	0.00	0.034	0.248	0.000	0.003
Wichita Falls	9.0 RVP	371.0	8.05	267.5	0.38	2.25	0.00	0.068	0.345	0.000	0.004
Yoakum	7.8 RVP	366.8	7.31	121.7	1.10	2.51	0.00	0.196	0.385	0.000	0.006

[1] Based on TCEQ summer 2005 fuel study. Counties in districts not under associated district sample-city rule were mapped to nearest sample city under same rule.
[2] Data indicated only ether-based oxygenates for summer. Oxygen weight percent total divided by 100 is MOBILE6 numerical input specification (e.g., 0.336 oxygen percent by weight is input in decimal fraction form, or 0.003).
[3] Straight district-to-county mapping was maintained for summer diesel sulfur input values, which were used for all months due to lack of availability of more appropriate data.
[4] The minimum allowable gasoline sulfur input value in MOBILE6 is 30.0 ppm.

Mapping of Fuels Data to Counties – TTI modified the TCEQ summer fuel study straight district-to-county mapping (for gasoline only), where needed, to ensure use of fuels data representative of the summer gasoline rules in place for each county. General "gas rule" criteria were used (i.e., RFG and RVP limits: 7.0, 7.8, and 9.0). The criterion pertaining to each county and to sample cities for each district was identified. Counties in each district were thus grouped by rule criterion; those counties under a rule different from their district's fuel sample were assigned fuel parameter values from the nearest sample city under the same rule criterion.

TTI also used gasoline rule criteria to map the NGMS winter gasoline data from the NGMS sample cities (Amarillo, El Paso, Dallas, Houston, and San Antonio) to each county. The gasoline rule criteria for the winter fuel parameter allocations are: winter oxygenated gasoline, RFG, and summer 7.8/9.0 RVP limits. The El Paso data were used only for El Paso County since it is the only county covered by the state winter oxygenated gasoline rule. Dallas and Houston (RFG) data were used for DFW and HGA RFG counties, respectively. The remaining counties used San Antonio and Amarillo data based on summer 7.8 and 9.0 RVP limit county coverage (even though these rules pertain to ozone control periods). San Antonio (under 7.8 limit) and Amarillo (under 9.0 limit) data were mapped to 7.8 and 9.0 RVP limit county groups, respectively. This distinction was used because the state 7.8/9.0 RVP limit geographic boundary is close to the 99-degree longitude division of Texas East/West counties used in the American Society for Testing and Materials (ASTM) Schedule of Seasonal and Geographic Volatility Classes for Texas. The ASTM schedule provides the volatility classes by county and month that TTI used to develop interpolation factors for estimating the transitional month fuel properties (the ASTM volatility class profile is different for counties on either side of this boundary).

The fuel parameters mapping was performed in a spreadsheet, which is provided with the electronic data submitted. See Appendix A (Part 4) description.

Estimation of Fuel Properties by Month – To distribute the summer and winter fuels data to each month of the year, TTI interpolated the fuels data based on the method found in *Draft National Mobile Inventory Model (NMIM) Base and Future Year County Database Documentation and Quality Assurance Procedures*, ERG for EPA, April 2003.

Volatility (RVP) classes (Table 26) were assigned to each county by month and for the summer and winter seasons (Tables 27 and 28). These class schedules provided an annual RVP profile for each county with stepwise changes by month for those months between the summer and winter periods. This process of applying the ASTM volatility classes and ASTM Schedule of Geographic Volatility Classes was based in part on "ASTM Class Guidance" in the *User's Guide to MOBILE4*, EPA, February 1989). This original guidance was followed in that for cases where more than one volatility class was listed for a month, the class with the lower volatility limit was used. The ASTM volatility class schedule lists volatility classes for each state, or portion of state, for each month of the year.

Table 26
Seasonal Volatility Classes for Texas Counties

Label	Description	RVP (psi)[1]
ELP	Summer - El Paso Low RVP	7.0
RFG	Summer - Reformulated Gasoline	7.2
AA	Summer - Regional Low RVP	7.8
A	Summer - Federal Low RVP	9.0
B	Non-Summer RVP	10.0
C	Non-Summer RVP	11.5
D	Non-Sumer RVP	13.5

[1] RVP values are from ASTM standard D4814-04b$^{\epsilon 1}$ Schedule of Geographic Volatility Classes, except for RFG RVP value that TTI developedderived by estimating and adding the average refiner compliance safety margin from 7.0/7.8 RVP limit counties (i.e., using summer 2005 data, average difference between RVP limits and estimated actuals for 7.0/7.8 limit counties) to the average summer RFG RVP value.

Using these RVP profiles, TTI calculated interpolation factors for each county group and month (Table 29) using the formula:

$$Factor_{Monthly\ Interpolation} = (RVP_{month\ class} - RVP_{summer\ class})/(RVP_{winter\ class} - RVP_{summer\ class})$$

Fuel property values by county or county group and month were calculated as:

$$\text{Interpolated Monthly Value} = \text{Summer Value} + Factor_{Monthly\ Interpolation} \times (\text{Winter Value} - \text{Summer Value})$$

This method was used for estimating the monthly gasoline sulfur content, oxygen content, and RVP values, producing stepwise changes in sulfur and oxygen content along the same schedule as RVP (see Table 28 footnote on El Paso winter oxygenate interpolation exception).

Table 27
RVP Class Schedule[1] for Texas Counties

Month	El Paso County	RFG Counties	7.8 Limit Counties[2]	9.0 Limit Counties[2]
January	D	D	D	D
February	C	D	D	C
March	B	C	C	B
April	A	A	A	A
May	A	A	A	A
June	ELP	RFG	AA	A
July	ELP	RFG	AA	A
August	ELP	RFG	AA	A
September[1]	ELP	RFG	AA	A
October	B	B	B	B
November	C	C	C	C
December	D	D	D	D
Summer	ELP	RFG	AA	A
Winter	D	D	D	D

[1] For volatility control periods through September 15, the RVP class value was applied through the end of September.
[2] 7.8 RVP limit county group (i.e., East Texas Regional low RVP counties and Beaumont/Port Arthur (BPA) nonattainment counties) and 9.0 RVP limit county group RVP profiles are based, respectively, on the volatility class schedule for counties east and west of the 99-degree longitude dividing line in the ASTM Schedule of Geographic Volatility Classes.

Table 28
Interpolation Factors for Estimating Texas Gasoline Parameter Values by Month

Month	El Paso County[1]	RFG Counties	7.8 Limit Counties	9.0 Limit Counties
January	1.00	1.00	1.00	1.00
February	1.00	0.69	1.00	0.56
March	0.65	0.46	0.68	0.22
April	0.21	0.31	0.29	0.00
May	0.21	0.31	0.29	0.00
June	0.00	0.00	0.00	0.00
July	0.00	0.00	0.00	0.00
August	0.00	0.00	0.00	0.00
September[1]	0.00	0.00	0.00	0.00
October	0.39	0.46	0.44	0.22
November	0.65	0.69	0.68	0.56
December	1.00	1.00	1.00	1.00

[1] El Paso County winter oxygenate was an exception to the interpolation procedure, due to the winter oxygenated gasoline control period, October 1 through March 31. The estimated actual winter oxygen content value (solely ethanol-based) was applied to all winter control period months, and was not included in interpolation with summer oxygenate (solely ether-based) for estimating transitional month oxygen content values.

The Excel worksheet identified in Appendix A (Part 4) provides all fuel property inputs by month for county groups as well as for individual counties.

MOBILE6 Fuel Parameter Commands - Estimated actual average sulfur content values were input through use of the FUEL PROGRAM Option 4 command, which allows input of average sulfur content values by calendar year of not less than 30 ppm (30 ppm was input for any estimated actual value less than that). Estimated actual average RVP values were input via the FUEL RVP command. Estimated oxygenate parameters, input through the OXYGENATED FUELS command, consisted of market share of oxygenated fuel by oxygenate type (100 percent ether-based, except for El Paso winter season, which is 100 percent alcohol-based). The parameter also consisted of the estimated average percent by weight oxygen content (summer survey summary values for all districts contained ether-based oxygen and no alcohol-based oxygenates), with no waiver for addition of oxygenate to gasoline by splash blending.

The DIESEL SULFUR command was used to specify input diesel sulfur content value for each county group emissions factor run. As previously noted, the summer fuel study diesel sulfur values were used for all months due to availability of data. MOBILE6 input files were provided as described in Appendix A.

Alternative Emissions Regulations and Control Measures
The only alternate input value used within this section of the MOBILE6 model, which includes application of the HDDV NOx off-cycle emissions effects and the effects of the associated NOx off-cycle emissions mitigation programs, was the Rebuild Effectiveness Rate.

In the late 1980s and most of the 1990s, HDDV engines were built with “defeat devices” allowing in-use engine emissions to be higher than emissions as specified under Federal Test Procedure conditions. MOBILE6 includes estimates of these excess HDDV emissions as well as the emissions offsetting effects of two programs — early pull-ahead of 2004 HDDV emissions standards, and the low emissions rebuilds of existing engines. The MOBILE6 default 2004 pull-ahead program was used, and for modeling the effectiveness of the rebuild program, alternate effectiveness rates were estimated and used.

No new rebuild program data were available, so TTI used EPA rebuild program tracking data acquired for prior analyses and extrapolated rebuild effectiveness rate values for January 1, 2005, July 1, 2005, and January 1, 2006 (8.5 percent, 9.5 percent, and 10.6 percent, respectively). These values were used for all counties and were applied in MOBILE6 as follows: 8.5 percent for January through March, 9.5 percent for April through September, and 10.6 percent for October through December. These values were extrapolated assuming linear growth, from January 2002 and April 2003 effectiveness rate estimates (2.12 and 4.78 percent, based on the available EPA data).

Using the MOBILE6 input parameters and options described above, MOBILE6 input files were set up and run with the POLFAC62_3 utility for each county for the summer weekday (for both hourly and daily emissions factors) and for each month of the year (for daily emissions factors). The resulting tabulated hourly summer weekday emissions factors indexed by speed, MOBILE6 drive cycle, vehicle type, and pollutant-specific emissions type were then input to the emissions calculations; the county daily emissions factors were used to produce the emissions rate annualization factors for the annual emissions calculations, discussed later (see emissions inventory utility descriptions in Appendix B). The modeled emissions factors are provided on CD-ROM (see description in Appendix A).

ESTIMATION OF VMT MIX

To distribute the county on-road, fleet wide VMT estimates to each of the 28 MOBILE6 vehicle classes, TTI estimated and used TxDOT district-level, 24-hour VMT mixes for 2005, by three functional classification groups (freeway, arterial, and collector).

Data

The primary data used to estimate VMT mixes were official TxDOT classification counts recorded by roadway functional class, that are collected as part of TxDOT’s ongoing statewide data collection effort. TTI aggregated the TxDOT classification counts across years, by TxDOT District and by the three functional classification groups, using the latest five years of data (1999-2003). Additional data used to expand from the vehicle classification count categories to

MOBILE6 vehicle classes were latest available year-end (2004) TxDOT district-level registrations data, and mid-analysis year (2005) MOBILE6 defaults.

TxDOT classification counts classify vehicles into the standard FHWA vehicle classifications (based on vehicle length/number of axles) using best practice vehicle classification count methods:

C	-	Passenger vehicles;
P	-	Two-axle, four-tire single-unit trucks;
B	-	Buses;
SU2	-	Six-tire, two-axle single-unit vehicles;
SU3	-	Three-axle single-unit vehicles;
SU4	-	Four or more axle single-unit vehicles;
SE4	-	Three or four axle single-trailer vehicles;
SE5	-	Five-axle single-trailer vehicles;
SE6	-	Six or more axle single-trailer vehicles;
SD5	-	Five or less axle multi-trailer vehicles;
SD6	-	Six-axle multi-trailer vehicles; and
SD7	-	Seven or more axle multi-trailer vehicles.

The 28 MOBILE6 vehicle classes are defined as a function of gross vehicle weight rating (GVWR) and fuel type (see Table 9). The FHWA axle/vehicle length-based classification categories were converted into the 28 MOBILE GVWR/fuel-type-based categories following the allocation methodology as described in the TTI Technical Report, *VMT Mix Estimation Method Refinement for MOBILE6,* August 2003, and summarized below.

Procedure

The FHWA vehicle classification counts were first aggregated into three intermediate groups, and the bus category:

Passenger Vehicles (PV)	-	C + P;
Heavy-Duty Vehicles (HDV)	-	SU2 + SU3 + SU4 + SE4;
HDDV8b (HDX)	-	SE5 + SE6 + SD5 + SD6 + SD7; and
Buses (B)	-	B.

The PV intermediate group was disaggregated into the nine MOBILE6 “light” classes (i.e., LDVs, LDTs, and MC – see MOBILE6 vehicle numbers 1-5, 14-15, 24, 28, defined in Table 9) using a combination of TxDOT registrations data, MOBILE6 defaults, and a nominal constant (for MC). TxDOT registrations data were used to split PV into light cars (LDV) and light trucks (LDT), and to further divide LDT into the $\leq$ 6,000 GVWR and > 6,000-to-8,500 GVWR categories. TxDOT light-duty vehicle registrations do not distinguish by fuel type, and include just the two weight classes of LDT. MOBILE6 defaults were thus used to produce the gasoline/diesel sub-classes, and to produce the further subsets of LDTs completing the LDT expansion to the four gasoline and two diesel classes as used in MOBILE6. MC was subtracted from the LDGV category using a nominal constant.

The HDV intermediate group was disaggregated into 15 of the 16 MOBILE6 HDV vehicle classes (i.e., the eight gasoline [HDGV] categories, and the lighter seven of the eight diesel [HDDV] categories: see MOBILE6 vehicle class numbers 6-13, and numbers 16-22, respectively, in Table 9). The allocation was performed using the TxDOT registration data, which includes all 16 of the MOBILE6 heavy-duty vehicle categories. The HDX intermediate group classification counts were used directly for the heaviest of the MOBILE6 diesel vehicle categories, HDDV8b, to better represent this critical category, which is possibly under represented by regional registration data.

The B, or bus, classifications were divided into the three MOBILE6 bus categories (see Table 9) using MOBILE6 defaults. (The TxDOT registrations data do not distinguish buses separately from the heavy-duty vehicle classes.)

The VMT mixes are weekday estimates, as the TxDOT vehicle classification data are collected for weekdays (Monday through Thursday). No seasonal changes were made. Tables 30 and 31 (in the Emissions Calculations section) relate the use of the functional group VMT mixes by individual HPMS functional class in the emissions calculations. Appendix H shows the estimated VMT mixes.

ESTIMATION OF ANNUALIZATION FACTORS

TTI developed a methodology for producing annual emissions estimates from seasonal weekday emissions estimates. There are two elements in the annualization methodology. The first is the VMT adjustment that converts the seasonal weekday VMT component of seasonal weekday emissions to annual VMT. The second is the emissions rate adjustment that is needed to accommodate changes in emissions rates between a particular season and the remainder of the year due to variation in various parameters. The general expression below shows how the VMT annualization factor and the emissions rate annualization factors were applied to summer weekday emissions for each county to produce the annual emissions estimate. For each county, a single VMT annualization factor was applied to all pollutants and vehicle types, whereas a separate emissions rate annualization factor was applied per pollutant and vehicle type:

$$EM\_ANN_{v,p,t,r} = EM\_SWKD_{v,p,t,r} \times VMT\_ANNFAC \times ER\_ANNFAC_{v,p,t}$$

Where:

v,p,t,r	=	vehicle class, pollutant, emissions type, and road class;
EM_ANN	=	annual emissions estimates;
EM_SWKD	=	summer weekday emissions estimate;
VMT ANNFAC	=	VMT annualization factor for given county; and
ER_ANNFAC	=	emissions rate annualization factor.

Annualization Factors for Summer Weekday VMT

To produce link-level, summer weekday VMT for the summer weekday emissions analyses, the HPMS consistent, summer weekday VMT control totals were used (Table 5). The control totals consist of the 2005 HPMS AADT VMT forecast for each county multiplied by a summer weekday adjustment factor. Thus, to annualize the summer weekday VMT, a factor to produce

AADT VMT and expand it from the daily to the annual period was needed. This VMT annualization factor is the inverse of the summer weekday adjustment factor multiplied by 365.

For example, the AADT to summer weekday adjustment factor for San Antonio District counties is 1.08871. The VMT annualization factor for each San Antonio District county is thus (1/1.08871) × 365, or 335.259159923. Conceptually, this value represents the number of days of summer weekday VMT equivalent to the calendar year 2005 VMT total, for counties in the San Antonio District. Table 5 also shows the annual VMT estimates by county. Detailed annual VMT estimates by vehicle and road type categories are included in the emissions summaries provided in the electronic data submittal as described in Appendix A.

Annualization Factors for Average Summer Weekday Emissions Rates
In addition to the VMT annualization component, ratios of emissions factors were needed to convert summer weekday emissions to annual emissions. These factors essentially consist of an annual average weekday emissions factor as the numerator, and the summer weekday emissions factor as the denominator. For each county and county group, one set of emissions rate annualization factors was developed by pollutant, emissions type, and vehicle type.

As previously described in the section on emissions factors development, average weekday emissions rates for each month were estimated to reflect changes in emissions rates during the year from the seasonal variation in meteorology, fuel properties, and fleet makeup. The average of the 12 monthly rates was calculated (using monthly weights of equal value for this study, since the multi-year, TxDOT District ATR-based travel factors showed minimal difference by month), yielding an annual average daily emissions factor. The quotient of the annual average weekday emissions factor and the summer weekday emissions factor for each vehicle type pollutant and emissions type yielded the desired annualization factors.

The general expression for the emissions rate annualization factor is:

$$ER\_ANNFAC_{v,p,t} = \frac{\sum_{i=1}^{12} EF_{i(v,p,t)} \times W_i}{EF_{SWKD(v,p,t)}} = \frac{EF_{AAD(v,p,t)}}{EF_{SWKD(v,p,t)}}$$

Where:

ER_ANNFAC	=	emissions rate annualization factor;
v,p,t	=	vehicle type, pollutant, emissions type;
EF_i	=	average weekday rate for month *i*;
W_i	=	weighting factor for month *i*;
EF_{SWKD}	=	summer weekday emissions rate; and
EF_{AAD}	=	annual average weekday emissions rate.

All emissions factors used to develop the annualization factors were 24-hour weekday freeway road type rates at the particular county level average speed rounded to the nearest 5 mph increment.

For example, Table 29 lists the components used to calculate the ER_ANNFAC for Comal County VOC exhaust running emissions. These components include: the average monthly weekday emissions rates and associated monthly travel factors (in this case, essentially equal across months), and the average summer weekday rate.

Table 29
LDGV VOC Exhaust Running Emissions Factors[1] for Comal County Emissions Rate Annualization Factor Example Calculation

Period	g/mi	Weighting Factor
Month 1	0.24868327	0.08333
Month 2	0.24939337	0.08333
Month 3	0.23395192	0.08333
Month 4	0.19513142	0.08333
Month 5	0.19539234	0.08333
Month 6	0.20100350	0.08334
Month 7	0.20295412	0.08334
Month 8	0.20328940	0.08334
Month 9	0.20189660	0.08334
Month 10	0.19113530	0.08333
Month 11	0.21855922	0.08333
Month 12	0.22885946	0.08333
Annual (monthly weighted average)	0.21418702	
Summer (average June through August)[2]	0.20075029	

[1] All emissions factors are based on weekday activity input data and are 24-hour, freeway rates, for the Comal County summer weekday average speed rounded to nearest 5 mph increment (i.e., 45 mph).
[2] Average summer weekday rate is from the summer weekday emissions analysis.

Using Table 29 values, the calculated emissions rate annualization factor is:

$$ER\_ANNFAC = \frac{EF_{AAD}}{EF_{SWKD}} \begin{array}{l} = (0.21418702 \text{ g/mi})/(0.20075029 \text{ g/mi}) \\ = 1.066932542. \end{array}$$

The values used in the example above were taken from analysis data files provided on CD-ROM as described in Appendix A. Appendix A (Part 3) describes the emissions rate annualization ratios provided in electronic form as part of the electronic data submittal.

EMISSIONS CALCULATIONS

TTI calculated summer weekday hourly emissions (pounds/hour), 24-hour emissions (pound/day), and annual emissions (tons/year) estimates using utilities developed by TTI for this purpose (see IMPSUM62, SUMMALL62, and ANNUALIZATION emissions inventory utility descriptions in Appendix B). This emissions estimation process was performed twice for all counties, once for each of the PM particle size cutoffs required in the analysis.

Hourly emissions were calculated at the TDM network link level. Generally, for each hour of the average summer weekday, link-VMT estimates were multiplied by the emissions factors (g/mi) to produce hourly emissions estimates for each of the 28 vehicle types and each pollutant and emissions type on each link. The MOBILE6 freeway, arterial, and freeway ramp drive cycle emissions factors were used; freeway emissions factors were applied to freeway links and arterial emissions factors to non-freeway links, except for TDM freeway ramp links for which ramp emissions factors were used. The daily summaries by vehicle type, road type, pollutant, and emissions type were next calculated by summing the hourly emissions estimates. The annualization factors (VMT and emissions rate components) were then multiplied by the daily summer weekday emissions summaries to produce the annual emissions estimates.

There were three file types output from the hourly and daily emissions calculations (results in same output file, with 24-hour results appended to hourly results). The file types were an emissions summary file of county-level hourly and 24-hour emissions estimates cross classified by vehicle type and road type (including VMT, VHT, VMT weighted speeds, and VMT mix); a tab-delimited version of the emissions summary file; and a log file containing the emissions calculation program execution records. The annual emissions output files consist of two types — a tab-delimited emissions summary file in same form as the hourly/daily output, and a file listing of emissions calculation program execution information. An additional set of NIFv3.0 formatted EI results were also produced (see Appendix I for NIF formatting information). These files are provided on CD-ROM (see Appendix A).

Hourly Link Emissions

Emissions were calculated by hour and link using the following basic inputs:

- MOBILE6 hourly road type-specific emissions factors, for the particular pollutants and emissions types, indexed by speed for 28 vehicle types, developed with POLFAC62_3;
- indexes associating the MOBILE6 road-type-specific emissions factors with the appropriate links, based on network functional class codes;

- directional link data from the post-processed TDM network assignment results from TRANSVMT, or directional virtual link data from post-processed HPMS data (TxDOT's RIFCREC data set) from VirtualLinkVMT including: indexes for county, functional class and area type; and fleet total VMT and operational fleet speed estimate; and

- VMT mix (to allocate link VMT by each of the 28 vehicle types) by time period and roadway type.

For each hour, the MOBILE6 emissions-type-specific pollutant emissions estimates were calculated by vehicle type for each link. District-level, 24-hour VMT mixes indexed by functional class group were multiplied by the county fleet total link VMT to produce hourly link VMT estimates by the 28 vehicle types for each individual county in a given district. Emissions factors from the associated county lookup table were then matched to appropriate link data using the pertinent parameter indexes. Emissions factors for estimated average operational link speeds not represented in the set of 14 MOBILE6 speed bin speeds were calculated by interpolation (see example calculation, Appendix B). For link speeds greater than or less than the MOBILE6 bounding speeds of 2.5 mph and 65 mph, the emissions factors corresponding to the bounding speeds were used. The link VMT were then multiplied by the emissions factors to produce the link-level emissions estimates in grams.

Tables 30 and 31 show the correlation of the functional classes to the MOBILE6 drive cycles and to the VMT mix functional classification groups, as used in the emissions calculations for the TDM network counties (Bexar) and the HPMS-based counties (Comal, Guadalup, and Wilson), respectively.

Table 30
San Antonio TDM Network Functional Class Groupings for Allocation of VMT Mix and MOBILE6 Drive Cycle Emissions Factors

MOBILE6 Drive Cycle	Functional Class Name	VMT Mix Functional Group
Freeway	Radial Freeway	Freeway
	Radial Parkway	
	Circular Freeway	
	Circular Parkway	
Ramp	Ramp	Arterial
Arterial	Expressway	
	Primary Arterial Divided	
	Primary Arterial Undivided	
	Minor Arterial Divided	
	Minor Arterial Undivided	
	Circular Arterial Undivided	
	Collectors Divided	Collector/Local
	Collectors Undivided	
	Centroid Connector[1]	
	Intrazonal[1, 2]	

[1] Emissions estimates for centroid connector and intrazonal links comprise the local road type estimate.
[2] Special links added for application of the intrazonal VMT estimate.

Table 31
HPMS Functional Class Groupings for
Allocation of VMT Mix and MOBILE6 Drive Cycle Emissions Factors

MOBILE6 Drive Cycle	HPMS Functional Class	VMT Mix Functional Group
Freeway	Interstate	Freeway
	Freeway	
Arterial	Other Principal Arterial	Arterial
	Minor Arterial	
	Major Collector	Collector
	Minor Collector	
	Local	

Summer Weekday (24-hour) Emissions
For each county, the link-emissions estimates were summed for each hour, converted to pounds, and the hourly emissions were summed for each day. The resulting VOC, CO, NOx, SO_2, NH_3, PM-10, and PM-2.5 emissions estimates (by sub-component as well as composites) are summarized by road type, vehicle type, and road type/vehicle type cross classification. VMT, vehicle hours of travel (VHT), VMT-weighted speeds, and other inventory data are included with the emissions summaries. These files (*.LST and a tab-delimited version, *.TAB) are included with the set of data files provided on CD-ROM (see Appendix A).

Annual Emissions
Annual emissions estimates were calculated as the product of 24-hour summer weekday emissions, VMT annualization factor, and emissions rate annualization factor. One county-level VMT annualization factor was used with summer weekday emissions (as well as with summer weekday VMT and VHT) for all pollutants, emissions types, vehicle types, and road types. The emissions rate annualization factor used on a pollutant, emissions type, and vehicle type-specific basis. These are the major inputs to the annual emissions calculation:

- tab-delimited county, 24-hour summer weekday emissions (pounds/day) summary file output from summer weekday emissions analysis;

- summer weekday travel factor (for calculation of VMT annualization factor);

- county emissions rate annualization factors by pollutant, emissions type, and vehicle type; and

- units (directs utility to convert emissions units from pounds to tons).

Using the equation from the "Estimation of Annualization Factors section and data from the analysis, the following example shows the calculation of annual Comal County LDGV VOC exhaust running emissions for the Rural Minor Arterial roadway type:

$$EM\_ANN_{(v,p,t,r)} = EM\_SWKD_{(v,p,t,r)} \times VMT\_ANNFAC \times ER\_ANNFAC_{(v,p,t)} \times Units\_Fac$$

Where:

v,p,t,r	=	LDGV, VOC, exhaust running, and Rural Minor Arterial;
EM_SKWD	=	77.26731 lbs./day;
VMT_ANNFAC	=	335.259159923 days/year;
ER_ANNFAC	=	1.066932542; and
Units_Fac	=	1 ton/2000 lbs.

Comal County Annual Rural Minor Arterial LDGV VOC exhaust running emissions = 77.26731 lbs./day × 335.259159923 days/year × 1.066932542 × 1 ton/2000 lbs. = 13.819216 tons/year.

The values for this example are in the EI input and output files provided as described in Appendix A.

APPENDIX A
2005 CERR EI ELECTRONIC SUBMITTAL DATA SET DESCRIPTION

2005 CERR EI Electronic Data Submittal Description

TTI provided the EI data (summer weekday, annual, and winter season weekday for El Paso County) on CD-ROM (1) to support the Texas 242 counties 2005 CERR EI task. The parts to this data submittal are:

- Part 1: Emissions Data Summaries;
- Part 2: Emissions Factors;
- Part 3: Emissions Rate Annualization Factors;
- Part 4: Fuels and Meteorological Inputs; and
- Part 5: NIFv3.0 Emissions Files.

County-level EI methods and data aggregation levels for input development varied depending on: 1) whether the county was in one of the six nonattainment/EAC areas (see the following table), and 2) nonattainment/EAC-county travel demand model availability. For the seasonal daily analyses, nonattainment/EAC counties with TDMs used the TDM link-based methodology; other counties used the HPMS-based virtual link method. In addition, for the summer weekday analyses, the ozone nonattainment/EAC areas used meteorological inputs developed based on area high ozone days (from prior analyses, i.e., 2002 CERR or SIP EIs), whereas other counties relied on 2005 meteorological data for average summer season day inputs. Additionally, the nonattainment/EAC counties used vehicle age distributions with light-duty class inputs based on county-level registration data; the remainder of the state relied on the TxDOT district-level aggregation.

Delineation of County-Level Emissions Analyses by Region and Activity Basis

Area	Counties[1]	Activity Basis
1. Houston-Galveston nonattainment area (HGB)	Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller	TDM
2. Beaumont-Port Arthur nonattainment area (BPA)	Jefferson, Hardin, Orange	TDM
3. El Paso nonattainment area (ELP)	El Paso	TDM
4. Austin EAC area (AUS)	Hays, Travis, Williamson Bastrop, Caldwell	TDM HPMS
5. San Antonio EAC area (SAN)	Bexar Comal, Guadalupe, Wilson	TDM HPMS
6 Northeast Texas EAC area (TLM)	Gregg, Smith Harrison, Rusk, Upshur	TDM HPMS
7. Rest of Texas	216 counties	HPMS
Totals by Activity Basis	18 224	TDM HPMS

[1] DFW CMSA was excluded (Collin, Dallas, Denton, Ellis, Henderson, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, and Tarrant).

Part 1: Emissions Data Summaries:

- Detailed seasonal weekday hourly and 24-hour emissions run output files for each county: *.LOG, *.LST, *.TAB files (05cerr_tx242_24hr_ems.zip).
- Detailed annual emissions output files for each county: *.LST, *.TAB (05cerr_tx242_annual_ems.zip).
- County totals extracted from detailed 24-hour and annual runs: VMT, VHT, speed (VMT/VHT), and emissions summaries (*.TAB files) (05cerr_tx242_tots.zip).

There were two emissions run jobs for each county, one for PM-10 (“pm1” in filenames) and one for PM-2.5 (“pm2” in filenames). The *.TAB files are tab-delimited ASCII text files suitable for use in spreadsheets, *.LST for hourly/24-hour runs is a space-delimited version of *.TAB; and *.LOG and *.LST (annual run) are run execution summary information. The following data (emissions units are pounds and tons for daily and annual, respectively) are included in the *.TAB summaries (by vehicle type and road type for the detailed output):

VEHICLE MILES OF TRAVEL;
VEHICLE HOURS;
AVERAGE SPEED WEIGHTED BY VMT (or VMT/VHT for county totals extraction);

VOC CRANKCASE EMISSIONS;
VOC DIURNAL EMISSIONS;
VOC EXH_RUNNING EMISSIONS;
VOC HOT_SOAK EMISSIONS;
VOC REST_LOSS EMISSIONS;
VOC RUN_LOSS EMISSIONS;
VOC START EMISSIONS;
VOC EMISSIONS;
CO EMISSIONS;
CO EXH_RUNNING EMISSIONS;
CO START EMISSIONS;
NOX EXH_RUNNING EMISSIONS;
NOX START EMISSIONS;
NOX EMISSIONS;
ECARBON EMISSIONS;
OCARBON EMISSIONS;
GASPM EMISSIONS;
LEAD EMISSIONS;
SO4 EMISSIONS;
BRAKE EMISSIONS;
TIRE EMISSIONS;
PMTOTAL EMISSIONS;
NH3 EMISSIONS; and
SO2 EMISSIONS.

Part 2: Emissions Factors:

- MOBILE6 input/output for hourly, seasonal weekday analyses and includes corresponding daily output used for rate annualization factor development; and external data files for all analyses (05cerr_swk_m6_ext.zip).
- MOBILE6 input/output for 24-hour average monthly weekday rates used for rate annualization factor development (05cerr_mnth_m6.zip).

The file names are: *.rat and *.rtd (hourly and 24-hour rate tables, respectively, of pollutants and emissions types as listed in Part 1, above, and also indexed by hour [*.rat only], road type, vehicle type, MOBILE6 speed bin speed), *.LOG files (program execution information), and *.LST files (MOBILE6 descriptive output).

<u>Rates for 24-hour Seasonal Weekday (winter for El Paso and summer for remaining counties)</u>
MOBILE6 input/output files are in folders labeled by area (e.g., HGB, BPA, AUS, ...) and in an "HPMS" folder for the 216 remaining counties. Nonattainment/EAC area emissions factors were developed by county (distinguished by county-level age distributions for light-duty classes); rates for the remaining 216 counties were developed with input data aggregations forming 51 county

groupings (see table at end of this appendix). For each set of emissions factors, two runs were required because PM-10 and PM-2.5 emissions factors cannot both be produced in the same run.

In the emissions factor filenames:

- “pm1” and “pm2” denote PM-10 and PM2.5;
- “s1,” “s2,” and “wco” denote June through August, July through September (TLM and HGB only), and December,/January/February (El Paso only) seasons;
- “A1,” “A2,”and “A0” for interim emissions factors, denote ATP1 (early model year ATP), ATP2 (late model year ATP), and No ATP for multiple runs needed for combining two-part ATP effects (El Paso and HGB I/M counties);
- “I1” and “I2” denote actual I/M begin year and I/M begin year plus one, for two runs needed for modeling May I/M begin date (Brazoria, Fort Bend, Galveston and Montgomery counties);
- “CCCC” denotes nonattainment/EAC county names, where CCCC is first four letters of county name (except HRSN for Harrison County); and
- “D##G##H##C#” is the county group code for emissions factors by county group (see table of counties by county group code at end of this appendix).

External data input files consist of:

- *. rgd: vehicle age distributions by county for nonattainment/EAC areas, by TxDOT District for 216 HPMS counties;
- HG05.tld: HGB travel model network-based 2005 trip length distributions;
- **SSSS*wk.vhr: seasonal weekday VMT distributions by TxDOT District and seasonal period (where *SSSS* is season: s1, s2 or w); and
- *.im: I/M input records (where, “H,” “HU,” “ELP,” “TW05ANN,” and “GConly” denote Harris; Brazoria/Fort Bend/Galveston/Montgomery/El Paso; Travis/Williamson [Austin setup for approximating effects for annual estimate; beginning date was in September 2005], gas cap test only.

For the summer weekday PM-10 runs for particular counties with I/M programs that began in May, multiple runs were required, with results combined to properly model the May begin date as well as two-part ATP (interim output is in appropriately labeled folders separate from final rates). No I/M/ATP post-processing was performed on PM-2.5 runs, which were solely for PM-related pollutants for which MOBILE6 applies no I/M/ATP-related affects.

Rates (used in annualization factors) for Annual Emissions Analysis

Rates for developing annualization factors consisted of 24-hour average monthly and 24-hour average summer weekday rates (from summer weekday emissions analysis). The labeling of monthly weekday rates files used a similar naming convention as for the summer weekday rates in the discussion above (see the table at the end of the appendix for county-to-county group codes by month). For monthly rates, however, no I/M/ATP post-processing was performed (thus no I/M/ATP labeling in the filenames). For counties with May I/M begin dates and two-part ATP modeling, the actual I/M beginning year and ATP2 input records were used.

Part 3: Emission Rate Annualization Factors:

- Emissions rate annualization factors calculated with rates from Part 2, including a spreadsheet table listing county/speed/annualization factor file identifier (05cerr_rateannfacs.zip).

The emissions rate annualization factors used (along with VMT annualization factors) to convert summer/ozone season weekday emissions estimates to annual emissions estimates are included in this part of the data set. Emissions rate annualization factors were calculated using 24-hour emissions factors (*.rtd) described above in Part 2. The factors were developed by pollutant emissions types for both PM-10 and PM-2.5 runs, using the weighted average of the 12 monthly weekday emissions factors as the numerator, and the summer weekday emissions rate as the denominator. All emissions factors used (in both numerator and denominator) were for the freeway road type, and for the county aggregate average speed (VMT/VHT). The speeds were rounded to the nearest MOBILE6 speed bin speed (i.e., 5 mph increment).

The filename convention is "**MPH*_rfac.txt," where the county group code or nonattainment/EAC county is identified the same way as for seasonal (summer) weekday rates as described in Part 2, and "*MPH*" is the speed used (county average speed rounded to nearest MOBILE6 speed bin speed).

Part 4: Fuels and Meteorological Inputs:

- "05cerr_fuels_meteorology.zip" contains one spreadsheet containing the fuels parameters and coding scheme used by county and month (including data values that may be used in MOBILE6 toxics analyses); and the meteorological input record files by month and average summer day by climate zone (*.prn) and by typical ozone (plus CO for El Paso) season day for nonattainment/EAC counties.

Part 5: NIFv3.0 Emissions Files:

- "05cerr_nif.zip" contains the NIF record files for 242 county 2005 CERR EIs and a wpd file (NIF_dataval_05cerr.wpd) with data dictionary and description of NIFv3.0 records/files.

The 2005 NIF TR, PE, and EM records for the 242 Texas Counties are in:
242tx_or2005_NIFtr.txt;
242tx_or2005_NIFpe.txt; and
242tx_or2005_NIFem.txt.

County Group and Nonattainment/EAC County Emissions Coding Scheme[Notes] — Filenames by County and Period

County	District	Summer Weekday	January	February	March	April	May	June	July	August	September	October	November	December
Borden	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Callahan	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Fisher	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Haskell	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Howard	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Jones	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Kent	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Mitchell	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Nolan	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Scurry	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Shackelford	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Stonewall	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Taylor	Abilene	*D01G01H01C6	*M01_G02*	*M02_G01*	*M03_G01*	*M04_G01*	*M05_G01*	*M06_G01*	*M07_G01*	*M08_G01*	*M09_G01*	*M10_G01*	*M11_G01*	*M12_G02*
Armstrong	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Carson	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Dallam	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Deaf Smith	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Gray	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Hansford	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Hartley	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Hemphill	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Hutchinson	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Lipscomb	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Moore	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Ochiltree	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Oldham	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Potter	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Randall	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Roberts	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*
Sherman	Amarillo	*D02G02H02C1	*M01_G02*	*M02_G02*	*M03_G02*	*M04_G02*	*M05_G02*	*M06_G02*	*M07_G02*	*M08_G02*	*M09_G02*	*M10_G02*	*M11_G02*	*M12_G02*

County	District	Summer Weekday	January	February	March	April	May	June	July	August	September	October	November	December
Bowie	Atlanta	*D03G03H03C3	*M01_G21*	*M02_G21*	*M03_G03*	*M04_G03*	*M05_G03*	*M06_G03*	*M07_G03*	*M08_G03*	*M09_G03*	*M10_G03*	*M11_G03*	*M12_G21*
Camp	Atlanta	*D03G03H03C3	*M01_G21*	*M02_G21*	*M03_G03*	*M04_G03*	*M05_G03*	*M06_G03*	*M07_G03*	*M08_G03*	*M09_G03*	*M10_G03*	*M11_G03*	*M12_G21*
Cass	Atlanta	*D03G03H03C3	*M01_G21*	*M02_G21*	*M03_G03*	*M04_G03*	*M05_G03*	*M06_G03*	*M07_G03*	*M08_G03*	*M09_G03*	*M10_G03*	*M11_G03*	*M12_G21*
Harrison	Atlanta	*HRSN*_05s*	*M01_HRSN	*M02_HRSN	*M03_HRSN	*M04_HRSN	*M05_HRSN	*M06_HRSN	*M07_HRSN	*M08_HRSN	*M09_HRSN	*M10_HRSN	*M11_HRSN	*M12_HRSN
Marion	Atlanta	*D03G03H03C3	*M01_G21*	*M02_G21*	*M03_G03*	*M04_G03*	*M05_G03*	*M06_G03*	*M07_G03*	*M08_G03*	*M09_G03*	*M10_G03*	*M11_G03*	*M12_G21*
Morris	Atlanta	*D03G03H03C3	*M01_G21*	*M02_G21*	*M03_G03*	*M04_G03*	*M05_G03*	*M06_G03*	*M07_G03*	*M08_G03*	*M09_G03*	*M10_G03*	*M11_G03*	*M12_G21*
Panola	Atlanta	*D03G03H03C3	*M01_G21*	*M02_G21*	*M03_G03*	*M04_G03*	*M05_G03*	*M06_G03*	*M07_G03*	*M08_G03*	*M09_G03*	*M10_G03*	*M11_G03*	*M12_G21*
Titus	Atlanta	*D03G03H03C3	*M01_G21*	*M02_G21*	*M03_G03*	*M04_G03*	*M05_G03*	*M06_G03*	*M07_G03*	*M08_G03*	*M09_G03*	*M10_G03*	*M11_G03*	*M12_G21*
Upshur	Atlanta	*UPSH*_05s*	*M01_UPSH	*M02_UPSH	*M03_UPSH	*M04_UPSH	*M05_UPSH	*M06_UPSH	*M07_UPSH	*M08_UPSH	*M09_UPSH	*M10_UPSH	*M11_UPSH	*M12_UPSH
Bastrop	Austin	*BAST*_05s*	*M01_BAST	*M02_BAST	*M03_BAST	*M04_BAST	*M05_BAST	*M06_BAST	*M07_BAST	*M08_BAST	*M09_BAST	*M10_BAST	*M11_BAST	*M12_BAST
Blanco	Austin	*D04G06H04C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Burnet	Austin	*D04G06H04C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Caldwell	Austin	*CALD*_05s*	*M01_CALD	*M02_CALD	*M03_CALD	*M04_CALD	*M05_CALD	*M06_CALD	*M07_CALD	*M08_CALD	*M09_CALD	*M10_CALD	*M11_CALD	*M12_CALD
Gillespie	Austin	*D04G06H04C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Hays	Austin	*HAYS*_05s*	*M01_HAYS	*M02_HAYS	*M03_HAYS	*M04_HAYS	*M05_HAYS	*M06_HAYS	*M07_HAYS	*M08_HAYS	*M09_HAYS	*M10_HAYS	*M11_HAYS	*M12_HAYS
Lee	Austin	*D04G04H04C8	*M01_G21*	*M02_G21*	*M03_G04*	*M04_G04*	*M05_G04*	*M06_G04*	*M07_G04*	*M08_G04*	*M09_G04*	*M10_G04*	*M11_G04*	*M12_G21*
Llano	Austin	*D04G06H04C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Mason	Austin	*D04G06H04C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Travis	Austin	*TRAV*_05s*	*M01_TRAV	*M02_TRAV	*M03_TRAV	*M04_TRAV	*M05_TRAV	*M06_TRAV	*M07_TRAV	*M08_TRAV	*M09_TRAV	*M10_TRAV	*M11_TRAV	*M12_TRAV
Williamson	Austin	*WILL*_05s*	*M01_WILL	*M02_WILL	*M03_WILL	*M04_WILL	*M05_WILL	*M06_WILL	*M07_WILL	*M08_WILL	*M09_WILL	*M10_WILL	*M11_WILL	*M12_WILL
Chambers	Beaumont	*CHAM*_05s*	*M01_CHAM	*M02_CHAM	*M03_CHAM	*M04_CHAM	*M05_CHAM	*M06_CHAM	*M07_CHAM	*M08_CHAM	*M09_CHAM	*M10_CHAM	*M11_CHAM	*M12_CHAM
Hardin	Beaumont	*HARD*_05s*	*M01_HARD	*M02_HARD	*M03_HARD	*M04_HARD	*M05_HARD	*M06_HARD	*M07_HARD	*M08_HARD	*M09_HARD	*M10_HARD	*M11_HARD	*M12_HARD
Jasper	Beaumont	*D05G05H05C5	*M01_G21*	*M02_G21*	*M03_G05*	*M04_G05*	*M05_G05*	*M06_G05*	*M07_G05*	*M08_G05*	*M09_G05*	*M10_G05*	*M11_G05*	*M12_G21*
Jefferson	Beaumont	*JEFF*_05s*	*M01_JEFF	*M02_JEFF	*M03_JEFF	*M04_JEFF	*M05_JEFF	*M06_JEFF	*M07_JEFF	*M08_JEFF	*M09_JEFF	*M10_JEFF	*M11_JEFF	*M12_JEFF
Liberty	Beaumont	*LIBE*_05s*	*M01_LIBE	*M02_LIBE	*M03_LIBE	*M04_LIBE	*M05_LIBE	*M06_LIBE	*M07_LIBE	*M08_LIBE	*M09_LIBE	*M10_LIBE	*M11_LIBE	*M12_LIBE
Newton	Beaumont	*D05G05H05C5	*M01_G21*	*M02_G21*	*M03_G05*	*M04_G05*	*M05_G05*	*M06_G05*	*M07_G05*	*M08_G05*	*M09_G05*	*M10_G05*	*M11_G05*	*M12_G21*
Orange	Beaumont	*ORAN*_05s*	*M01_ORAN	*M02_ORAN	*M03_ORAN	*M04_ORAN	*M05_ORAN	*M06_ORAN	*M07_ORAN	*M08_ORAN	*M09_ORAN	*M10_ORAN	*M11_ORAN	*M12_ORAN
Tyler	Beaumont	*D05G05H05C5	*M01_G21*	*M02_G21*	*M03_G05*	*M04_G05*	*M05_G05*	*M06_G05*	*M07_G05*	*M08_G05*	*M09_G05*	*M10_G05*	*M11_G05*	*M12_G21*
Brown	Brownwood	*D06G06H06C7	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Coleman	Brownwood	*D06G06H06C7	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Comanche	Brownwood	*D06G06H06C3	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Eastland	Brownwood	*D06G06H06C6	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*

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Lampasas	Brownwood	*D06G06H06C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Mc Culloch	Brownwood	*D06G06H06C7	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Mills	Brownwood	*D06G06H06C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
San Saba	Brownwood	*D06G06H06C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Stephens	Brownwood	*D06G06H06C6	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Brazos	Bryan	*D07G07H07C5	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Burleson	Bryan	*D07G07H07C8	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Freestone	Bryan	*D07G07H07C3	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Grimes	Bryan	*D07G07H07C5	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Leon	Bryan	*D07G07H07C5	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Madison	Bryan	*D07G07H07C5	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Milam	Bryan	*D07G07H07C8	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Robertson	Bryan	*D07G07H07C5	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Walker	Bryan	*D07G07H07C5	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Washington	Bryan	*D07G07H07C8	*M01_G21*	*M02_G21*	*M03_G07*	*M04_G07*	*M05_G07*	*M06_G07*	*M07_G07*	*M08_G07*	*M09_G07*	*M10_G07*	*M11_G07*	*M12_G21*
Briscoe	Childress	*D08G08H08C1	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Childress	Childress	*D08G08H08C1	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Collingsworth	Childress	*D08G08H08C1	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Cottle	Childress	*D08G08H08C6	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Dickens	Childress	*D08G08H08C6	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Donley	Childress	*D08G08H08C1	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Foard	Childress	*D08G08H08C6	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Hall	Childress	*D08G08H08C1	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Hardeman	Childress	*D08G08H08C6	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
King	Childress	*D08G08H08C6	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Knox	Childress	*D08G08H08C6	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Motley	Childress	*D08G08H08C6	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Wheeler	Childress	*D08G08H08C1	*M01_G02*	*M02_G08*	*M03_G08*	*M04_G08*	*M05_G08*	*M06_G08*	*M07_G08*	*M08_G08*	*M09_G08*	*M10_G08*	*M11_G08*	*M12_G02*
Aransas	Corpus Christi	*D09G09H09C2	*M01_G21*	*M02_G21*	*M03_G09*	*M04_G09*	*M05_G09*	*M06_G09*	*M07_G09*	*M08_G09*	*M09_G09*	*M10_G09*	*M11_G09*	*M12_G21*
Bee	Corpus Christi	*D09G09H09C2	*M01_G21*	*M02_G21*	*M03_G09*	*M04_G09*	*M05_G09*	*M06_G09*	*M07_G09*	*M08_G09*	*M09_G09*	*M10_G09*	*M11_G09*	*M12_G21*
Goliad	Corpus Christi	*D09G09H09C2	*M01_G21*	*M02_G21*	*M03_G09*	*M04_G09*	*M05_G09*	*M06_G09*	*M07_G09*	*M08_G09*	*M09_G09*	*M10_G09*	*M11_G09*	*M12_G21*
Jim Wells	Corpus Christi	*D09G19H09C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*

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Karnes	Corpus Christi	*D09G09H09C2	*M01_G21*	*M02_G21*	*M03_G09*	*M04_G09*	*M05_G09*	*M06_G09*	*M07_G09*	*M08_G09*	*M09_G09*	*M10_G09*	*M11_G09*	*M12_G21*
Kleberg	Corpus Christi	*D09G19H09C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*
Live Oak	Corpus Christi	*D09G09H09C2	*M01_G21*	*M02_G21*	*M03_G09*	*M04_G09*	*M05_G09*	*M06_G09*	*M07_G09*	*M08_G09*	*M09_G09*	*M10_G09*	*M11_G09*	*M12_G21*
Nueces	Corpus Christi	*D09G09H09C2	*M01_G21*	*M02_G21*	*M03_G09*	*M04_G09*	*M05_G09*	*M06_G09*	*M07_G09*	*M08_G09*	*M09_G09*	*M10_G09*	*M11_G09*	*M12_G21*
Refugio	Corpus Christi	*D09G09H09C2	*M01_G21*	*M02_G21*	*M03_G09*	*M04_G09*	*M05_G09*	*M06_G09*	*M07_G09*	*M08_G09*	*M09_G09*	*M10_G09*	*M11_G09*	*M12_G21*
San Patricio	Corpus Christi	*D09G09H09C2	*M01_G21*	*M02_G21*	*M03_G09*	*M04_G09*	*M05_G09*	*M06_G09*	*M07_G09*	*M08_G09*	*M09_G09*	*M10_G09*	*M11_G09*	*M12_G21*
Collin	Dallas	*COLL*_05s*	*M01_COLL	*M02_COLL	*M03_COLL	*M04_COLL	*M05_COLL	*M06_COLL	*M07_COLL	*M08_COLL	*M09_COLL	*M10_COLL	*M11_COLL	*M12_COLL
Dallas	Dallas	*DALL*_05s*	*M01_DALL	*M02_DALL	*M03_DALL	*M04_DALL	*M05_DALL	*M06_DALL	*M07_DALL	*M08_DALL	*M09_DALL	*M10_DALL	*M11_DALL	*M12_DALL
Denton	Dallas	*DENT*_05s*	*M01_DENT	*M02_DENT	*M03_DENT	*M04_DENT	*M05_DENT	*M06_DENT	*M07_DENT	*M08_DENT	*M09_DENT	*M10_DENT	*M11_DENT	*M12_DENT
Ellis	Dallas	*ELLI*_05s*	*M01_ELLI	*M02_ELLI	*M03_ELLI	*M04_ELLI	*M05_ELLI	*M06_ELLI	*M07_ELLI	*M08_ELLI	*M09_ELLI	*M10_ELLI	*M11_ELLI	*M12_ELLI
Kaufman	Dallas	*KAUF*_05s*	*M01_KAUF	*M02_KAUF	*M03_KAUF	*M04_KAUF	*M05_KAUF	*M06_KAUF	*M07_KAUF	*M08_KAUF	*M09_KAUF	*M10_KAUF	*M11_KAUF	*M12_KAUF
Navarro	Dallas	*D10G23H10C3	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Rockwall	Dallas	*ROCK*_05s*	*M01_ROCK	*M02_ROCK	*M03_ROCK	*M04_ROCK	*M05_ROCK	*M06_ROCK	*M07_ROCK	*M08_ROCK	*M09_ROCK	*M10_ROCK	*M11_ROCK	*M12_ROCK
Brewster	El Paso	*D11G17H11C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Culberson	El Paso	*D11G17H11C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
El Paso	El Paso	*ELPA*_05s*	*M01_ELPA	*M02_ELPA	*M03_ELPA	*M04_ELPA	*M05_ELPA	*M06_ELPA	*M07_ELPA	*M08_ELPA	*M09_ELPA	*M10_ELPA	*M11_ELPA	*M12_ELPA
Hudspeth	El Paso	*D11G17H11C4	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Jeff Davis	El Paso	*D11G17H11C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Presidio	El Paso	*D11G17H11C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Erath	Fort Worth	*D12G06H12C3	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Hood	Fort Worth	*D12G23H12C3	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Jack	Fort Worth	*D12G24H12C3	*M01_G02*	*M02_G24*	*M03_G24*	*M04_G24*	*M05_G24*	*M06_G24*	*M07_G24*	*M08_G24*	*M09_G24*	*M10_G24*	*M11_G24*	*M12_G02*
Johnson	Fort Worth	*JOHN*_05s*	*M01_JOHN	*M02_JOHN	*M03_JOHN	*M04_JOHN	*M05_JOHN	*M06_JOHN	*M07_JOHN	*M08_JOHN	*M09_JOHN	*M10_JOHN	*M11_JOHN	*M12_JOHN
Palo Pinto	Fort Worth	*D12G06H12C3	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Parker	Fort Worth	*PARK*_05s*	*M01_PARK	*M02_PARK	*M03_PARK	*M04_PARK	*M05_PARK	*M06_PARK	*M07_PARK	*M08_PARK	*M09_PARK	*M10_PARK	*M11_PARK	*M12_PARK
Somervell	Fort Worth	*D12G23H12C3	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Tarrant	Fort Worth	*TARR*_05s*	*M01_TARR	*M02_TARR	*M03_TARR	*M04_TARR	*M05_TARR	*M06_TARR	*M07_TARR	*M08_TARR	*M09_TARR	*M10_TARR	*M11_TARR	*M12_TARR
Wise	Fort Worth	*D12G18H12C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Brazoria	Houston	*BRAZ*_05s*	*M01_BRAZ	*M02_BRAZ	*M03_BRAZ	*M04_BRAZ	*M05_BRAZ	*M06_BRAZ	*M07_BRAZ	*M08_BRAZ	*M09_BRAZ	*M10_BRAZ	*M11_BRAZ	*M12_BRAZ
Fort Bend	Houston	*FORT*_05s*	*M01_FORT	*M02_FORT	*M03_FORT	*M04_FORT	*M05_FORT	*M06_FORT	*M07_FORT	*M08_FORT	*M09_FORT	*M10_FORT	*M11_FORT	*M12_FORT
Galveston	Houston	*GALV*_05s*	*M01_GALV	*M02_GALV	*M03_GALV	*M04_GALV	*M05_GALV	*M06_GALV	*M07_GALV	*M08_GALV	*M09_GALV	*M10_GALV	*M11_GALV	*M12_GALV
Harris	Houston	*HARR*_05s*	*M01_HARR	*M02_HARR	*M03_HARR	*M04_HARR	*M05_HARR	*M06_HARR	*M07_HARR	*M08_HARR	*M09_HARR	*M10_HARR	*M11_HARR	*M12_HARR

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Montgomery	Houston	*MONT*_05s*	*M01_MONT	*M02_MONT	*M03_MONT	*M04_MONT	*M05_MONT	*M06_MONT	*M07_MONT	*M08_MONT	*M09_MONT	*M10_MONT	*M11_MONT	*M12_MONT
Waller	Houston	*WALL*_05s*	*M01_WALL	*M02_WALL	*M03_WALL	*M04_WALL	*M05_WALL	*M06_WALL	*M07_WALL	*M08_WALL	*M09_WALL	*M10_WALL	*M11_WALL	*M12_WALL
Dimmit	Laredo	*D14G14H14C8	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Duval	Laredo	*D14G14H14C2	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Kinney	Laredo	*D14G14H14C8	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
La Salle	Laredo	*D14G14H14C8	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Maverick	Laredo	*D14G14H14C8	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Val Verde	Laredo	*D14G14H14C7	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Webb	Laredo	*D14G14H14C8	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Zavala	Laredo	*D14G14H14C8	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Bailey	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Castro	Lubbock	*D15G15H15C1	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Cochran	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Crosby	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Dawson	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Floyd	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Gaines	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Garza	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Hale	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Hockley	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Lamb	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Lubbock	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Lynn	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Parmer	Lubbock	*D15G15H15C1	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Swisher	Lubbock	*D15G15H15C1	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Terry	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Yoakum	Lubbock	*D15G15H15C6	*M01_G02*	*M02_G15*	*M03_G15*	*M04_G15*	*M05_G15*	*M06_G15*	*M07_G15*	*M08_G15*	*M09_G15*	*M10_G15*	*M11_G15*	*M12_G02*
Angelina	Lufkin	*D16G16H16C3	*M01_G21*	*M02_G21*	*M03_G16*	*M04_G16*	*M05_G16*	*M06_G16*	*M07_G16*	*M08_G16*	*M09_G16*	*M10_G16*	*M11_G16*	*M12_G21*
Houston	Lufkin	*D16G16H16C5	*M01_G21*	*M02_G21*	*M03_G16*	*M04_G16*	*M05_G16*	*M06_G16*	*M07_G16*	*M08_G16*	*M09_G16*	*M10_G16*	*M11_G16*	*M12_G21*
Nacogdoches	Lufkin	*D16G16H16C3	*M01_G21*	*M02_G21*	*M03_G16*	*M04_G16*	*M05_G16*	*M06_G16*	*M07_G16*	*M08_G16*	*M09_G16*	*M10_G16*	*M11_G16*	*M12_G21*
Polk	Lufkin	*D16G16H16C5	*M01_G21*	*M02_G21*	*M03_G16*	*M04_G16*	*M05_G16*	*M06_G16*	*M07_G16*	*M08_G16*	*M09_G16*	*M10_G16*	*M11_G16*	*M12_G21*
Sabine	Lufkin	*D16G16H16C3	*M01_G21*	*M02_G21*	*M03_G16*	*M04_G16*	*M05_G16*	*M06_G16*	*M07_G16*	*M08_G16*	*M09_G16*	*M10_G16*	*M11_G16*	*M12_G21*

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San Augustine	Lufkin	*D16G16H16C3	*M01_G21*	*M02_G21*	*M03_G16*	*M04_G16*	*M05_G16*	*M06_G16*	*M07_G16*	*M08_G16*	*M09_G16*	*M10_G16*	*M11_G16*	*M12_G21*
San Jacinto	Lufkin	*D16G16H16C5	*M01_G21*	*M02_G21*	*M03_G16*	*M04_G16*	*M05_G16*	*M06_G16*	*M07_G16*	*M08_G16*	*M09_G16*	*M10_G16*	*M11_G16*	*M12_G21*
Shelby	Lufkin	*D16G16H16C3	*M01_G21*	*M02_G21*	*M03_G16*	*M04_G16*	*M05_G16*	*M06_G16*	*M07_G16*	*M08_G16*	*M09_G16*	*M10_G16*	*M11_G16*	*M12_G21*
Trinity	Lufkin	*D16G16H16C5	*M01_G21*	*M02_G21*	*M03_G16*	*M04_G16*	*M05_G16*	*M06_G16*	*M07_G16*	*M08_G16*	*M09_G16*	*M10_G16*	*M11_G16*	*M12_G21*
Andrews	Odessa	*D17G17H17C6	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Crane	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Ector	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Loving	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Martin	Odessa	*D17G17H17C6	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Midland	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Pecos	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Reeves	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Terrell	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Upton	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Ward	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Winkler	Odessa	*D17G17H17C7	*M01_G02*	*M02_G17*	*M03_G17*	*M04_G17*	*M05_G17*	*M06_G17*	*M07_G17*	*M08_G17*	*M09_G17*	*M10_G17*	*M11_G17*	*M12_G02*
Delta	Paris	*D18G18H18C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Fannin	Paris	*D18G18H18C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Franklin	Paris	*D18G18H18C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Grayson	Paris	*D18G18H18C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Hopkins	Paris	*D18G18H18C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Hunt	Paris	*D18G18H18C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Lamar	Paris	*D18G18H18C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Rains	Paris	*D18G18H18C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Red River	Paris	*D18G18H18C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Brooks	Pharr	*D19G19H19C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*
Cameron	Pharr	*D19G19H19C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*
Hidalgo	Pharr	*D19G19H19C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*
Jim Hogg	Pharr	*D19G19H19C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*
Kenedy	Pharr	*D19G19H19C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*
Starr	Pharr	*D19G19H19C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*
Willacy	Pharr	*D19G19H19C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*

County	District	Summer Weekday	January	February	March	April	May	June	July	August	September	October	November	December
Zapata	Pharr	*D19G19H19C2	*M01_G02*	*M02_G19*	*M03_G19*	*M04_G19*	*M05_G19*	*M06_G19*	*M07_G19*	*M08_G19*	*M09_G19*	*M10_G19*	*M11_G19*	*M12_G02*
Coke	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Concho	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Crockett	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Edwards	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Glasscock	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Irion	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Kimble	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Menard	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Reagan	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Real	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Runnels	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Schleicher	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Sterling	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Sutton	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Tom Green	San Angelo	*D20G20H20C7	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Atascosa	San Antonio	*D21G21H21C8	*M01_G21*	*M02_G21*	*M03_G21*	*M04_G21*	*M05_G21*	*M06_G21*	*M07_G21*	*M08_G21*	*M09_G21*	*M10_G21*	*M11_G21*	*M12_G21*
Bandera	San Antonio	*D21G06H21C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Bexar	San Antonio	*BEXA*_05s*	*M01_BEXA	*M02_BEXA	*M03_BEXA	*M04_BEXA	*M05_BEXA	*M06_BEXA	*M07_BEXA	*M08_BEXA	*M09_BEXA	*M10_BEXA	*M11_BEXA	*M12_BEXA
Comal	San Antonio	*COMA*_05s*	*M01_COMA	*M02_COMA	*M03_COMA	*M04_COMA	*M05_COMA	*M06_COMA	*M07_COMA	*M08_COMA	*M09_COMA	*M10_COMA	*M11_COMA	*M12_COMA
Frio	San Antonio	*D21G14H21C8	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Guadalupe	San Antonio	*GUAD*_05s*	*M01_GUAD	*M02_GUAD	*M03_GUAD	*M04_GUAD	*M05_GUAD	*M06_GUAD	*M07_GUAD	*M08_GUAD	*M09_GUAD	*M10_GUAD	*M11_GUAD	*M12_GUAD
Kendall	San Antonio	*D21G06H21C8	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Kerr	San Antonio	*D21G20H21C8	*M01_G02*	*M02_G20*	*M03_G20*	*M04_G20*	*M05_G20*	*M06_G20*	*M07_G20*	*M08_G20*	*M09_G20*	*M10_G20*	*M11_G20*	*M12_G02*
Mc Mullen	San Antonio	*D21G14H21C2	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Medina	San Antonio	*D21G14H21C8	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Uvalde	San Antonio	*D21G14H21C8	*M01_G02*	*M02_G14*	*M03_G14*	*M04_G14*	*M05_G14*	*M06_G14*	*M07_G14*	*M08_G14*	*M09_G14*	*M10_G14*	*M11_G14*	*M12_G02*
Wilson	San Antonio	*WILS*_05s*	*M01_WILS	*M02_WILS	*M03_WILS	*M04_WILS	*M05_WILS	*M06_WILS	*M07_WILS	*M08_WILS	*M09_WILS	*M10_WILS	*M11_WILS	*M12_WILS
Anderson	Tyler	*D22G22H22C3	*M01_G21*	*M02_G21*	*M03_G22*	*M04_G22*	*M05_G22*	*M06_G22*	*M07_G22*	*M08_G22*	*M09_G22*	*M10_G22*	*M11_G22*	*M12_G21*
Cherokee	Tyler	*D22G22H22C3	*M01_G21*	*M02_G21*	*M03_G22*	*M04_G22*	*M05_G22*	*M06_G22*	*M07_G22*	*M08_G22*	*M09_G22*	*M10_G22*	*M11_G22*	*M12_G21*
Gregg	Tyler	*GREG*_05s*	*M01_GREG	*M02_GREG	*M03_GREG	*M04_GREG	*M05_GREG	*M06_GREG	*M07_GREG	*M08_GREG	*M09_GREG	*M10_GREG	*M11_GREG	*M12_GREG
Henderson	Tyler	*D22G22H22C3	*M01_G21*	*M02_G21*	*M03_G22*	*M04_G22*	*M05_G22*	*M06_G22*	*M07_G22*	*M08_G22*	*M09_G22*	*M10_G22*	*M11_G22*	*M12_G21*

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Rusk	Tyler	*RUSK*_05s*	*M01_RUSK	*M02_RUSK	*M03_RUSK	*M04_RUSK	*M05_RUSK	*M06_RUSK	*M07_RUSK	*M08_RUSK	*M09_RUSK	*M10_RUSK	*M11_RUSK	*M12_RUSK
Smith	Tyler	*SMIT*_05s*	*M01_SMIT	*M02_SMIT	*M03_SMIT	*M04_SMIT	*M05_SMIT	*M06_SMIT	*M07_SMIT	*M08_SMIT	*M09_SMIT	*M10_SMIT	*M11_SMIT	*M12_SMIT
Van Zandt	Tyler	*D22G22H22C3	*M01_G21*	*M02_G21*	*M03_G22*	*M04_G22*	*M05_G22*	*M06_G22*	*M07_G22*	*M08_G22*	*M09_G22*	*M10_G22*	*M11_G22*	*M12_G21*
Wood	Tyler	*D22G22H22C3	*M01_G21*	*M02_G21*	*M03_G22*	*M04_G22*	*M05_G22*	*M06_G22*	*M07_G22*	*M08_G22*	*M09_G22*	*M10_G22*	*M11_G22*	*M12_G21*
Bell	Waco	*D23G23H23C8	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Bosque	Waco	*D23G23H23C3	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Coryell	Waco	*D23G23H23C8	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Falls	Waco	*D23G23H23C3	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Hamilton	Waco	*D23G06H23C3	*M01_G02*	*M02_G06*	*M03_G06*	*M04_G06*	*M05_G06*	*M06_G06*	*M07_G06*	*M08_G06*	*M09_G06*	*M10_G06*	*M11_G06*	*M12_G02*
Hill	Waco	*D23G23H23C3	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Limestone	Waco	*D23G23H23C3	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Mc Lennan	Waco	*D23G23H23C3	*M01_G21*	*M02_G21*	*M03_G23*	*M04_G23*	*M05_G23*	*M06_G23*	*M07_G23*	*M08_G23*	*M09_G23*	*M10_G23*	*M11_G23*	*M12_G21*
Archer	Wichita Falls	*D24G24H24C6	*M01_G02*	*M02_G24*	*M03_G24*	*M04_G24*	*M05_G24*	*M06_G24*	*M07_G24*	*M08_G24*	*M09_G24*	*M10_G24*	*M11_G24*	*M12_G02*
Baylor	Wichita Falls	*D24G24H24C6	*M01_G02*	*M02_G24*	*M03_G24*	*M04_G24*	*M05_G24*	*M06_G24*	*M07_G24*	*M08_G24*	*M09_G24*	*M10_G24*	*M11_G24*	*M12_G02*
Clay	Wichita Falls	*D24G24H24C3	*M01_G02*	*M02_G24*	*M03_G24*	*M04_G24*	*M05_G24*	*M06_G24*	*M07_G24*	*M08_G24*	*M09_G24*	*M10_G24*	*M11_G24*	*M12_G02*
Cooke	Wichita Falls	*D24G18H24C3	*M01_G21*	*M02_G21*	*M03_G18*	*M04_G18*	*M05_G18*	*M06_G18*	*M07_G18*	*M08_G18*	*M09_G18*	*M10_G18*	*M11_G18*	*M12_G21*
Montague	Wichita Falls	*D24G24H24C3	*M01_G02*	*M02_G24*	*M03_G24*	*M04_G24*	*M05_G24*	*M06_G24*	*M07_G24*	*M08_G24*	*M09_G24*	*M10_G24*	*M11_G24*	*M12_G02*
Throckmorton	Wichita Falls	*D24G24H24C6	*M01_G02*	*M02_G24*	*M03_G24*	*M04_G24*	*M05_G24*	*M06_G24*	*M07_G24*	*M08_G24*	*M09_G24*	*M10_G24*	*M11_G24*	*M12_G02*
Wichita	Wichita Falls	*D24G24H24C6	*M01_G02*	*M02_G24*	*M03_G24*	*M04_G24*	*M05_G24*	*M06_G24*	*M07_G24*	*M08_G24*	*M09_G24*	*M10_G24*	*M11_G24*	*M12_G02*
Wilbarger	Wichita Falls	*D24G24H24C6	*M01_G02*	*M02_G24*	*M03_G24*	*M04_G24*	*M05_G24*	*M06_G24*	*M07_G24*	*M08_G24*	*M09_G24*	*M10_G24*	*M11_G24*	*M12_G02*
Young	Wichita Falls	*D24G24H24C6	*M01_G02*	*M02_G24*	*M03_G24*	*M04_G24*	*M05_G24*	*M06_G24*	*M07_G24*	*M08_G24*	*M09_G24*	*M10_G24*	*M11_G24*	*M12_G02*
Austin	Yoakum	*D25G25H25C5	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
Calhoun	Yoakum	*D25G25H25C2	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
Colorado	Yoakum	*D25G25H25C5	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
De Witt	Yoakum	*D25G25H25C2	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
Fayette	Yoakum	*D25G25H25C8	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
Gonzales	Yoakum	*D25G25H25C8	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
Jackson	Yoakum	*D25G25H25C2	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
Lavaca	Yoakum	*D25G25H25C2	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
Matagorda	Yoakum	*D25G25H25C5	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
Victoria	Yoakum	*D25G25H25C2	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*
Wharton	Yoakum	*D25G25H25C5	*M01_G21*	*M02_G21*	*M03_G25*	*M04_G25*	*M05_G25*	*M06_G25*	*M07_G25*	*M08_G25*	*M09_G25*	*M10_G25*	*M11_G25*	*M12_G21*

Notes:

Emissions factor filename prefixes (codes) are given by county. There is a maximum of 51 unique county groups for the summer season data set due to its broader geographic fuel sample as compared to the winter data set. Additionally, the 26 individual county runs for nonattainment counties and EAC counties are named (coded) with the first four letters of the county name in the filenames and the 12 DFW CMSA counties (grey background) were excluded from analysis.

"D/G/H/C" combination codes in filenames (see summer weekday column) denote the combination of district (i.e., activity and fleet)/gasoline/diesel/climate input data used (e.g., D01G01H01 is for Abilene District/Abilene Gasoline/Abilene Diesel data, where numeric portion of codes denotes district which data are from). Each county uses its associated district diesel data (i.e., the numeric portion of D and H codes are the same for each county), thus the "D" code was dropped from "monthly" rate filenames to reduce filename size, and "H##" code was used to denote both district (activity and fleet) and diesel data sources. Gasoline data for a given county (denoted by "G##" code) may be mapped from a different district, depending on rule criteria (e.g., RVP limit, RFG), or in the case of winter gasoline data, sample city coverage (five winter sample cities versus 25 districts with samples for summer). Each county uses the same "H/C" code combination (climate data was associated to county based on eight zone scheme) regardless of period, so these code portions are wildcarded (*) in monthly filenames in the table, along with other filename elements, to save space in the table.

Climate data values vary by month, and fuel data values vary by month depending on season (summer, winter or transitional month).

There are two sets of emissions factor files, one including PM-10 and one with PM-2.5 (denoted by "pm1" and "pm2," respectively, in "asterisk'd" part of the filenames).

An additional set of emissions factors was included for the El Paso CO (winter) season weekday.

For the summer weekday analysis, for some counties multiple runs were made and combined for I/M and ATP modeling; associated coding is discussed elsewhere.

APPENDIX B
EMISSIONS ESTIMATION PROGRAMS

TTI EMISSIONS ESTIMATION PROGRAMS

Following is a summary of programs developed by TTI for producing detailed link-based, hourly and 24-hour emissions estimates for on-road mobile sources; producing annual emissions estimates as a conversion of 24-hour emissions; and for formatting the results in EPA's National Emissions Inventory reporting format (NIF version 3.0).

These programs produce emissions factors with the latest version of EPA's MOBILE emissions factor model, and multiply them with travel model link-based or HPMS-based (virtual link) activity estimates to produce emissions at user-specified temporal and spatial scales. In the case of annual emissions calculations, the emissions factors are used in the form of emissions rate annualization factors used in converting 24-hour emissions estimates to annual period estimates.

The main programs for calculating hourly and 24-hour emissions are: TRANSVMT, VirtualLinkVMT, POLFAC62_3, RATEADJ62DK, RATEADJV62DK, IMPSUM62, and SUMALL62. TRANSVMT and VirtualLinkVMT prepare activity input; POLFAC62_3 prepares emissions factor input; the RATEADJ programs make special adjustments to emissions factors when required; IMPSUM62 calculates emissions by hourly time period; and SUMALL62 summarizes emissions at various levels by 24-hour period.

For calculating annual emissions, the programs are RATEANNUALFACT and ANNUALIZATION. RATEANNUALFACT is used to calculate emissions rate annualization factors; ANNUALIZATION is used to calculate annual emissions. Additionally, the NIFformat program formats emissions inventory data in the EPA's NIF version 3.0 reporting format.

TRANSVMT

The TRANSVMT program post-processes travel demand models (TDM) to produce time-of-day specific, on-road vehicle, link VMT and speed estimates. The TRANSVMT program processes a TDM traffic assignment by multiplying the link volumes by the appropriate HPMS, seasonal, or other VMT factors. Time-of-day factors are then used to distribute the link VMT to each hour in the day. The Dallas speed model is used to estimate the operational time-of-day link speeds for each direction (unless the analysis is for Houston, in which case the Houston speed model is used). Since intrazonal links are not included in the TDM, special intrazonal links are created and the VMT and speeds for these special links are estimated using the intrazonal trips from the trip matrix and the zonal radii. The link VMT and speeds produced by TRANSVMT are input to the emissions calculation program, IMPSUM62.

VirtualLinkVMT

The VirtualLinkVMT program post-processes county HPMS AADT VMT, centerline miles, and lane miles by functional classification and area type (from TxDOT's annual RIFCREC Report) to produce hourly, on-road vehicle fleet, seasonal and day-of-week specific actual or projected VMT, and directional operational speed estimates. These estimated VMT and speeds are produced for the up to 42 directional HPMS functional classification/area type combinations, or "links." The VirtualLinkVMT program was developed for use in areas that do not have TDM networks, as well as for emissions inventory applications for which network link-based detail is not required. The main inputs to VirtualLinkVMT are: 1) county HPMS data sets, which include

AADT VMT, centerline miles, and lane miles by HPMS area type and functional class; and 2) county-level VMT control totals. The other main inputs are: 3) hourly VMT distributions; and 4) speed model inputs to include volume/delay equation parameters adapted for HPMS, and freeflow speeds and lane capacities by HPMS functional classification and area type.

VirtualLinkVMT initially scales the county HPMS AADT VMT at the link level to the appropriate VMT (e.g., uses county-level VMT control total-to-AADT ratio to produce seasonal, day-of-week specific VMT). Hourly factors and directional split factors are applied to the adjusted VMT on each link to estimate the hourly, directional VMT (and volumes) by HPMS link. Congested speed models each for the high- and low-capacity links are used to estimate the hourly operational speeds by direction for each link. The operational speeds are based on v/c derived directional delay (minutes/mile) applied to the estimated freeflow speeds for each link. The virtual link VMT and speeds produced using the VirtualLinkVMT program are an input to the emissions calculation program, IMPSUM62.

POLFAC62_3

The POLFAC62_3 program is used to apply the EPA’s latest MOBILE6 program (September 2003 version) to calculate the on-road mobile emissions factors. The MOBILE6 emissions factors may be produced for each of the pollutant-specific emissions types (e.g., depending on the pollutant and vehicle type, the total composite, exhaust running, exhaust start, plus the six sub-component evaporative rates), 28 vehicle types, and four MOBILE6 functional classifications (or drive cycles, i.e., Freeway, Arterial/Collector, Local, and Ramp). Emissions factors are produced for 14 speeds (i.e., 2.5 mph, and 5 mph through 65 mph at 5 mph increments for Freeway and Arterial functional classifications — MOBILE6 Local and Ramp functional classification rates are single speed only, 12.9 mph, and 34.6 mph, respectively), and each of the 24 hours of the day. Daily rate tables are produced additionally, if specified.

The POLFAC62_3 emissions factors are average vehicle class rates calculated from the MOBILE6 detailed data by multiplying the by-model-year emissions rates within each vehicle class by its corresponding travel fraction. These emissions factors are produced individually by geographical area (county or county group) and analysis day for the evaluation year. These emissions factors are output to an ASCII file for subsequent input to the IMPSUM62 program. The IMPSUM62 program is then used to multiply the hourly emissions factors by hourly VMT estimates by link. POLFAC62_3 also calculates the additional pollutant (i.e., particulate matter-related pollutants and toxics) emissions factors provided by MOBILE6.

RATEADJ62DK

RATEADJ62DK is a utility that produces a new set of emissions factors by linearly combining the emissions factors from multiple applications of POLFAC62_3, RATEADJV62DK, RATEADJ62DK, or RATEADJV62hrDK. There is a separate set of factors for each of the input emissions factor data sets.

An example application of RATEADJ62DK is the combining of two sets of emissions factors, where each has different control program credits, into one set with the combined credits. For example, this program may be used to combine different ATP credits from two separate POLFAC62_3 runs into one set of emissions factors that includes the credits for both ATPs.

RATEADJV62DK
RATEADJV62DK is a utility that produces a new set of emissions factors by applying emissions factor adjustments to each pollutant, emissions type, and vehicle type. RATEADJV62DK can be applied to emission rates produced by POLFAC62_3, RATEADJV62DK, RATEADJ62DK, or RATEADJV62hrDK.

A practical application of RATEADJV62DK is the application of emissions factor credits by individual vehicle class and/or individual pollutant. For example, for analyses requiring the effects of the Texas Low-Emissions Diesel (TxLED) fuel program in MOBILE6 emissions factors, RATEADJV62DK may be used to apply reduction factors to the NOx emissions factors for diesel-fueled vehicle classes only.

RATEADJV62hrDK
RATEADJV62hrDK is a special utility program that produces a new set of emissions factors by applying emissions factor adjustments to each pollutant, emissions type, and vehicle type by hour. RATEADJV62DK can be applied to emission rates produced by POLFAC62_3, RATEADJV62DK, RATEADJ62DK, or RATEADJV62hrDK.

IMPSUM62
The IMPSUM62 program multiplies the VMT mixes (fractions of fleet VMT attributable to each vehicle class in the study) and hourly emissions factors to the hourly, fleet, link-VMT estimates to produce hourly emissions. The four primary inputs to IMPSUM62 are:

- MOBILE6 emissions factors look-up table developed with POLFAC62_3 (or a RATEADJ utility, if used);
- records associating a MOBILE6 drive cycle (Freeway, Arterial, Local, and Ramp) emissions factor to each study functional class;
- link operational VMT and speed estimates for each hour and direction, and other link data as developed using the TRANSVMT or VirtualLinkVMT program to include county, functional class and area type coding; and
- VMT mix by time period and roadway type.

Using these input data, the VMT for each link is stratified by MOBILE6 drive cycle and the 28 vehicle types. The MOBILE6 emissions factors are matched to link VMT by drive cycle, speed, and vehicle type and are interpolated (for the speed that falls between the 14 MOBILE6 speeds, see the following MOBILE6 interpolation methodology) and multiplied by the link VMT to estimate the mobile source emissions for that link. Emissions factors for 65 mph are used for links with speeds greater than 65 mph and emissions factors for 2.5 mph are used for links with speeds lower than 2.5 mph. The emissions for the county and emissions type are reported by both roadway type and vehicle type for each of the episode time periods. A data set is produced for subsequent input to the SUMALL62 program. Additionally, link emissions may be written by county at the pollutant-specific emissions type (sub-component) level.

A tab-delimited output is optionally produced. This output includes all 28 vehicle types across a single output line. A tab character separates each field in the output.

Example Emissions Factor Interpolation

To calculate emissions factors for average operational speeds that fall between two of the 14 MOBILE6 speed bin speeds, MOBILE6 interpolates each emissions factor using a factor developed from the inverse link speed and the inverse high and low bounding speed bin speeds (Section 5.3.4, *MOBILE6 User's Guide*, August 2003).

Using the MOBILE6 emissions factors tabulated by the 14 speeds, the IMPSUM62 program uses the MOBILE6 method to interpolate emissions factors as shown in the following example. This example interpolates an emissions factor corresponding to an average speed of 41.2 mph.

The interpolated emissions factor (EF_{Interp}) is expressed as:

$$EF_{Interp} = EF_{LowSpeed} - FAC_{Interp} \times (EF_{LowSpeed} - EF_{HighSpeed})$$

Where:

$EF_{LowSpeed}$ = emissions factor (EF) corresponding to tabulated speed below the average link speed,

$EF_{HighSpeed}$ = EF corresponding to tabulated speed above the average link speed, and

$$FAC_{Interp} = \left(\frac{1}{Speed_{link}} - \frac{1}{Speed_{low}}\right) \Big/ \left(\frac{1}{Speed_{high}} - \frac{1}{Speed_{low}}\right)$$

Given that:

$EF_{LowSpeed}$ = 0.7413 g/mi;
$EF_{HighSpeed}$ = 0.7274 g/mi;
$Speed_{lnk}$ = 41.2 mph;
$Speed_{low}$ = 40 mph; and
$Speed_{high}$ = 45 mph.

$$FAC_{Interp} = \left(\frac{1}{41.2 mph} - \frac{1}{40 mph}\right) \Big/ \left(\frac{1}{45 mph} - \frac{1}{40 mph}\right) = \frac{-0.00073}{-0.00278} = 0.26214,$$

$$EF_{Interp} = 0.7413 \text{ g/mi} - (0.26214) \times (0.7413 \text{ g/mi} - 0.7274 \text{ g/mi})$$

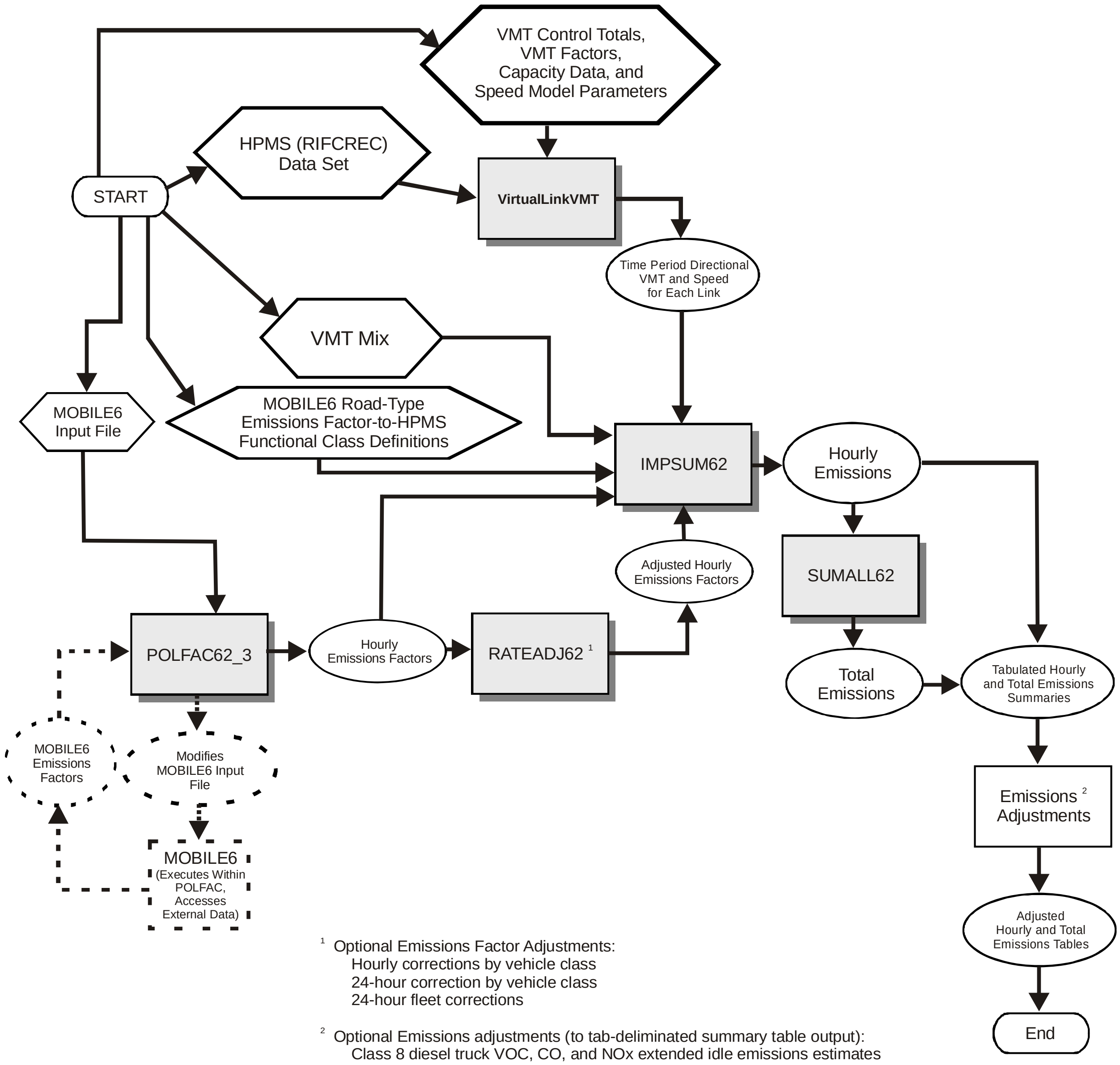
$$= 0.7377 \text{ g/mi}.$$

SUMALL62
The SUMALL62 program is used to sum the emissions estimates for the hourly periods to develop 24-hour emissions estimates. The emissions by pollutant type are reported by roadway type and 28 vehicle types.

A tab-delimited output is optionally produced. This output includes all 28 vehicle types across a single output line. A tab character separates each field in the output.

The overall link-based, hourly emissions estimate process flow is shown in the following diagrams.

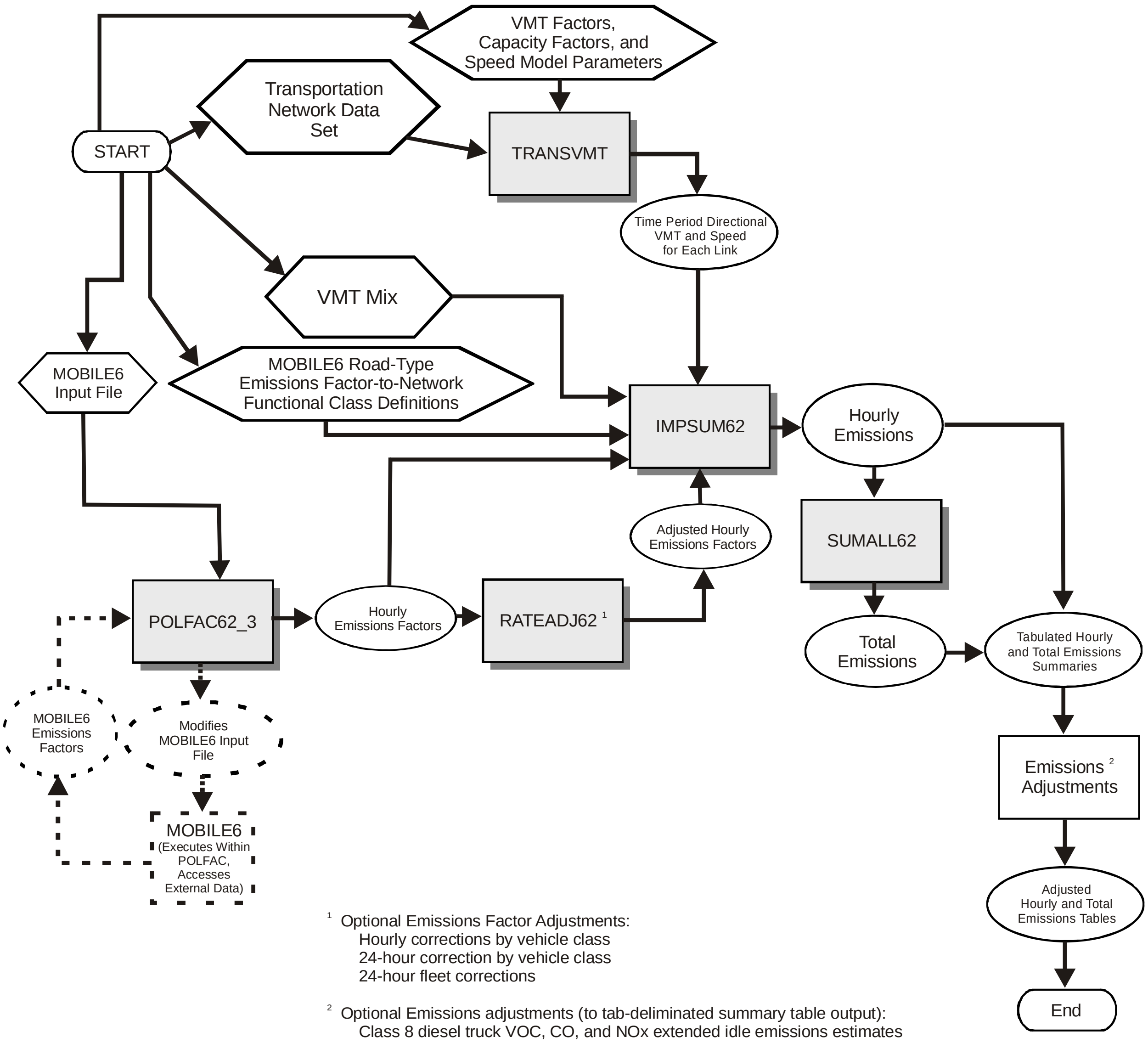
HPMS / Virtual Link-Based Emissions Estimation Process



[1] Optional Emissions Factor Adjustments:
- Hourly corrections by vehicle class
- 24-hour correction by vehicle class
- 24-hour fleet corrections

[2] Optional Emissions adjustments (to tab-deliminated summary table output):
- Class 8 diesel truck VOC, CO, and NOx extended idle emissions estimates
- VOC, CO, and NOx emissions adjustments by county, hour, and vehicle class

Travel Demand Model Network Link-Based Hourly MOBILE6 Emissions Estimates with Texas Mobile Source Emissions Software



[1] Optional Emissions Factor Adjustments:
- Hourly corrections by vehicle class
- 24-hour correction by vehicle class
- 24-hour fleet corrections

[2] Optional Emissions adjustments (to tab-deliminated summary table output):
- Class 8 diesel truck VOC, CO, and NOx extended idle emissions estimates
- VOC, CO, and NOx emissions adjustments by county, hour, and vehicle class

RATEANNUALFACT

This utility calculates emissions rate annualization factors for input to the ANNUALIZATION utility, which calculates annual emissions by multiplying an average daily emissions estimate (e.g., summer weekday emissions) by a set of conversion factors (i.e., the emissions rate annualization factor and VMT annualization factors).

The RATEANNUALFACT program weights MOBILE6 emissions factors together in the numerator to form the 24-hour average annual rate, and for the denominator uses the 24-hour average daily rates from the emissions to be converted to annual emissions. The main inputs to RATEANNUALFACT are: 1) average daily emissions factors for periods comprising the analysis year (e.g., seasonal or monthly periods); and 2) weighting factors for combining these rates into 24-hour average annual rate estimates. The other main inputs are: 3) 24-hour average emissions factors from the (average seasonal day) emissions estimate to be converted to annual emissions; and 4) the average speed and road type for the emissions factors to be used in the calculation. The input emissions factors are in the POLFAC lookup table form.

The utility looks up the emissions factor sets (i.e., by pollutant, emission type and vehicle type) in the input tables, for the user-selected speed (e.g., county average speed to nearest MOBILE6 speed bin speed) and road type. The seasonal period emissions factors are then combined, with the associated weights, into average annual daily rates, which are divided by the average daily rate from the 24-hour emissions estimate to be converted to annual period emissions. The resulting table of emissions rate annualization factors by pollutant, emissions type and vehicle type are an input to the ANNUALIZATION utility.

ANNUALIZATION

The ANNUALIZATION utility produces the annual emissions estimate as a conversion from a specified 24-hour average emissions estimate. The utility converts the 24-hour average emissions estimate to annual emissions using a set of annualization factors consisting of VMT and emissions rate annualization components.

The main inputs consist of: 1) the seasonal adjustment factor for VMT from the emissions to be annualized (e.g., original summer weekday factor used to convert AADT VMT to summer weekday VMT), 2) the emissions rate annualization factors output from RATEANNUALFACT; 3) the tab-delimited 24-hour average emissions output from SUMALL62 to be annualized. The program calculates annual emissions data and produces tab-delimited summary tables (same as SUMALL62 tables, except with appropriate table header and units).

The utility calculates the VMT annualization factor as the inverse of the seasonal adjustment factor multiplied by days in the year (i.e., 365). The program then multiplies the data to be converted to annual period estimates (from the input tab delimited 24-hour SUMALL62 tables) by the annualization factors. All emissions, VMT, and VHT estimates are multiplied by the VMT annualization factor. Emissions by pollutant, emissions type, vehicle type, and road type are multiplied by the emissions rate annualization factors (i.e., one for each pollutant/emissions type/vehicle type combination). The VMT weighted average speeds from the original 24-hour emissions analysis are used for the annual speed estimates (i.e., no change is made to the

SUMALL62 average speed tables). The resulting annual emissions output consists of the same data tables and format as contained in the input SUMALL62 emissions tables.

NIFformat

Additionally, the NIFformat utility formats emissions inventory data in the EPA's NIF version 3.0 reporting format. This utility produces the NIF transmittal (TR), emission period (PE), and emissions (EM) records for each county and period of analysis. Among the NIF specifications are county emissions and activity data by a (up to) 12-by-12 matrix of vehicle type and HPMS road type categories. For HPMS virtual link-based county analyses, emissions and activity data are compressed from the HPMS virtual link (up to) 21-by-28 vehicle type/road type matrix (in SUMALL62 output) to the NIF form. For TDM link-based county analyses, a function is also included that directs the program to re-categorize the emissions and activity data from TDM functional class and MOBILE6 28-vehicle class categories to the NIF specified HPMS functional class and vehicle class categories. The TDM-to-HPMS functional class conversion is accomplished using VMT distributions from the latest available county HPMS data set (i.e., historical HPMS data from TxDOT RIFCREC report). In addition, the NIFformat utility categorizes activity and emissions by process: exhaust, evaporative, brake wear and tire wear. (See section 5.5.1 of the report *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter, NAAQS, and Regional Haze Regulations*, EPA, August 2005.)

APPENDIX C
HOURLY TRAVEL FACTORS

San Antonio Hourly Travel Factors[1]

Hour	Summer Weekday	Winter Weekday
6:00 a.m.	0.047864	0.048924
7:00 a.m.	0.073108	0.074187
8:00 a.m.	0.060157	0.060951
9:00 a.m.	0.048799	0.048716
10:00 a.m.	0.048657	0.048326
11:00 a.m..	0.053212	0.052958
12:00 p.m..	0.055702	0.055386
1:00 p.m.	0.057024	0.057023
2:00 p.m.	0.059542	0.060420
3:00 p.m.	0.065961	0.068189
4:00 p.m.	0.074486	0.076904
5:00 p.m.	0.078488	0.079832
6:00 p.m.	0.062357	0.063847
7:00 p.m.	0.046158	0.045746
8:00 p.m.	0.037955	0.035945
9:00 p.m.	0.034466	0.032125
10:00 p.m..	0.027108	0.025601
11:00 p.m.	0.019242	0.017391
12:00 a.m.	0.010386	0.009244
1:00 a.m.	0.006487	0.005888
2:00 a.m.	0.005727	0.005342
3:00 a.m.	0.004572	0.004380
4:00 a.m.	0.006495	0.006423
5:00 a.m.	0.016046	0.016250

[1] Based on latest multi-year (1999-2004), Monday through Friday TxDOT San Antonio District ATR data: June through August for summer and December, January, and February for winter.

APPENDIX D
DIRECTIONAL SPLIT ESTIMATES

San Antonio Network Directional Split Factors - AM Peak Period

Functional Class	Area Type[1]					
	1	2	3	4	5	6
Local Roads	50.00000	50.00000	50.00000	50.00000	50.00000	50.00000
Radial Freeway	53.37670	53.37670	74.13610	61.25710	61.73610	74.13610
Radial Parkway	53.37670	53.37670	74.13610	61.25710	61.73610	74.13610
Expressway	53.37670	53.37670	74.13610	61.25710	61.73610	74.13610
Primary Arterial Divided	68.72790	68.72790	68.03360	56.38190	61.73610	68.03360
Primary Arterial Undivided	68.72790	68.72790	68.03360	56.38190	61.73610	68.03360
Minor Arterial Divided	68.72790	68.72790	68.03360	56.38190	61.73610	68.03360
Minor Arterial Undivided	68.72790	68.72790	68.03360	56.38190	61.73610	68.03360
Collectors Divided	65.87060	65.87060	65.87060	65.87060	65.57410	65.87060
Collectors Undivided	65.87060	65.87060	65.87060	65.87060	65.57410	65.87060
Frontage Road	68.72790	68.72790	68.03360	56.38190	61.73610	68.03360
Ramp	68.72790	68.72790	68.03360	56.38190	61.73610	68.03360
Circumferential Freeway	53.37670	53.37670	74.13610	61.25710	61.73610	74.13610
Circumferential Parkway	53.37670	53.37670	74.13610	61.25710	61.73610	74.13610
Circumferential Arterial	68.72790	68.72790	68.03360	56.38190	61.73610	68.03360

[1] Area Type codes are listed at the end of this appendix.

San Antonio Network Directional Split Factors - Mid-Day Period

Functional Class	Area Type[1]					
	1	2	3	4	5	6
Local Roads	50.00000	50.00000	50.00000	50.00000	50.00000	50.00000
Radial Freeway	51.85418	51.85418	58.91482	58.91482	56.18798	58.91482
Radial Parkway	51.85418	51.85418	58.91482	58.91482	56.18798	58.91482
Expressway	51.85418	51.85418	58.91482	58.91482	56.18798	58.91482
Primary Arterial Divided	59.80851	59.80851	57.87852	57.87852	56.18798	57.87852
Primary Arterial Undivided	59.80851	59.80851	57.87852	57.87852	56.18798	57.87852
Minor Arterial Divided	59.80851	59.80851	57.87852	57.87852	56.18798	57.87852
Minor Arterial Undivided	59.80851	59.80851	57.87852	57.87852	56.18798	57.87852
Collectors Divided	59.53949	59.53949	59.53949	59.53949	58.27722	59.53949
Collectors Undivided	59.53949	59.53949	59.53949	59.53949	58.27722	59.53949
Frontage Road	59.80851	59.80851	57.87852	54.04745	56.18798	57.87852
Ramp	59.80851	59.80851	57.87852	57.87852	56.18798	57.87852
Circumferential Freeway	51.85418	51.85418	58.91482	58.91482	56.18798	58.91482
Circumferential Parkway	51.85418	51.85418	58.91482	58.91482	56.18798	58.91482
Circumferential Arterial	59.80851	59.80851	57.87852	57.87852	56.18798	57.87852

[1] Area Type codes are listed at the end of this appendix.

San Antonio Network Directional Split Factors - PM Peak Period

Functional Class	Area Type[1]					
	1	2	3	4	5	6
Local Roads	50.00000	50.00000	50.00000	50.00000	50.00000	50.00000
Radial Freeway	52.62830	52.62830	69.38360	56.48830	58.00540	69.38360
Radial Parkway	52.62830	52.62830	69.38360	56.48830	58.00540	69.38360
Expressway	52.62830	52.62830	69.38360	56.48830	58.00540	69.38360
Primary Arterial Divided	63.81940	63.81940	60.33020	56.78330	58.00540	60.33020
Primary Arterial Undivided	63.81940	63.81940	60.33020	56.78330	58.00540	60.33020
Minor Arterial Divided	63.81940	63.81940	60.33020	56.78330	58.00540	60.33020
Minor Arterial Undivided	63.81940	63.81940	60.33020	56.78330	58.00540	60.33020
Collectors Divided	60.07770	60.07770	60.07770	60.07770	57.38310	60.07770
Collectors Undivided	60.07770	60.07770	60.07770	60.07770	57.38310	60.07770
Frontage Road	63.81940	63.81940	60.33020	56.78330	58.00540	60.33020
Ramp	63.81940	63.81940	60.33020	56.78330	58.00540	60.33020
Circumferential Freeway	52.62830	52.62830	69.38360	56.48830	58.00540	69.38360
Circumferential Parkway	52.62830	52.62830	69.38360	56.48830	58.00540	69.38360
Circumferential Arterial	63.81940	63.81940	60.33020	56.78330	58.00540	60.33020

[1] Area Type codes are listed at the end of this appendix.

San Antonio Network Directional Split Factors - Overnight Period

Functional Class	Area Type[1]					
	1	2	3	4	5	6
Local Roads	50.00000	50.00000	50.00000	50.00000	50.00000	50.00000
Radial Freeway	52.89322	52.89322	57.80462	58.35028	60.92629	57.80462
Radial Parkway	52.89322	52.89322	57.80462	58.35028	60.92629	57.80462
Expressway	52.89322	52.89322	57.80462	58.35028	60.92629	57.80462
Primary Arterial Divided	64.07599	64.07599	60.11187	58.87167	60.92629	60.11187
Primary Arterial Undivided	64.07599	64.07599	60.11187	58.87167	60.92629	60.11187
Minor Arterial Divided	64.07599	64.07599	60.11187	58.87167	60.92629	60.11187
Minor Arterial Undivided	64.07599	64.07599	60.11187	58.87167	60.92629	60.11187
Collectors Divided	63.07224	63.07224	63.07224	63.07224	60.48731	63.07224
Collectors Undivided	63.07224	63.07224	63.07224	63.07224	60.48731	63.07224
Frontage Road	64.07599	64.07599	60.11187	58.87167	60.92629	60.11187
Ramp	64.07599	64.07599	60.11187	58.87167	60.92629	60.11187
Circumferential Freeway	52.89322	52.89322	57.80462	58.35028	60.92629	57.80462
Circumferential Parkway	52.89322	52.89322	57.80462	58.35028	60.92629	57.80462
Circumferential Arterial	64.07599	64.07599	60.11187	58.87167	60.92629	60.11187

[1] Area Type codes are listed at the end of this appendix.

San Antonio Time-of-Day Travel Periods

Period	Hours
AM Peak	7 a.m. - 8 a.m.
Mid-Day	8 a.m. - 5 p.m.
PM Peak	5 p.m. - 6 p.m.
Overnight	6 p.m. - 7 a.m.

San Antonio TDM Network Area Types

Area Type Code	Area Type Name
1	Central Business District (CBD)
2	Urban
3	Urban Residential
4	Suburban
5	Rural
6	Military

APPENDIX E
CAPACITY FACTORS AND SPEED FACTORS

San Antonio Network Capacity Factors

Roadway Type	Area Type[1]					
	1	2	3	4	5	6
Local Roads	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
Radial Freeway	0.0750	0.0684	0.0693	0.1054	0.1527	0.1054
Radial Parkway	0.1043	0.0946	0.0959	0.1660	0.2632	0.1660
Expressway	0.0698	0.0777	0.0788	0.0878	0.1333	0.0878
Primary Arterial Divided	0.0659	0.0800	0.0915	0.1160	0.1818	0.1160
Primary Arterial Undivided	0.0662	0.0809	0.0938	0.1205	0.1859	0.1205
Minor Arterial Divided	0.0759	0.0923	0.1136	0.1728	0.2941	0.1728
Minor Arterial Undivided	0.0758	0.0924	0.1139	0.1667	0.2813	0.1667
Collectors Divided	0.0726	0.0856	0.1075	0.1642	0.3194	0.1642
Collectors Undivided	0.0702	0.0833	0.1047	0.1587	0.3088	0.1587
Frontage Road	0.0407	0.0444	0.0463	0.0933	0.1364	0.0933
Ramp	0.0638	0.0614	0.0639	0.1191	0.1974	0.1191
Circumferential Freeway	0.1000	0.0539	0.0564	0.1054	0.1000	0.1054
Circumferential Parkway	0.1000	0.1000	0.0852	0.1013	0.1039	0.1013
Circumferential Arterial	0.1000	0.1000	0.0839	0.1115	0.1280	0.1115

[1] Area Type codes are listed at the end of this appendix.

San Antonio Network Speed Factors

Roadway Type	Area Type[1]					
	1	**2**	**3**	**4**	**5**	**6**
Local Roads	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
Radial Freeway	1.70588	1.61111	1.59459	1.42857	1.42000	1.59459
Radial Parkway	1.61111	1.56757	1.68571	1.39535	1.39216	1.68571
Expressway	1.25000	1.25926	1.25000	1.24324	1.27660	1.25000
Primary Arterial Divided	1.25000	1.26087	1.26667	1.24242	1.25000	1.26667
Primary Arterial Undivided	1.25000	1.27273	1.25000	1.26471	1.22222	1.25000
Minor Arterial Divided	1.27273	1.26316	1.24000	1.26667	1.13636	1.24000
Minor Arterial Undivided	1.30000	1.26316	1.24000	1.25000	1.25000	1.24000
Collectors Divided	1.22222	1.27778	1.26087	1.24000	1.12500	1.25926
Collectors Undivided	1.25000	1.25000	1.27273	1.24000	1.18421	1.25926
Frontage Road	1.25000	1.23529	1.26087	1.24000	1.41026	1.24000
Ramp	1.26316	1.25714	1.25714	1.26190	1.20000	1.26190
Circumferential Freeway	1.00000	1.34884	1.31111	1.25000	1.00000	1.31111
Circumferential Parkway	1.00000	1.00000	1.22917	1.20000	1.33962	1.11321
Circumferential Arterial	1.00000	1.00000	1.26190	1.24444	1.26087	1.26190

[1] Area Type codes are listed at the end of this appendix.

San Antonio TDM Network Area Types

Area Type Code	Area Type Name
1	Central Business District (CBD)
2	Urban
3	Urban Residential
4	Suburban
5	Rural
6	Military

APPENDIX F
METEOROLOGICAL INPUTS

San Antonio Inputs for Ozone Season Weekday Analysis

* San Antonio June through August, 2000-2002, 10 maximum O_3 exceedance day averages
HOURLY TEMPERATURES: 72.4 74.8 78.8 82.0 84.9 87.3 89.2 90.6 92.5 92.6 92.6 92.6 91.3 88.1 84.9 82.5 81.7 79.6 77.7 76.5 75.1 74.2 73.4 72.5
RELATIVE HUMIDITY: 85.0 82.3 73.9 62.9 55.1 49.1 44.9 41.6 38.3 36.8 36.6 36.2 37.0 42.6 47.3 53.4 57.1 64.3 70.2 74.6 78.4 80.5 82.5 84.4
BAROMETRIC PRES: 29.1

San Antonio Climate Zone: Monthly Inputs for Annual Analysis

* C8: San Antonio Climate Zone; January, 2005 (CST)
HOURLY TEMPERATURES: 49.6 49.9 52.0 54.5 57.1 59.0 60.7 62.2 62.8 63.0 62.5 60.1 58.0 56.4 55.5 53.9 52.8 51.9 52.0 51.5 51.2 50.7 50.2 49.8
RELATIVE HUMIDITY: 84.2 84.5 81.3 76.3 69.9 65.7 62.2 59.4 56.9 55.4 56.2 59.7 64.4 66.9 69.3 73.1 75.6 78.1 79.8 79.8 80.8 82.0 83.2 83.9
BAROMETRIC PRES: 29.3

* C8: San Antonio Climate Zone; February, 2005 (CST)
HOURLY TEMPERATURES: 51.8 52.0 53.2 55.1 56.9 58.7 60.0 60.9 61.8 62.0 61.9 60.5 59.0 57.2 56.5 55.1 54.4 54.3 53.5 53.1 52.4 52.3 51.9 51.6
RELATIVE HUMIDITY: 88.3 87.8 84.8 80.6 75.7 72.0 68.8 67.4 65.7 65.0 65.3 67.5 70.0 74.2 76.0 79.0 81.9 81.0 82.6 84.2 86.4 86.0 87.5 88.5
BAROMETRIC PRES: 29.2

* C8: San Antonio Climate Zone; March, 2005 (CST)
HOURLY TEMPERATURES: 52.7 55.5 59.0 62.1 64.8 67.2 69.1 70.9 71.6 71.9 70.9 69.0 66.2 63.8 61.4 59.5 57.9 57.3 55.8 55.0 54.1 53.4 52.8 52.9
RELATIVE HUMIDITY: 84.9 81.8 74.6 68.2 63.3 59.2 55.9 52.3 49.4 47.8 48.5 50.8 53.8 57.3 62.2 67.7 72.1 72.9 77.0 79.8 81.9 84.2 85.0 84.9
BAROMETRIC PRES: 29.1

* C8: San Antonio Climate Zone; April, 2005 (CDT)
HOURLY TEMPERATURES: 58.8 59.5 63.0 66.3 69.3 71.7 74.2 76.4 77.6 78.8 78.9 78.4 76.7 73.4 70.2 68.2 66.2 64.8 63.4 62.3 61.2 60.2 59.6 58.8
RELATIVE HUMIDITY: 78.9 79.3 73.2 65.6 60.1 55.0 50.0 46.4 43.6 41.7 41.5 42.3 44.7 48.1 54.1 57.2 61.4 65.2 68.8 71.0 73.5 76.5 76.8 78.7
BAROMETRIC PRES: 29.1
* C8: San Antonio Climate Zone; May, 2005 (CDT)
HOURLY TEMPERATURES: 66.4 67.7 70.1 73.1 75.6 78.0 79.5 81.2 81.9 83.0 83.5 83.0 81.0 78.5 75.6 74.1 72.6 71.1 70.0 68.4 67.7 67.2 66.8 66.7
RELATIVE HUMIDITY: 90.4 88.2 83.1 75.9 70.2 64.8 61.5 57.6 54.7 52.9 51.6 51.4 54.3 59.1 66.0 71.7 75.6 79.5 82.5 85.8 87.6 88.8 90.0 90.7
BAROMETRIC PRES: 29.1

* C8: San Antonio Climate Zone; June, 2005 (CDT)
HOURLY TEMPERATURES: 73.7 75.5 78.0 80.2 82.8 85.0 87.1 88.9 90.4 90.9 91.3 90.9 89.5 87.0 83.8 81.7 80.1 78.7 77.4 76.1 75.5 74.4 74.0 73.9
RELATIVE HUMIDITY: 92.2 89.0 82.4 74.9 67.9 62.0 57.4 53.3 50.0 48.4 47.1 46.7 49.1 53.1 60.0 66.0 70.3 75.6 79.8 84.5 86.7 89.4 90.8 91.6
BAROMETRIC PRES: 29.0

* C8: San Antonio Climate Zone; July, 2005 (CDT)
HOURLY TEMPERATURES: 76.2 77.7 79.9 82.7 85.3 87.6 90.3 91.6 92.9 93.3 92.7 91.4 90.2 87.3 84.8 82.5 81.4 79.8 79.0 78.0 77.6 77.1 76.9 76.4
RELATIVE HUMIDITY: 92.6 90.1 82.8 74.4 67.2 61.0 55.0 51.8 49.5 47.8 49.6 51.0 53.6 58.8 64.7 70.7 74.4 78.9 81.5 85.7 88.0 90.1 90.5 92.5
BAROMETRIC PRES: 29.1

* C8: San Antonio Climate Zone; August, 2005 (CDT)
HOURLY TEMPERATURES: 76.3 77.5 80.3 82.7 85.5 88.4 90.9 91.9 93.3 94.2 94.6 94.3 92.2 89.4 86.3 84.3 82.7 81.4 79.8 78.6 77.9 77.5 77.1 76.5
RELATIVE HUMIDITY: 91.3 89.2 81.4 74.1 66.1 58.3 52.1 49.3 46.2 44.0 42.1 42.3 45.3 51.2 59.2 65.3 70.5 74.8 80.0 83.3 85.9 87.5 89.2 90.4
BAROMETRIC PRES: 29.1

* C8: San Antonio Climate Zone; September, 2005 (CDT)
HOURLY TEMPERATURES: 74.6 74.9 78.6 82.1 85.5 88.2 90.3 92.5 93.3 94.1 93.7 92.6 90.2 86.9 84.6 82.6 81.2 79.7 78.2 77.4 76.7 75.9 75.4 74.8
RELATIVE HUMIDITY: 88.8 88.2 79.9 71.5 62.5 55.0 49.7 44.8 42.6 41.1 41.7 43.1 46.7 52.2 57.6 64.4 69.8 74.6 78.8 80.7 83.0 85.7 87.7 88.9
BAROMETRIC PRES: 29.1

* C8: San Antonio Climate Zone; October, 2005 (CDT)
HOURLY TEMPERATURES: 61.6 61.9 65.1 69.3 72.7 75.0 77.4 79.4 80.4 80.8 80.2 78.7 75.0 72.0 70.5 69.1 67.5 65.8 64.6 64.1 63.6 62.8 62.3 61.9
RELATIVE HUMIDITY: 89.8 89.0 83.1 73.6 64.9 59.4 53.8 49.1 47.3 46.4 46.2 47.7 53.4 58.9 62.3 66.1 71.1 77.1 80.9 85.6 86.5 89.2 90.0 89.7
BAROMETRIC PRES: 29.2

* C8: San Antonio Climate Zone; November, 2005 (CST)
HOURLY TEMPERATURES: 55.3 57.4 62.0 65.9 69.1 72.0 74.3 76.0 76.6 76.2 74.5 70.3 67.4 64.9 62.7 61.2 59.7 58.6 57.2 56.9 56.4 55.9 55.7 55.6
RELATIVE HUMIDITY: 78.1 75.0 65.1 58.0 51.8 46.7 42.3 37.7 36.1 36.1 37.6 43.5 49.5 55.0 60.7 65.8 70.0 73.3 74.9 76.2 77.6 78.5 78.2 78.4
BAROMETRIC PRES: 29.2

* C8: San Antonio Climate Zone; December, 2005 (CST)
HOURLY TEMPERATURES: 44.8 45.6 49.9 53.9 57.1 60.0 62.0 63.3 64.3 64.1 62.8 59.1 56.3 54.2 52.7 51.0 50.2 49.3 47.6 46.8 46.0 46.2 46.1 45.9
RELATIVE HUMIDITY: 67.1 65.7 58.6 53.1 48.4 44.1 40.1 37.7 37.2 37.5 38.8 43.5 48.1 52.1 55.1 58.2 61.2 62.9 66.4 67.6 68.9 67.8 68.4 67.9
BAROMETRIC PRES: 29.2

APPENDIX G
SAN ANTONIO DISTRICT REGISTRATION DISTRIBUTIONS AND STATEWIDE DIESEL FRACTIONS

Bexar County Registration Distributions

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* Vehicle Age Distributions Calculated from Mid-Year (July) 2005 Registrations data
* LDV, LDT, MC: based on Bexar County data only
* HDV: based on 4-county San Antonio EAC area aggregate data (Bexar, Comal, Guadalupe, Wilson)
* LDV
       1 0.07206 0.07835 0.07734 0.08114 0.07958 0.07986 0.06840 0.05929 0.05488 0.04772 0.05246
0.04290 0.03742 0.02980 0.02653 0.02047 0.01723 0.01351 0.01050 0.00898 0.00774 0.00616 0.00374
0.00255 0.02139
* LDT1
       2 0.03888 0.06613 0.08013 0.08731 0.08324 0.06886 0.05896 0.05522 0.05616 0.04353 0.04821
0.04883 0.03465 0.02648 0.02379 0.01885 0.01931 0.01696 0.01275 0.01604 0.01443 0.01243 0.00818
0.00831 0.05236
* LDT2
       3 0.03888 0.06613 0.08013 0.08731 0.08324 0.06886 0.05896 0.05522 0.05616 0.04353 0.04821
0.04883 0.03465 0.02648 0.02379 0.01885 0.01931 0.01696 0.01275 0.01604 0.01443 0.01243 0.00818
0.00831 0.05236
* LDT3
       4 0.07724 0.15865 0.11901 0.10136 0.09821 0.06921 0.08702 0.03261 0.04899 0.03311 0.03311
0.02456 0.01918 0.01495 0.01032 0.00906 0.00855 0.00769 0.00418 0.00676 0.00601 0.00567 0.00321
0.00304 0.01830
* LDT4
       5 0.07724 0.15865 0.11901 0.10136 0.09821 0.06921 0.08702 0.03261 0.04899 0.03311 0.03311
0.02456 0.01918 0.01495 0.01032 0.00906 0.00855 0.00769 0.00418 0.00676 0.00601 0.00567 0.00321
0.00304 0.01830
* HDV2b
       6 0.16122 0.15857 0.12649 0.10959 0.09480 0.06100 0.05228 0.02759 0.03142 0.01122 0.02020
0.01703 0.01584 0.00924 0.00951 0.00951 0.00924 0.00964 0.00673 0.00871 0.00832 0.00858 0.00436
0.00607 0.02284
* HDV3
       7 0.06292 0.06968 0.05574 0.05448 0.09798 0.08404 0.09544 0.02998 0.06630 0.03674 0.04688
0.04688 0.03674 0.02449 0.01900 0.02238 0.02618 0.01351 0.01056 0.01351 0.00929 0.00802 0.00507
0.00718 0.05701
* HDV4
       8 0.05722 0.08356 0.06812 0.06721 0.08538 0.09083 0.10171 0.04723 0.07266 0.06903 0.04269
0.02543 0.02089 0.01272 0.01726 0.01272 0.00999 0.01090 0.00999 0.00363 0.00454 0.00999 0.00545
0.01090 0.05995
* HDV5
       9 0.15011 0.10402 0.06028 0.06501 0.04019 0.10284 0.11348 0.03310 0.03191 0.02246 0.02600
0.01182 0.02128 0.01537 0.01537 0.01418 0.01537 0.03664 0.01182 0.00591 0.01064 0.01182 0.00473
0.00827 0.06738
* HDV6
      10 0.08868 0.06712 0.05312 0.04774 0.05922 0.08866 0.07286 0.06461 0.03159 0.04092 0.06892
0.03625 0.03302 0.02333 0.01974 0.02333 0.01687 0.01651 0.01472 0.01866 0.02261 0.01579 0.01077
0.01184 0.05312
* HDV7
      11 0.06358 0.04188 0.04114 0.05684 0.06956 0.08450 0.06507 0.06806 0.03366 0.04637 0.04413
0.03515 0.04114 0.03665 0.04488 0.03815 0.02169 0.02319 0.02917 0.02019 0.01571 0.01571 0.01421
0.01122 0.03815
* HDV8a
      12 0.03990 0.02238 0.02871 0.03406 0.04234 0.06229 0.06618 0.04769 0.03796 0.04574 0.06665
0.05645 0.05985 0.03212 0.03893 0.04185 0.04964 0.03796 0.03163 0.03504 0.03212 0.01703 0.00827
0.01655 0.04866
* HDV8b
      13 0.09399 0.03497 0.07213 0.00765 0.06120 0.12130 0.08962 0.04590 0.06230 0.05574 0.03279
0.07213 0.07432 0.01093 0.02077 0.00546 0.00219 0.00765 0.00437 0.01530 0.02842 0.02951 0.00765
0.00874 0.03497
*   HDBS is MOBILE6 default
*   HDBT is MOBILE6 default
* MC
      16 0.14331 0.11321 0.13535 0.10197 0.08344 0.06419 0.04961 0.03706 0.02786 0.02648 0.02280
0.01879 0.01590 0.01117 0.00795 0.00788 0.00867 0.00683 0.00604 0.01353 0.01235 0.00841 0.00966
0.01268 0.05486
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Comal County Registration Distributions

```
* Vehicle Age Distributions Calculated from Mid-Year (July) 2005 Registrations data
* LDV, LDT, MC: based on Comal County data only
* HDV: based on 4-county San Antonio EAC area aggregate data (Bexar, Comal, Guadalupe, Wilson)
* LDV
       1 0.05109 0.07922 0.08382 0.08667 0.08045 0.08211 0.07339 0.06243 0.05470 0.04764 0.04868
0.04235 0.03572 0.02972 0.02534 0.01946 0.01725 0.01291 0.01007 0.00884 0.00744 0.00626 0.00397
0.00279 0.02768
* LDT1
       2 0.03138 0.06363 0.08252 0.08554 0.08160 0.07213 0.06704 0.05833 0.05985 0.04551 0.05130
0.04902 0.03550 0.02743 0.02402 0.02110 0.01840 0.01472 0.01201 0.01472 0.01104 0.01088 0.00644
0.00595 0.04994
* LDT2
       3 0.03138 0.06363 0.08252 0.08554 0.08160 0.07213 0.06704 0.05833 0.05985 0.04551 0.05130
0.04902 0.03550 0.02743 0.02402 0.02110 0.01840 0.01472 0.01201 0.01472 0.01104 0.01088 0.00644
0.00595 0.04994
* LDT3
       4 0.07257 0.14364 0.11576 0.10114 0.10516 0.07606 0.08706 0.03501 0.05701 0.03488 0.03555
0.02495 0.02240 0.01476 0.01087 0.00751 0.00952 0.00791 0.00241 0.00671 0.00483 0.00456 0.00215
0.00215 0.01543
* LDT4
       5 0.07257 0.14364 0.11576 0.10114 0.10516 0.07606 0.08706 0.03501 0.05701 0.03488 0.03555
0.02495 0.02240 0.01476 0.01087 0.00751 0.00952 0.00791 0.00241 0.00671 0.00483 0.00456 0.00215
0.00215 0.01543
* HDV2b
       6 0.16122 0.15857 0.12649 0.10959 0.09480 0.06100 0.05228 0.02759 0.03142 0.01122 0.02020
0.01703 0.01584 0.00924 0.00951 0.00951 0.00924 0.00964 0.00673 0.00871 0.00832 0.00858 0.00436
0.00607 0.02284
* HDV3
       7 0.06292 0.06968 0.05574 0.05448 0.09798 0.08404 0.09544 0.02998 0.06630 0.03674 0.04688
0.04688 0.03674 0.02449 0.01900 0.02238 0.02618 0.01351 0.01056 0.01351 0.00929 0.00802 0.00507
0.00718 0.05701
* HDV4
       8 0.05722 0.08356 0.06812 0.06721 0.08538 0.09083 0.10171 0.04723 0.07266 0.06903 0.04269
0.02543 0.02089 0.01272 0.01726 0.01272 0.00999 0.01090 0.00999 0.00363 0.00454 0.00999 0.00545
0.01090 0.05995
* HDV5
       9 0.15011 0.10402 0.06028 0.06501 0.04019 0.10284 0.11348 0.03310 0.03191 0.02246 0.02600
0.01182 0.02128 0.01537 0.01537 0.01418 0.01537 0.03664 0.01182 0.00591 0.01064 0.01182 0.00473
0.00827 0.06738
* HDV6
      10 0.08868 0.06712 0.05312 0.04774 0.05922 0.08866 0.07286 0.06461 0.03159 0.04092 0.06892
0.03625 0.03302 0.02333 0.01974 0.02333 0.01687 0.01651 0.01472 0.01866 0.02261 0.01579 0.01077
0.01184 0.05312
* HDV7
      11 0.06358 0.04188 0.04114 0.05684 0.06956 0.08450 0.06507 0.06806 0.03366 0.04637 0.04413
0.03515 0.04114 0.03665 0.04488 0.03815 0.02169 0.02319 0.02917 0.02019 0.01571 0.01571 0.01421
0.01122 0.03815
* HDV8a
      12 0.03990 0.02238 0.02871 0.03406 0.04234 0.06229 0.06618 0.04769 0.03796 0.04574 0.06665
0.05645 0.05985 0.03212 0.03893 0.04185 0.04964 0.03796 0.03163 0.03504 0.03212 0.01703 0.00827
0.01655 0.04866
* HDV8b
      13 0.09399 0.03497 0.07213 0.00765 0.06120 0.12130 0.08962 0.04590 0.06230 0.05574 0.03279
0.07213 0.07432 0.01093 0.02077 0.00546 0.00219 0.00765 0.00437 0.01530 0.02842 0.02951 0.00765
0.00874 0.03497
*   HDBS is MOBILE6 default
*   HDBT is MOBILE6 default
* MC
      16 0.07600 0.10152 0.10369 0.11619 0.08686 0.08686 0.06189 0.03583 0.02769 0.02986 0.01846
0.02063 0.02117 0.01249 0.00869 0.00706 0.01031 0.00380 0.01303 0.01574 0.01737 0.01357 0.01303
0.01954 0.07872
```

Guadalupe County Registration Distributions

```
* Vehicle Age Distributions Calculated from Mid-Year (July) 2005 Registrations data
* LDV, LDT, MC: based on Guadalupe County data only
* HDV: based on 4-county San Antonio EAC area aggregate data (Bexar, Comal, Guadalupe, Wilson)
* LDV
       1 0.04374 0.07647 0.08400 0.08759 0.07868 0.08071 0.07005 0.06238 0.05615 0.04855 0.05313
0.04220 0.03923 0.03094 0.02615 0.02215 0.01798 0.01351 0.01070 0.00831 0.00870 0.00707 0.00334
0.00251 0.02576
* LDT1
       2 0.02916 0.05899 0.07773 0.08080 0.08157 0.06747 0.05991 0.06093 0.05628 0.04688 0.04990
0.05107 0.03713 0.02911 0.02615 0.02099 0.02278 0.01675 0.01241 0.01849 0.01425 0.01343 0.00766
0.00853 0.05163
* LDT2
       3 0.02916 0.05899 0.07773 0.08080 0.08157 0.06747 0.05991 0.06093 0.05628 0.04688 0.04990
0.05107 0.03713 0.02911 0.02615 0.02099 0.02278 0.01675 0.01241 0.01849 0.01425 0.01343 0.00766
0.00853 0.05163
* LDT3
       4 0.05606 0.13135 0.10139 0.10203 0.10652 0.07320 0.09547 0.03652 0.05510 0.03972 0.03972
0.02659 0.02499 0.01682 0.01410 0.01057 0.01041 0.00593 0.00368 0.00817 0.00817 0.00513 0.00449
0.00449 0.01938
* LDT4
       5 0.05606 0.13135 0.10139 0.10203 0.10652 0.07320 0.09547 0.03652 0.05510 0.03972 0.03972
0.02659 0.02499 0.01682 0.01410 0.01057 0.01041 0.00593 0.00368 0.00817 0.00817 0.00513 0.00449
0.00449 0.01938
* HDV2b
       6 0.16122 0.15857 0.12649 0.10959 0.09480 0.06100 0.05228 0.02759 0.03142 0.01122 0.02020
0.01703 0.01584 0.00924 0.00951 0.00951 0.00924 0.00964 0.00673 0.00871 0.00832 0.00858 0.00436
0.00607 0.02284
* HDV3
       7 0.06292 0.06968 0.05574 0.05448 0.09798 0.08404 0.09544 0.02998 0.06630 0.03674 0.04688
0.04688 0.03674 0.02449 0.01900 0.02238 0.02618 0.01351 0.01056 0.01351 0.00929 0.00802 0.00507
0.00718 0.05701
* HDV4
       8 0.05722 0.08356 0.06812 0.06721 0.08538 0.09083 0.10171 0.04723 0.07266 0.06903 0.04269
0.02543 0.02089 0.01272 0.01726 0.01272 0.00999 0.01090 0.00999 0.00363 0.00454 0.00999 0.00545
0.01090 0.05995
* HDV5
       9 0.15011 0.10402 0.06028 0.06501 0.04019 0.10284 0.11348 0.03310 0.03191 0.02246 0.02600
0.01182 0.02128 0.01537 0.01537 0.01418 0.01537 0.03664 0.01182 0.00591 0.01064 0.01182 0.00473
0.00827 0.06738
* HDV6
      10 0.08868 0.06712 0.05312 0.04774 0.05922 0.08866 0.07286 0.06461 0.03159 0.04092 0.06892
0.03625 0.03302 0.02333 0.01974 0.02333 0.01687 0.01651 0.01472 0.01866 0.02261 0.01579 0.01077
0.01184 0.05312
* HDV7
      11 0.06358 0.04188 0.04114 0.05684 0.06956 0.08450 0.06507 0.06806 0.03366 0.04637 0.04413
0.03515 0.04114 0.03665 0.04488 0.03815 0.02169 0.02319 0.02917 0.02019 0.01571 0.01571 0.01421
0.01122 0.03815
* HDV8a
      12 0.03990 0.02238 0.02871 0.03406 0.04234 0.06229 0.06618 0.04769 0.03796 0.04574 0.06665
0.05645 0.05985 0.03212 0.03893 0.04185 0.04964 0.03796 0.03163 0.03504 0.03212 0.01703 0.00827
0.01655 0.04866
* HDV8b
      13 0.09399 0.03497 0.07213 0.00765 0.06120 0.12130 0.08962 0.04590 0.06230 0.05574 0.03279
0.07213 0.07432 0.01093 0.02077 0.00546 0.00219 0.00765 0.00437 0.01530 0.02842 0.02951 0.00765
0.00874 0.03497
*   HDBS is MOBILE6 default
*   HDBT is MOBILE6 default
* MC
      16 0.05850 0.09498 0.14796 0.10874 0.09635 0.06951 0.06401 0.03992 0.03441 0.02822 0.02409
0.02409 0.01170 0.01032 0.00895 0.00757 0.01239 0.00551 0.00757 0.01789 0.01652 0.01239 0.01032
0.01445 0.07364
```

Wilson County Registration Distributions

```
* Vehicle Age Distributions Calculated from Mid-Year (July) 2005 Registrations data
* LDV, LDT, MC: based on Wilson County data only
* HDV: based on 4-county San Antonio EAC area aggregate data (Bexar, Comal, Guadalupe, Wilson)
* LDV
       1 0.03981 0.06928 0.07781 0.08118 0.07970 0.08684 0.07437 0.06082 0.05680 0.04933 0.05417
0.04219 0.04063 0.02971 0.02643 0.02183 0.01896 0.01445 0.01174 0.00952 0.00928 0.00698 0.00607
0.00345 0.02865
* LDT1
       2 0.03520 0.06232 0.07647 0.08642 0.08302 0.06852 0.06244 0.05847 0.05589 0.05040 0.04899
0.05192 0.03297 0.02923 0.02713 0.02350 0.02210 0.01462 0.01368 0.01462 0.01310 0.01076 0.00854
0.00713 0.04256
* LDT2
       3 0.03520 0.06232 0.07647 0.08642 0.08302 0.06852 0.06244 0.05847 0.05589 0.05040 0.04899
0.05192 0.03297 0.02923 0.02713 0.02350 0.02210 0.01462 0.01368 0.01462 0.01310 0.01076 0.00854
0.00713 0.04256
* LDT3
       4 0.06409 0.11843 0.12167 0.09687 0.10248 0.07797 0.09185 0.03662 0.05848 0.03249 0.04017
0.03544 0.02894 0.01477 0.01477 0.00738 0.00797 0.00561 0.00413 0.00916 0.00768 0.00620 0.00266
0.00236 0.01181
* LDT4
       5 0.06409 0.11843 0.12167 0.09687 0.10248 0.07797 0.09185 0.03662 0.05848 0.03249 0.04017
0.03544 0.02894 0.01477 0.01477 0.00738 0.00797 0.00561 0.00413 0.00916 0.00768 0.00620 0.00266
0.00236 0.01181
* HDV2b
       6 0.16122 0.15857 0.12649 0.10959 0.09480 0.06100 0.05228 0.02759 0.03142 0.01122 0.02020
0.01703 0.01584 0.00924 0.00951 0.00951 0.00924 0.00964 0.00673 0.00871 0.00832 0.00858 0.00436
0.00607 0.02284
* HDV3
       7 0.06292 0.06968 0.05574 0.05448 0.09798 0.08404 0.09544 0.02998 0.06630 0.03674 0.04688
0.04688 0.03674 0.02449 0.01900 0.02238 0.02618 0.01351 0.01056 0.01351 0.00929 0.00802 0.00507
0.00718 0.05701
* HDV4
       8 0.05722 0.08356 0.06812 0.06721 0.08538 0.09083 0.10171 0.04723 0.07266 0.06903 0.04269
0.02543 0.02089 0.01272 0.01726 0.01272 0.00999 0.01090 0.00999 0.00363 0.00454 0.00999 0.00545
0.01090 0.05995
* HDV5
       9 0.15011 0.10402 0.06028 0.06501 0.04019 0.10284 0.11348 0.03310 0.03191 0.02246 0.02600
0.01182 0.02128 0.01537 0.01537 0.01418 0.01537 0.03664 0.01182 0.00591 0.01064 0.01182 0.00473
0.00827 0.06738
* HDV6
      10 0.08868 0.06712 0.05312 0.04774 0.05922 0.08866 0.07286 0.06461 0.03159 0.04092 0.06892
0.03625 0.03302 0.02333 0.01974 0.02333 0.01687 0.01651 0.01472 0.01866 0.02261 0.01579 0.01077
0.01184 0.05312
* HDV7
      11 0.06358 0.04188 0.04114 0.05684 0.06956 0.08450 0.06507 0.06806 0.03366 0.04637 0.04413
0.03515 0.04114 0.03665 0.04488 0.03815 0.02169 0.02319 0.02917 0.02019 0.01571 0.01571 0.01421
0.01122 0.03815
* HDV8a
      12 0.03990 0.02238 0.02871 0.03406 0.04234 0.06229 0.06618 0.04769 0.03796 0.04574 0.06665
0.05645 0.05985 0.03212 0.03893 0.04185 0.04964 0.03796 0.03163 0.03504 0.03212 0.01703 0.00827
0.01655 0.04866
* HDV8b
      13 0.09399 0.03497 0.07213 0.00765 0.06120 0.12130 0.08962 0.04590 0.06230 0.05574 0.03279
0.07213 0.07432 0.01093 0.02077 0.00546 0.00219 0.00765 0.00437 0.01530 0.02842 0.02951 0.00765
0.00874 0.03497
*   HDBS is MOBILE6 default
*   HDBT is MOBILE6 default
* MC
      16 0.09949 0.08673 0.12756 0.11990 0.07908 0.06633 0.06888 0.05102 0.02041 0.02806 0.01020
0.01786 0.01786 0.02041 0.00510 0.01020 0.00255 0.01276 0.00510 0.02296 0.00765 0.00765 0.01786
0.01020 0.08418
```

2005 Statewide Diesel Fractions Estimates

```
* HDV fractions are estimated from TxDOT registration data (Mid-year July
2005)
* LDV, LDT and Bus fractions are EPA defaults
* One record per vehicle type.  The order of vehicle types is: LDV, LDT1,
LDT2, LDT3, LDT4, HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8a, HDV8b, HDBS

DIESEL FRACTIONS:
0.00090 0.00090 0.00090 0.00090 0.00090 0.00090 0.00090 0.00090 0.00090
0.00090 0.00060 0.00010 0.00030 0.00060 0.00130 0.00040 0.00040 0.00010
0.00270 0.00320 0.00970 0.01620 0.02410 0.05100 0.07060
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00070 0.00330 0.00480 0.01200 0.02230 0.06560 0.06160
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00070 0.00330 0.00480 0.01200 0.02230 0.06560 0.06160
0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260
0.01260 0.01150 0.01110 0.01450 0.01150 0.01290 0.00960 0.00830 0.00720
0.00820 0.01240 0.01350 0.01690 0.02090 0.02560 0.00130
0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260
0.01260 0.01150 0.01110 0.01450 0.01150 0.01290 0.00960 0.00830 0.00720
0.00820 0.01240 0.01350 0.01690 0.02090 0.02560 0.00130
0.80727 0.85880 0.79626 0.76336 0.71156 0.57882 0.62666 0.53215 0.45513
0.43053 0.20721 0.39488 0.37150 0.35696 0.36316 0.29108 0.24619 0.18987
0.16935 0.18496 0.15575 0.20032 0.17544 0.13619 0.00252
0.75422 0.69565 0.64314 0.63874 0.63332 0.63221 0.61230 0.48030 0.56752
0.53492 0.32654 0.54201 0.55668 0.61608 0.48880 0.56212 0.49160 0.36852
0.26829 0.32512 0.19953 0.23661 0.16912 0.17021 0.01006
0.82953 0.75912 0.72704 0.68240 0.69571 0.72079 0.65446 0.67783 0.73703
0.65948 0.43887 0.65817 0.67624 0.62701 0.69375 0.57605 0.61423 0.26263
0.24503 0.10700 0.10573 0.20225 0.21818 0.13095 0.02287
0.82614 0.88206 0.85909 0.88344 0.84910 0.88533 0.85240 0.70056 0.72396
0.80220 0.49180 0.63941 0.72500 0.63594 0.73795 0.59627 0.63309 0.33569
0.34450 0.22581 0.30159 0.21739 0.29167 0.15102 0.08285
0.88811 0.88834 0.89974 0.92151 0.87787 0.85887 0.82563 0.78874 0.77934
0.80210 0.60857 0.79070 0.77868 0.60498 0.68447 0.74280 0.73388 0.58797
0.67378 0.57627 0.46954 0.46046 0.41379 0.39268 0.14184
0.96056 0.95136 0.98026 0.89626 0.89382 0.90778 0.88756 0.84000 0.77970
0.83333 0.55516 0.83757 0.85385 0.88809 0.88287 0.85229 0.88219 0.80270
0.83740 0.76855 0.77287 0.72797 0.71429 0.67059 0.40811
0.96719 0.95265 0.95541 0.95288 0.93773 0.93368 0.95825 0.94940 0.90797
0.92862 0.75307 0.95733 0.95373 0.94996 0.93049 0.93216 0.94866 0.95047
0.93968 0.91036 0.91883 0.93425 0.90435 0.90832 0.65140
0.99150 0.98783 0.99435 0.98311 0.98820 0.98844 0.97735 0.98077 0.95736
0.99504 0.76660 0.97368 0.96629 0.97849 0.98291 0.93258 0.94958 0.96970
0.92453 0.93651 0.96250 0.95455 0.94444 0.89655 0.65873
0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850
0.95850 0.88570 0.85250 0.87950 0.99000 0.91050 0.87600 0.77100 0.75020
0.73450 0.67330 0.51550 0.38450 0.32380 0.32600 0.26390
```

APPENDIX F
24-HOUR VMT MIX

San Antonio District 24-Hour VMT Mix

	Arterial	Collector	Freeway
LDGV	0.5970006	0.6054675	0.5917981
LDGT1	0.0521003	0.0528380	0.0516471
LDGT2	0.1734410	0.1758967	0.1719321
LDGT3	0.0430510	0.0436606	0.0426765
LDGT4	0.0197983	0.0200786	0.0196261
HDGV2b	0.0087750	0.0091358	0.0060691
HDGV_3	0.0037717	0.0039268	0.0026086
HDGV_4	0.0015202	0.0015827	0.0010514
HDGV_5	0.0008852	0.0009216	0.0006122
HDGV_6	0.0028673	0.0029851	0.0019831
HDGV_7	0.0007505	0.0007813	0.0005191
HDGV8a	0.0005581	0.0005810	0.0003860
HDGV8b	0.0001155	0.0001202	0.0000799
LDDV	0.0008013	0.0008126	0.0007943
LDDT12	0.0001281	0.0001299	0.0001269
HDDV2b	0.0211047	0.0219724	0.0145967
HDDV_3	0.0050732	0.0052818	0.0035088
HDDV_4	0.0027396	0.0028522	0.0018948
HDDV_5	0.0020800	0.0021656	0.0014386
HDDV_6	0.0078128	0.0081340	0.0054036
HDDV_7	0.0045659	0.0047537	0.0031579
HDDV8a	0.0073562	0.0076587	0.0050878
HDDV8b	0.0365727	0.0200726	0.0680506
MC	0.0010000	0.0010000	0.0010000
HDGB	0.0005801	0.0007007	0.0003293
HDDBT	0.0016247	0.0019625	0.0009224
HDDBS	0.0028167	0.0034023	0.0015991
LDDT34	0.0011095	0.0011252	0.0010999

APPENDIX I
NIF APPLICATION

NIFv3.0 (EPA, November 2003) Record Specifications -- Application for Texas 2005 CERR Emissions Estimates

The three record types (TR, PE, EM) are organized and transmitted in three files, one file for each record type (i.e., 242tx_or2005_NIFtr.txt, 242tx_or2005_NIFpe.txt, 242tx_or2005_NIFem.txt). For each record type, the data elements, positions in the record, and brief data value description are provided in the three following tables. Additional information regarding the record specifications may be found in *NEI Input Format (NIF) Version 3.0, User's Guide Instructions and Conventions for Use*, EPA, November 2003.

Transmittal Record (TR)

There is one transmittal record provided per county excluding the Dallas/Fort Worth 12-county CMSA (242 total). Included were 20 of 25 possible data elements with the following values. Note that the last six data elements (columns 479 through 524) were added by TCEQ for the 1999 and 2002 NEIs and were maintained for this 2005 NEI.

Position (begin/end col.)	**Data Element**	**Value/(Description)**
1/2	Record Type	TR
3/7	State and County FIPS Code	(Individual five-character code for each county – two-digit Texas state code is 48 followed by three-digit county code – provided in second column of table in modrun_TRkey.CERR.xls)
8/87	Organization Name	Texas Transportation Institute
88/89	Transaction Type	00
90/93	Inventory Year	2005
94/103	Inventory Type Code	CRIT
104/111	Transaction Creation Date	(Date that transmittal record was created)
112/115	Incremental Submission #	1
116/120	Reliability Indicator	(Left blank)
121/200	Transaction Comments	(Left blank)
201/270	Contact Person Name	Marty Boardman
271/285	Contact Phone Number	(979) 458-0878
286/295	Telephone Number Type Name	Voice
296/395	Electronic Address Text	m-boardman@tamu.edu
396/405	Electronic Address Type Name	E-mail
406/430	Source Type	On-Road Mobile
431/470	Affiliation Type	(Left blank)
471/474	Format Version	3.0
475/477	Tribal Code	000
478/478	(Not used)	
479/486	Quality_Assured	(Left blank)
487/494	Quality_Contact	(Left blank)
495/504	Model_Used	MOBILE
505/510	Model_Version	6.2.03
511/516	Model_Run	(Three-character county FIPS code for HPMS-based counties, and county FIPS plus “LB” for link-based counties.)
517/524	Model_Run_Date	(Annual emissions run date)

Emission Period Record (PE)

The PE records contain VMT values for each county by period (summer season, and winter season for El Paso, and annual) and source classification code (SCC, combined road type [12 AMS road type codes], vehicle type [12-category NIFv3.0 scheme] and emissions process [exhaust, evaporative, brake, tire]).

Position (begin/end col.)	Data Element	Value/(Description)
1/2	Record Type	PE
3/7	FIPS Code	State and County (Five-character code)
8/17	SCC[1]	(This is a 10-digit code identifying the source corresponding to the Actual Throughput [VMT] data element. Provides major source type as first two digits, highway vehicle type are next five digits [12 categories according to NIF aggregation level], and last three digits are AMS road type code [up to 12 AMS road type codes]. The third AMS code digit, normally zero, is replaced with X, V, T, or B[2], to signify the emissions process to which the VMT corresponds.)
18/25	Begin Date	20050101 (annual), 20050601 (summer), 20041201 (winter, El Paso); except for HGB and TLM: 20050701 (summer)
26/33	End Date	20051231 (annual), 20050831 (summer), 20050228 (winter, El Paso); except for HGB and TLM: 20050930 (summer)
34/35	(Not used)	
36/39	Begin Time	(Left blank)
40/43	End Time	(Left blank)
44/53	Actual Throughput[3]	(Numeric VMT value), corresponds to begin and end date
54/63	Throughput Unit Numerator	E6MILE (units of millions of miles)
64/67	Submittal Flag	(Left blank)
68/71	Tribal Code	000

[1] Vehicle Type and Road Type codes used in 10 digit SCC:

2201001	LDGV	110	RURAL INTERSTATE: TOTAL
2201020	LDGT12	130	RURAL OTHER PRINCIPAL ARTERIAL: TOTAL
2201040	LDGT34	150	RURAL MINOR ARTERIAL: TOTAL
2201070	HDGV,HDGB	170	RURAL MAJOR COLLECTOR: TOTAL
2201080	MC	190	RURAL MINOR COLLECTOR: TOTAL
2230001	LDDV	210	RURAL LOCAL: TOTAL
2230060	LDDT1-4	230	URBAN INTERSTATE: TOTAL
2230071	HDDV2b	250	URBAN OTHER FREEWAYS AND EXPRESSWAYS: TOTAL
2230072	HDDV3-5	270	URBAN OTHER PRINCIPAL ARTERIAL: TOTAL
2230073	HDDV6-7	290	URBAN MINOR ARTERIAL: TOTAL
2230074	HDDV8a-b	310	URBAN COLLECTOR: TOTAL
2230075	HDDB	330	URBAN LOCAL: TOTAL

[2] These SCC's further employ the X, B, T, and V codes in place of the third "0" digit of the road type code to designate the "emissions process" to which the SCC relates (i.e., exhaust, brake, tire, and evaporative, respectively). For every SCC with emissions in the emissions record, the SCC must also be included in the PE record with the corresponding throughput (VMT).

[3] Seasonal period (total) VMT was required in NIF, although not used in the emissions analysis. Calculated specifically for the NIF report, seasonal period VMT is the product of county AADT VMT, district ATR-based seasonal facors, and the number of days in the seasonal period.

Emissions Record (EM)

The EM records contain the emissions estimate values for each county, period, pollutant, and SCC (as described for PE record) in units of pounds for daily values and tons for annual values, with floating point decimal and exponential notation for small values. Included were 10 of 15 possible data elements with the following values. See the note on conversion of travel model link-based EI data from travel model functional classes to HPMS functional classes.

Position (begin/end col.)	**Data Element**	**Value/(Description)**
1/2	Record Type	EM
3/7	State and County FIPS Code	(Five-character code)
8/17	SCC	(This is a 10-digit code identifying the emissions source. Provides major source type as first two digits, highway vehicle type is next five digits [12 categories according to NIF aggregation level], and last three digits is AMS road type code [up to 12 AMS road type codes] with the third AMS code digit, normally zero, replaced with X, V, T, or B, to signify the associated emissions process.)
18/27	(Not used)	
28/35	Begin Date	20050101 (annual), 20050601 (summer), 20041201 (winter, El Paso); except for HGB and TLM: 20050701 (summer)
36/43	End Date	20051231 (annual), 20050831 (summer), 20050228 (winter, El Paso); except for HGB and TLM: 20050930 (summer)
44/45	(Not used)	
46/49	Begin Time	(Left blank)
50/53	End Time	(Left blank)
54/62	Pollutant Code	VOC, CO, NOX, SO2, NH3, PM25-PRI, PM10-PRI
63/143	Emissions Process Description	(Left blank)
144/153	Emissions Numeric Value	(Pollutant/SCC-specific and period-specific [i.e. summer weekday, winter weekday, annual] Numeric Value – floating point decimal and exponential notation for small values.)
154/163	Emissions Unit Numerator	TON (for annual estimates), LB (for average seasonal weekday estimates)
164/165	Emissions Type	30 (for annual), 27 (average weekday)
166/170	EM Reliability Indicator	(Left blank)
171/174	Submittal Flag	(Left blank)
175/177	Tribal Code	000

A note about the travel model link-based counties: As a part of converting the EIs to NIF format, the emissions and VMT estimates were re-categorized from travel model network functional class scheme to HPMS functional class scheme. For each county, the seasonal weekday and annual VMT and emissions totals (from emissions TAB file output) were re-allocated to the NIF HPMS categories using VMT distributions from the latest available county HPMS data set (2004 historical HPMS data from TxDOT RIFCREC report).

Section 5 – Truck Idling Emissions

5.1: Introduction

AACOG is in charge of identifying air pollutant sources in the region and collecting data on the volume of emissions that these sources release into the environment. This task, which is referred to as an "Emissions Inventory", requires periodic updates and its results are essential elements of the photochemical modeling process. In the past, emission data from truck stops has not been included in the emission inventory, but due to increases in truck traffic on IH-35 and the intention of air quality planners to identify emissions from all possible sources, the emission inventory of truck stops is a necessity.

In this regard, the Texas Commission on Environmental Quality (TCEQ) in an interagency contract with the Texas Transportation Institute (TTI) conducted phase 1 of a statewide study on the magnitude of emissions from heavy-duty truck idling in 2003. The report attempted to give an account of the heavy-duty (long-haul) truck population that uses truck stops and examined various methodologies to calculate the truck idling emission factors[1]. This report paved the way for the second TCEQ report prepared by the Eastern Research Group Inc., which provided annual truck idling emission estimates for the base year 2004 through 2030 on a county-based level.[2]

The latter study expanded the truck stop database by determining their locations and capacities and calculating existing and future emissions. In the following pages, this report will be frequently mentioned as the primary source of methodology for calculating truck idling emissions in the San Antonio region.

5.1.1: Background

The trucking industry is a major part of North America's economy, transporting over 80% of the nations goods, and it is growing rapidly.[3] The population of large trucks is estimated at 4.2 million, 1.3 million of which are "long haul" trucks equipped with sleeper cabs and powered by diesel engines.[4]

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[1] TTI, Aug. 2003. HDDV Idling Activity and Emissions, Study: Phase 1, Study Design and Estimation of Magnitude of the Problem. TCEQ. Austin, Texas.

[2] Eastern Research Group, Inc., Cambridge Systematics, Inc., and Alliance Transportation Group, Inc., August 31, 2004. Heavy-Duty Vehicle Idle Activity and Emissions Characterization Study, Final Report. TCEQ. Austin,Texas. Available online: http://www.tceq.state.tx.us/assets/public/implementation/air/am/contracts/reports/mob/HDDV_Idle_Activity_and_EI_Phase2-tti.pdf

[3] IdleAire Technologies Corp., August 2007. Diesel Idling and the IdleAire Solution Fact Sheet. Available online: http://www.idleaire.com/files/newsroom/Diesel%20Idling%20Fact%20Sheet.pdf

[4] *Ibid.*

As Table 5-1 indicates, Mexican domiciled truck traffic has increased by 41% between 1995 and 2006. The sudden increase in truck traffic in 1999, as compared to 1995 is due to the impacts of the North American Free Trade Agreement (NAFTA).

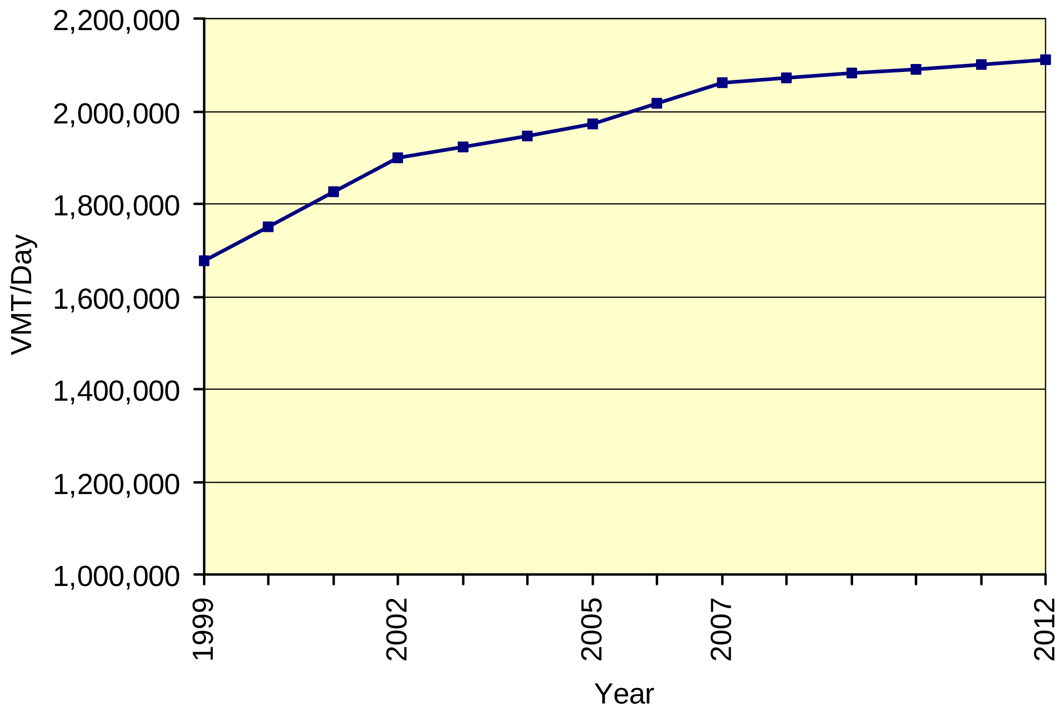
A comparison of 1999 and 2007 county-based on-road emission files, prepared by the Texas Transportation Institute (TTI), indicated a 23% increase in "long haul" truck traffic in Bexar County for the year 2007. As depicted in Figure 5-1, TTI's projection of daily vehicle miles traveled (VMT) on long haul trucks in Bexar County indicates a steadily increasing trend in coming years.

Table 5-1: Historical Data on Incoming Trucks by Port of Entry in Texas, 1995-2005[5]

Port	1995	1999	2004	2005	2006	1995-2006 Period Change
Brownsville	223,689	303,540	226,289	234,640	243,116	8%
Del Rio	37,431	58,843	64,061	64,075	65,487	43%
Eagle Pass	53,026	101,140	100,100	97,729	97,567	46%
El Paso	606,742	673,003	719,545	740,654	744,951	19%
Hidalgo	177,459	325,225	454,351	491,077	457,825	61%
Laredo	747,241	1,486,489	1,391,850	1,455,607	1,518,989	51%
Presidio	4,328	8,848	7,433	5,763	6,306	31%
Progreso	20,838	16,617	23,064	23,807	31,533	34%
Rio Grande City	12,668	20,832	40,815	46,308	42,435	70%
Roma	11,300	16,522	8,510	8,345	8,502	-33%
Total	1,894,722	3,011,059	3,036,018	3,168,005	3,216,711	41%

[5] Bureau of Transportation Statistics, Aug. 2006. Border Crossing: Border Crossing/Entry Data: Trucks. Washington D.C. Available online: http://www.bts.gov

Figure 5-1: Daily VMT Trend for Long Haul Trucks in Bexar County[6]



The Department of Transportation requires that drivers rest 10 hours for every 14 hours of driving. [7] Interstate 35, Interstate 10, and other major highways, converge in San Antonio so drivers frequently use truck stops in the San Antonio area to comply with mandatory rest breaks. It is not uncommon for truck drivers to idle their engines throughout their rest periods to provide electricity for cooling and heating their cabins, or to keep their engine fluids warm[8]. This extended idling consumes fuel, creates air and noise pollution, and is an inefficient use of the nation's energy supply. According to an estimate by the EPA, each year in the U.S., trucks consume more than 800 million gallons of diesel fuel while stationary[9].

Because of San Antonio's near non-attainment status, the importance of assessing idling emissions from heavy-duty diesel trucks is evident. This assessment should provide key information on the impact of increased truck traffic and various idle reduction policies. The goal of this report is to

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[6] TTI, Aug. 2003. San Antonio Metropolitan Statistical Area On-road Mobile Source, Emission Inventories for 1995,1999, 2002, 2005, 2007, and 2012. College Station, Texas.

[7] Department of Transportation Federal Motor Car Safety Administration, August 2005. Summary of New Hours of Service Regulations Effective October 1, 2005. Washington D.C. Available online: http://www.fmcsa.dot.gov/rules-regulations/topics/hos/HOS-2005.htm

[8] EPA, January 2004. Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity. Research Triangle Park, North Carolina. p. 2. Available online: http://www.epa.gov/otaq/smartway/documents/420b04001.pdf

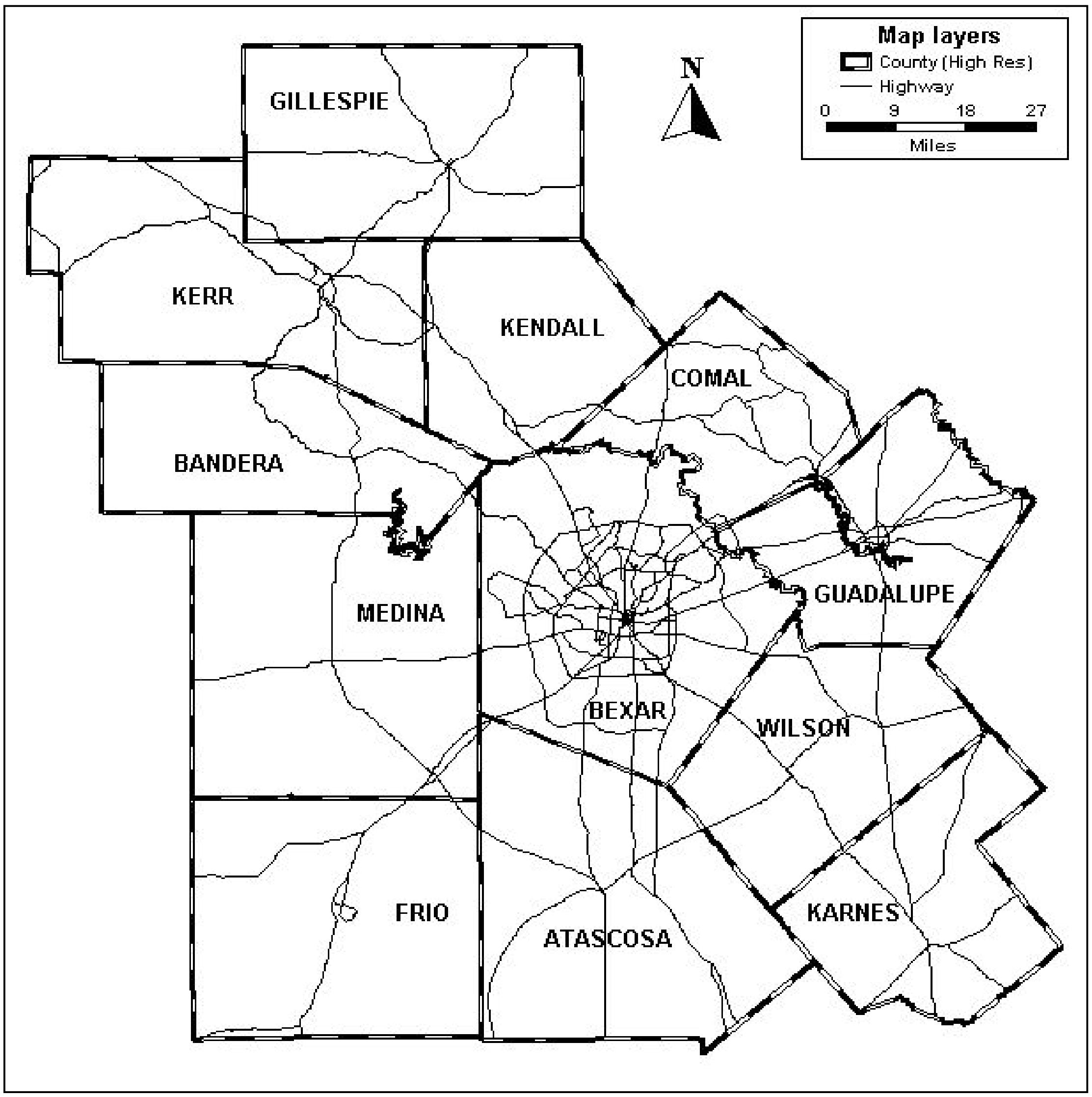
[9] U.S. Department of Energy, January 2006. Clean Cities Idle Reduction website: http://www.eere.energy.gov/cleancities/idle/

establish a foundation for assessment of emissions at local truck stops and their inclusion in the San Antonio emission inventory database.

5.1.2: Definition of Study Area

The AACOG region, shown in Figure 5-2, encompasses 12 counties, which include Bexar, the most populous county of the region, and the 11 surrounding counties of Atascosa, Bandera, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina and Wilson. The emission inventory developed for this report includes all 12 AACOG counties.

Figure 5-2: AACOG 12-County Region Encompassing the Study Area



Plot Date: August 20, 2007
Map Compilation: August 24, 2004
Source: 2000 TIGER files

5.1.3: Definition of Heavy-Duty Trucks Included in this Study

The focus of this report is an analysis of engine idling practices by long-haul truck drivers and an estimation of emissions due to idling engines during resting periods. Long-haul trucks are classified as heavy-duty diesel vehicles (HDDV) and further subdivided into HDDV8a and HDDV8b types in EPA's MOBILE6 model environment[10]. The Class 8a vehicles weigh between 33,001 to 60,000 lbs, and the Class 8b vehicles weigh over 60,000 lbs.

Drivers typically idle their trucks' engines at the following locations:

- Truck stops
- Rest Areas/Picnic Areas
- Drop off and pick-up areas at distribution centers

In the course of this study, attempts were made to locate truck stops, rest areas, picnic areas, and major goods distribution centers in the San Antonio area and determine whether rules had been implemented to restrict truck idling at those places.

5.2: Methodology

Information on numbers and locations of rest areas in the San Antonio region were obtained from TxDOT's Maintenance Division[11]. In addition to the TxDOT list, truck stop data was collected from Yahoo yellow pages, trucking industry web pages, facility managers, and TTI and ERG reports. Combined, these sources provided other necessary information as well, such as parking capacity, idling rate, and utilization rate, for analysis of HDDV idling. According to the ERG, "there is no single comprehensive list of truck stops available for Texas" and, subsequently, for the San Antonio region. The ERG report continued the explanation by stating:

> "For example, the industry trade association, the National Association of Truck Stop Operators (NATSO) website only lists 74 sites, primarily from large chain operations. Other "trucker oriented" websites typically list between 50 and 300 locations across the state. In fact, it is likely that a complete list cannot be compiled from public sources such as the Internet, as certain sites may not advertise at all using standard media methods."[12]

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[10] EPA, January 2004.Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity (EPA420-B-04-001). Research Triangle Park, North Carolina. Available online: http://www.epa.gov/otaq/smartway/documents/420b04001.pdf

[11] TxDOT Expressway, Facility Location Map, online: http://www.dot.state.tx.us/mnt/sra/map.htm

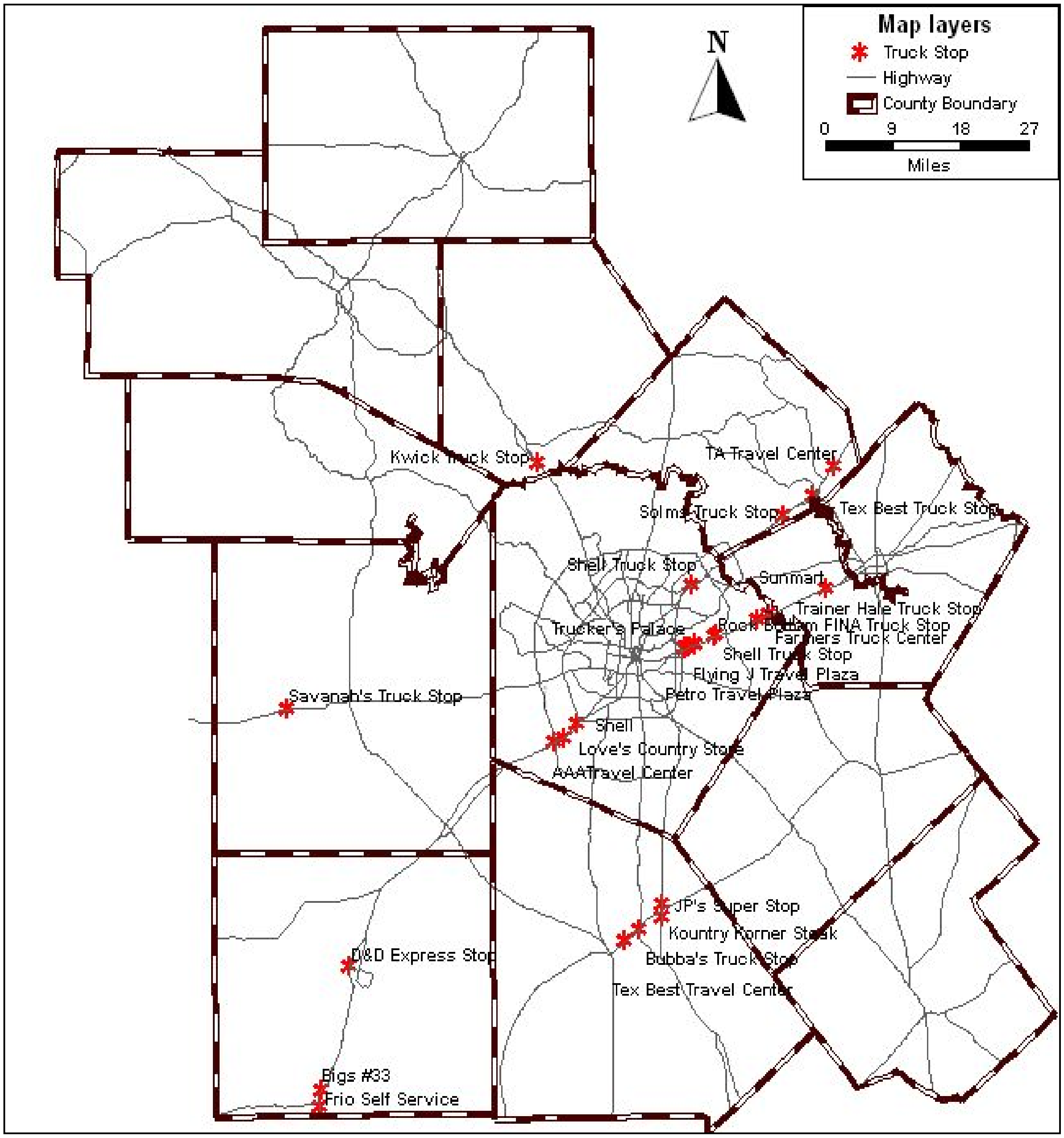
[12] Eastern Research Group, Inc., Cambridge Systematics, Inc., and Alliance Transportation Group, Inc., August 31, 2004. Heavy-Duty Vehicle Idle Activity and Emissions Characterization Study: Final Report. TCEQ. Austin, Texas. Available online: http://www.tceq.state.tx.us/assets/public/implementation/air/am/contracts/reports/mob/HDDV_Idle_Activity_and_EI_Phase2-tti.pdf

A random sampling of distribution centers in the San Antonio region was taken and the managers of the facilities contacted to gain information about idling practices at their facility. Distribution centers to be contacted were chosen from participants in the EPA SmartWay Transport Partnership program and the Yahoo yellow pages. Information about idling practices at these facilities was applied to other known distribution centers in the AACOG 12-county region.

5.2.1: Locations of Truck Stops

AACOG staff compared information collected from the sources mentioned above to develop a geographic dataset of regional truck stops using TransCAD software. Regional aerial images were also used to verify the accuracy of location information and determine the number of available parking spaces. Assigning geographic coordinates to the truck stops facilitated the development of a visual tool for analyzing their dispersion throughout the region as well as the creation of a grid-based input file for use in the photochemical model. As indicated in Figure 5-3, the truck stops are primarily clustered in the eastern section of the region, off IH-10. However, comparison of collected data indicated that the parking capacity of existing truck stops located off IH-35 has increased recently, and as the truck traffic increases on IH-35, an increase in the number of truck stops, and/or their parking capacity, should be expected.

Figure 5-3: Locations of Truck Stops in the AACOG 12-County Region



Plot Date: September 11, 2006
Map Compilation: June 24, 2006
Source: Yahoo Yellow Pages, truck industry websites, aerial images, 2000 TIGER files

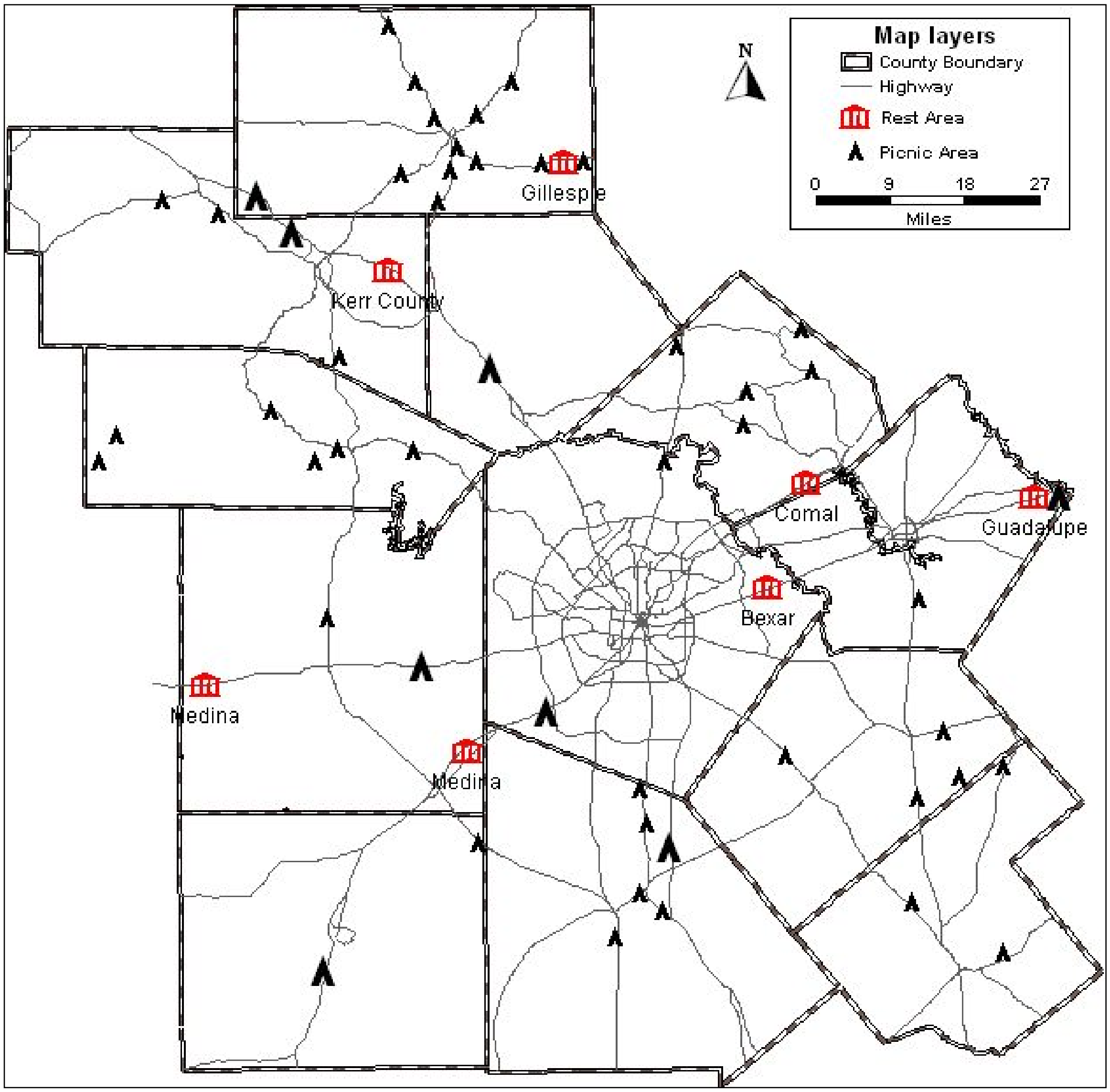
5.2.2: Locations of Rest/Picnic Areas

TxDOT was contacted for information on the location of rest areas and to answer questions about newly built or renovated facilities in the AACOG region. An official Texas Travel Map was also acquired to locate regional picnic areas. TxDOT is sponsoring a program whereby modern safety rest areas are being built to encourage drivers to stop more frequently. These facilities help drivers fight driving-related fatigue, which is a major cause of serious accidents: “The new safety rest areas feature many elements to enhance traveler comfort and safety, such as security systems, expanded truck parking areas, updated restroom facilities, sheltered picnic areas and walking paths.”[13]

The geographic database was updated with information collected on rest areas in the region using TransCAD software. This step also facilitated the development of a grid-based input file of rest/picnic areas for use in the regional photochemical model. Figure 5-4 indicates the locations of rest areas and picnic areas in the San Antonio region. Truck drivers frequently use picnic areas alongside major freeways for their mandatory rest periods. These picnic areas, shown in larger print on the map, are included in the calculation of emissions from truck idling.

[13] TxDOT, 2007, Safety Rest Areas. Available online: http://www.dot.state.tx.us/services/maintenance/rest_areas.htm

Figure 5-4: Locations of Rest/Picnic Areas in the AACOG 12-County Region



Plot Date: September 11, 2006
Map Compilation: June 24, 2006
Source: Texas official travel map, aerial images, 2000 TIGER files

5.2.3: Locations of Distribution Centers

A random sample of area distribution centers was compiled, and the facility managers contacted, to determine HDDV idling activities in the AACOG region. The sample distribution centers were chosen using the EPA SmartWay Partners database and the Yahoo Yellow Pages. A list of the chosen companies and their idling policies is located in Table 5-10.

All of the contacted companies had either a "no-idling" or a short-term only idling policy in place at their facilities. From the results of this sampling it was assumed that other distribution centers in the AACOG area maintained similar policies, therefore idling emissions from these types of facilities would be zero and the locations would not need to be recorded.

5.2.4: Methodology for Calculating HDDV Idling Emissions at Truck Stops

The Texas Commission on Environmental Quality (TCEQ), in an interagency contract with the Texas Transportation Institute (TTI), conducted phase 1 of a statewide study on the magnitude of emissions from truck idling in 2003. The intent of the study was to develop an inventory of the truck population and examine various methodologies to calculate truck idling emission factors[14]. This report paved the way for the second report prepared by the Eastern Research Group Inc., which gave an account of annual truck idling emission estimates for the base year 2004 through 2030 on a county-based level.

AACOG staff reviewed these TCEQ reports and existing EPA literature in preparation for determining a methodology to calculate emissions from truck idling in the 12-county AACOG region. These various sources were evaluated and comparisons were made to approaches that TTI and ERG had used in their analysis of HDDV idling. The following steps were selected:

Step 1: Determine the historic idling activity at truck parking spaces involved in the project.[15]

After locating the truck stops in the study area, temporal data on occupancy rate and idling rate were needed. For this purpose, the field observations that ERG's subcontractors, Alliance Transportation Group[16] (ATG) made were used. ATG visited the majority of the truck stop locations

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[14] TTI, Aug. 2003. HDDV Idling Activity and Emissions, Study: Phase 1, Study Design and Estimation of Magnitude of the Problem. TCEQ. Austin, Texas. Available online: http://www.tceq.state.tx.us/assets/public/implementation/air/am/contracts/reports/mob/HDDV_Idle_Activity_and_EI_Phase1-tti.pdf

[15] EPA, January 2004. Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity (EPA420-B-04-001), Research Triangle Park, North Carolina. Available online: http://www.epa.gov/otaq/smartway/documents/420b04001.pdf

[16] Eastern Research Group, Inc., Cambridge Systematics, Inc., Alliance Transportation Group, Inc., August 31, 2004. Heavy-Duty Vehicle Idle Activity and Emissions Characterization Study: Final Report. TCEQ. Austin, Texas. Available online:

that are included in this report, and interviewed the facility managers of the truck stops that were not visited, to compile information on idling and utility rates for the following time divisions:

- 9 am to 4 pm
- 4 pm to 9 pm
- 9 pm to 6 am
- 6 am to 9 am

Step 2: Select the emission factor for the criteria air pollutant or precursor.[17]

The EPA-recommended NOx emission factor for Class 8 truck idling is 135 grams per hour. The VOC emission factor of 42.30 grams per hour was derived from a calculation that Chris Kite of TCEQ developed based on the results[18] of testing exhaust emissions, at both low and high engine speeds, from five Class 8 trucks. The exhaust emissions were tested under three conditions:

- Heat in cabin with 0 degree Fahrenheit ambient temperature (-18 Celsius)
- Air conditioning (AC) in cabin with 90 degree Fahrenheit ambient temperature (32 Celsius)
- No heat or air conditioning in cabin with 64 degree Fahrenheit ambient temperature (18 Celsius)

For application in Texas during ozone season, Chris extracted the "with AC" emissions only and averaged them to come up with an extended idling VOC emission rate of 42.3 grams per hour.[19] These emissions factors were used to calculate the emissions from HDDV idling.

Step 3: Calculate occupancy and idling rates

Idling rates per parking space are the product of occupancy per parking space and hours of idling per truck. The ERG, after statistically testing the collected data, determined that "occupancy rates for parking spaces are highest in the late night and lowest during the middle of the day. The percentage of trucks idling per parking space is approximately 60 percent and this percentage is

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http://www.tceq.state.tx.us/assets/public/implementation/air/am/contracts/reports/mob/HDDV_Idle_Activity_and_EI_Phase2-tti.pdf

[17] EPA, January 2004. Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity (EPA420-B-04-001), Research Triangle Park, North Carolina. Available online: http://www.epa.gov/otaq/smartway/documents/420b04001.pdf

[18] Storey, J., Thomas, J.F., Lewis, S.A., Dam, T.Q., Edwards, K.D., 2003. Particulate Matter and Aldehyde Emissions from Idling Heavy-Duty Diesel Trucks (SAE Paper 2003-01-0289). Society of Automotive Engineers, Inc. Troy, Michigan. Available online: http://www.cleancitiessacramento.org/Pages/idle_reduction_files/pmteststudy.pdf

[19] Chris Kite. TCEQ. (email, September 13, 2006)

roughly flat throughout the day. However, the high occupancy rates of the evening and late night periods results in higher idling rates per parking space during these time periods."[20]

Further expansion of the collected data revealed that there was no statistically significant difference between a weekday and a weekend day for per parking space idling rate. In addition, a statistical test suggested that the collected data should be organized into the following three time periods instead of the original four time periods to better depict the real world.

- Morning (5 a.m. – 10 a.m.)
- Daytime (10 a.m. – 10 p.m.)
- Evening/Night (10 p.m. – 5 a.m.)

To calculate the hours per parking space idling time for the San Antonio region, the summer idling rate was multiplied by the number of hours per time period. Results of the hours per parking space calculations are shown in Table 5-2. Summer idling rates were used to represent truck idling practices during the peak ozone season.

Table 5-2: Summer Time per Parking Space Idling Rates in San Antonio Region

Time Period	Number of Hours	Summer Idling Rate	Hours per Parking Space
Daytime	12	16.4%	2.0
Morning	5	37.4%	1.9
Eve/Night	7	54.3%	3.8

Step 4: Multiply the emission factor in Step 2 by the number of hours per time period, idling rate, and parking capacity to calculate periodical and daily emissions.

The time-of-day idling rates, shown in Table 5-2, were used to calculate the periodic NOx and VOC emissions for each facility. The results were converted into tons per day. For this report the following equation was used:

Emissions (tons/period) = (EF x H x R x C) / 907,184 g/ton

[20] Eastern Research Group, Inc., Cambridge Systematics, Inc., Alliance Transportation Group, Inc., August 31, 2004. Heavy-Duty Vehicle Idle Activity and Emissions Characterization Study: Final Report. TCEQ. Austin, Texas. Available online: http://www.tceq.state.tx.us/assets/public/implementation/air/am/contracts/reports/mob/HDDV_Idle_Activity_and_EI_Phase2-tti.pdf

Where: EF = Emission factor (VOC 42.3 g/hr and NOx 135 g/hr)
H = Number of hours per period (from Table 5-2)
R = Idling rate (from Table 5-2)
C = Parking capacity for trucks (from Table 5-3)

Daytime NOx emissions for the Petro Travel Plaza with 250 parking spaces:

Daytime NOx Emissions = (135 g/hr x 12 h/period x 0.164 x 250) / 907,184 g/ton
= 0.07 tons of NOx/period

Step 5: *Sum all emissions for the project.*

Table 5-3 provides a summation of time-of-day NOx emissions from HDDV idling at each truck stop in the San Antonio area. Table 5-4 provides a summation of time-of-day VOC emissions from HDDV idling at each truck stop in the San Antonio area.

5.2.5: Methodology for Calculating Idling Emissions for HDDV at Rest/Picnic Areas

Longer mandatory resting times for truck drivers and construction of new rest areas with designated truck parking spaces and better amenities, such as air conditioned TV rooms and wireless Internet access, have made rest/picnic areas suitable resting places for long-haul truckers. Therefore, these areas must be included in the emission inventory.

A field survey of picnic/rest areas is the best method of acquiring accurate information on temporal utility rates and idling patterns. Due to a lack of resources for conducting in depth field observations and surveys, the utility rates used for truck stops was applied to calculate emissions from idling trucks at rest/picnic areas.

AACOG staff contacted TxDOT to acquire information on location and capacity of the state-owned picnic and rest areas in the region. Aerial images, as well as a limited field observation, were used to estimate available parking spaces. The rest areas in Bexar, Comal, Guadalupe, Kerr, Gillespie, and Medina counties and the picnic areas alongside major freeways were included in the emission calculations. For the picnic areas, the length of exit roadways were measured to estimate the number of trucks that could be parked parallel to the freeway main lanes at a safe distance from the freeway and each other. The eight picnic areas included in this study are shown in Figure 5-4 in larger print. The other picnic areas shown in Figure 5-4 are not on major truck routes and are not likely to be used extensively by truck drivers.

The remainder of the steps used to estimate rest/picnic area idling emissions was similar to the methodology for calculating emissions from idling trucks at truck stops.

Step 1: Determine the idling activity associated at truck parking spaces involved in the project.

After locating the rest/picnic areas in the region, temporal data on occupancy rate and idling rate were needed. For this purpose, AACOG staff assumed that the same time-of-day idling patterns at truck stops are repeated at the rest area facilities.

Table 5-3: 2006 Average Summer Day NOx Emissions at Truck Stops in the San Antonio Region

Facility	Address	Parking Spaces*	Morning (Ton)	Daytime (Ton)	Night (Ton)	Total Ton/day
Petro Travel Plaza	1112 Ackerman Rd, San Antonio	250	0.070	0.073	0.141	0.284
Farmers Truck Center	Exit 591,Converse, 78109	50	0.014	0.015	0.028	0.057
Pilot Travel Center	5619 IH 10 E, San Antonio,	50	0.014	0.015	0.028	0.057
TA Travel Center	6170 IH 10 E, San Antonio	198	0.055	0.058	0.112	0.225
Trainer Hale Truck Stop	14462 IH 10, Converse	15	0.004	0.004	0.008	0.017
Rock Bottom FINA	I-10 E, EXIT 585, Converse	53	0.015	0.016	0.030	0.060
Flying J Travel Plaza	1815 Foster Rd., San Antonio	228	0.063	0.067	0.129	0.259
Trucker's Palace	5855 IH 10 E, San Antonio	60	0.017	0.018	0.034	0.068
Shell Truck Stop	8755 IH 10 E, Converse	50	0.014	0.015	0.028	0.057
Shell Truck Stop	11607 N IH 35, San Antonio	27	0.008	0.008	0.015	0.031
Love's Country Store	11361 IH- 35, S Von Ormy	75	0.021	0.022	0.042	0.085
Shell	13575 IH 35, Von Ormy	28	0.008	0.008	0.016	0.032
AAA Travel Center	14555 IH 35, Von Ormy, 78073	57	0.016	0.017	0.032	0.065
Tex Best Travel Center Incorporated	20290 IH 37, Elmendorf	12	0.003	0.004	0.007	0.014
Solms Truck Stop	I-35, New Braunfels	5	0.001	0.001	0.003	0.006
TA Truck Stop	Conrads Rd / I-35, New Braunfels	123	0.034	0.036	0.070	0.140
Sunmart	Seguin	23	0.006	0.007	0.013	0.026
Bubba's Truck Stop	Pleasanton	20	0.006	0.006	0.011	0.023
D&D Express Stop	I-35 Exit 101, Pearsall	50	0.014	0.015	0.028	0.057
Bigs #33	Dilly	14	0.004	0.004	0.008	0.016
Frio Self Service	Dilly	18	0.005	0.005	0.010	0.020
Kuntry Korner Steak & Eggs	I-37 Exit 104, Pleasanton	50	0.014	0.015	0.028	0.057
JP's Super Stop	I-37 Exit 109, Pleasanton	24	0.007	0.007	0.014	0.027
Savannah’s Truck Stop	C.R 411 & US HWY 90, D'Hanis	5	0.001	0.001	0.003	0.006
Kwik Truck Stop	Boerne	11	0.003	0.003	0.006	0.013
Tex Best	New Braunfels	13	0.004	0.004	0.007	0.015
Total		1,509	0.420	0.442	0.854	1.715

*Data on number of parking spaces were collected by means of studying aerial images, phoning the managers, and using the Internet and published reports.

Table 5-4: 2006 Average Summer Day VOC Emissions at Truck Stops in the San Antonio Region

Facility	Address	Parking Spaces*	Morning (Ton)	Daytime (Ton)	Night (Ton)	Total Ton/day
Petro Travel Plaza	1112 Ackerman Rd, San Antonio	250	0.022	0.023	0.044	0.089
Farmers Truck Center	Exit 591,Converse, 78109	50	0.004	0.005	0.009	0.018
Pilot Travel Center	5619 IH 10 E, San Antonio,	50	0.004	0.005	0.009	0.018
Travel Centers of America	6170 IH 10 E, San Antonio	198	0.017	0.018	0.035	0.071
Trainer Hale Truck Stop	14462 IH 10, Converse	15	0.001	0.001	0.003	0.005
Rock Bottom FINA	I-10 E, EXIT 585, Converse	53	0.005	0.005	0.009	0.019
Flying J Travel Plaza	1815 Foster Rd., San Antonio	228	0.020	0.021	0.040	0.081
Trucker's Palace	5855 IH 10 E, San Antonio	60	0.005	0.006	0.011	0.021
Shell Truck Stop	8755 IH 10 E, Converse	50	0.004	0.005	0.009	0.018
Shell Truck Stop	11607 N IH 35, San Antonio	27	0.002	0.002	0.005	0.010
Love's Country Store	11361 IH- 35, S Von Ormy	75	0.007	0.007	0.013	0.027
Shell	13575 IH 35, Von Ormy	28	0.002	0.003	0.005	0.010
AAA Travel Center	14555 IH 35, Von Ormy, 78073	57	0.005	0.005	0.010	0.020
Tex Best Travel Center Incorporated	20290 IH 37, Elmendorf	12	0.001	0.001	0.002	0.004
Solms Truck Stop	I-35, New Braunfels	5	0.000	0.001	0.001	0.002
TA Truck Stop	Conrads Rd / I-35, New Braunfels	123	0.011	0.011	0.022	0.044
Sunmart	Seguin	23	0.002	0.002	0.004	0.008
Bubba's Truck Stop	Pleasanton	20	0.002	0.002	0.004	0.007
D&D Express Stop	I-35 Exit 101, Pearsall	50	0.004	0.005	0.009	0.018
Bigs #33	Dilly	14	0.001	0.001	0.002	0.005
Frio Self Service	Dilly	18	0.002	0.002	0.003	0.006
Kuntry Korner Steak & Eggs	I-37 Exit 104, Pleasanton	50	0.004	0.005	0.009	0.018
JP's Super Stop	I-37 Exit 109, Pleasanton	24	0.002	0.002	0.004	0.009
Savannah's Truck Stop	C.R 411 & US HWY 90, D'Hanis	5	0.000	0.001	0.001	0.002
Kwik Truck Stop	Boerne	11	0.001	0.001	0.002	0.004
Tex Best	New Braunfels	13	0.001	0.001	0.002	0.005
Total		1,509	0.132	0.138	0.267	0.537

*Data on number of parking spaces were collected by means of studying aerial images, phoning the managers, and using the Internet and published reports.

Step 2: Select the emission factor for the criteria air pollutant or precursor.[21]

The EPA-recommended NOx emission factor for Class 8 truck idling is 135 grams per hour. For this report, this EF and a 42.3-grams/hour VOC factor were used in the final emission calculation step.

Step 3: Calculate occupancy and idling rates

The summer per parking space idling rates from Table 5-2 were used to calculate the emissions at rest areas and the eight picnic areas included in this study.

Step 4: Multiply the emission factors in Step 2 by the number of hours per period, idling rate, and parking capacity to calculate periodic and daily emissions.

The equation from step 4, in section 5.2.4, was used to calculate HHDV idling emissions at rest/picnic areas. The idling rate and number of hours per period were from Table 5-2. The parking capacity of rest areas is shown in Table 5-6 and for picnic areas is shown in Tables 5-7. The calculation results are converted into tons per period. A sample calculation for determining daily idling emissions at individual rest/picnic areas is shown below.

Daytime NOx emissions at a Guadalupe County rest area with 81 truck-designated parking spaces:

Daytime NOx Emissions = 135 g/hr x 12 hr/period x 0.164 x 81 / 907,184 g/ton
= 0.023 tons/period

Step 5: Sum all emissions for the project.

Table 5-5 provides a summation of time-of-day NOx emissions from HDDV idling at each rest area in the ACCOG 12-county region. Table 5-6 provides a summation of time-of-day NOx emissions from HDDV idling at each picnic area included in this study. Time-of-day VOC emissions for rest areas are shown in Table 5-7, while Table 5-8 displays the picnic areas VOC emissions.

[21] EPA, January 2004. Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/otaq/smartway/documents/420b04001.pdf

Table 5-5: Average Summer Day NOx Emissions at Rest Areas in San Antonio

Rest Area	Truck Designated Parking Spaces	Morning tons	Daytime tons	Night tons	Total tons/day
Bexar County Eastbound	20	0.006	0.006	0.011	0.023
Bexar County Westbound	20	0.006	0.006	0.011	0.023
Comal County Northbound	12	0.003	0.004	0.007	0.014
Comal County Southbound	12	0.003	0.004	0.007	0.014
Guadalupe County Eastbound	42	0.012	0.012	0.024	0.048
Guadalupe County Westbound	39	0.011	0.011	0.022	0.044
Kerr County Eastbound	18	0.005	0.005	0.010	0.020
Kerr County Westbound	18	0.005	0.005	0.010	0.020
Medina County Northbound - IH 35	13	0.004	0.004	0.007	0.015
Medina County Southbound - IH 35	18	0.005	0.005	0.010	0.020
Medina County New Facility	28	0.007	0.007	0.014	0.027
Gillespie County Burg site	8	0.002	0.002	0.005	0.009
Gillespie County Trinity site	8	0.002	0.002	0.005	0.009
Total	252	0.070	0.074	0.143	0.290

Table 5-6: Average Summer Day NOx Emissions at Picnic Areas in San Antonio

County	Number of Picnic Areas Included in Study	Estimated Spaces	Morning tons	Daytime tons	Night tons	Total tons/day
Bexar	1	26	0.007	0.008	0.015	0.030
Medina	1	6	0.002	0.002	0.003	0.007
Kerr	1	7	0.002	0.002	0.004	0.008
Frio	1	32	0.009	0.009	0.018	0.036
Atascosa	1	28	0.008	0.008	0.016	0.032
Guadalupe	1	32	0.009	0.009	0.018	0.036
Kendal	1	28	0.008	0.008	0.016	0.032
Gillespie	1	14	0.004	0.004	0.008	0.016
Total	8	173	0.048	0.051	0.098	0.197

Table 5-7: Average Summer Day VOC Emissions at Rest Areas in San Antonio

Rest Area	Truck Designated Parking Spaces	Morning tons	Daytime tons	Night tons	Total tons/day
Bexar County Eastbound	20	0.002	0.002	0.004	0.007
Bexar County Westbound	20	0.002	0.002	0.004	0.007

Comal County Northbound	12	0.001	0.001	0.002	0.004
Comal County Southbound	12	0.001	0.001	0.002	0.004
Guadalupe County Eastbound	42	0.004	0.004	0.007	0.015
Guadalupe County Westbound	39	0.003	0.004	0.007	0.014
Kerr County Eastbound	18	0.002	0.002	0.003	0.006
Kerr County Westbound	18	0.002	0.002	0.003	0.006
Medina County Northbound - IH 35	13	0.001	0.001	0.002	0.005
Medina County Southbound - IH 35	18	0.002	0.002	0.003	0.006
Medina County New Facility	28	0.002	0.002	0.004	0.009
Gillespie County Burg site	8	0.001	0.001	0.001	0.003
Gillespie County Trinity site	8	0.001	0.001	0.001	0.003
Total	252	0.022	0.023	0.045	0.089

Table 5-8: Average Summer Day VOC Emissions at Picnic Areas in San Antonio

County	Number of Picnic Areas Included in Study	Estimated Spaces	Morning (tons)	Daytime (tons)	Nighttime Tons)	Total (tons/day)
Bexar	1	26	0.002	0.002	0.005	0.009
Medina	1	6	0.001	0.001	0.001	0.002
Kerr	1	7	0.001	0.001	0.001	0.002
Frio	1	32	0.003	0.003	0.006	0.011
Atascosa	1	28	0.002	0.003	0.005	0.010
Guadalupe	1	32	0.003	0.003	0.006	0.011
Kendal	1	28	0.002	0.003	0.005	0.010
Gillespie	1	14	0.001	0.001	0.002	0.005
Total	8	173	0.015	0.016	0.031	0.062

5.2.6: Methodology for Calculating Idling Emissions for HDDV at Distribution Centers

AACOG staff examined truck idling emissions during cargo pick up and drop off activities using the steps described below:

Step 1: Compile a list of fleet owners in the study area.

Distribution centers located in the region were identified from participants in the EPA SmartWay Transport Partnership program[22] and the Yahoo local yellow pages.

[22] EPA, August 2007. SmartWay Transport Partnership. Available online: http://www.epa.gov/otaq/smartway/partners.htm

Step 2: Interview transportation managers via telephone to acquire idling activity rates.

A random sampling was taken of the distribution centers identified in the San Antonio area and the managers of the facilities were contacted to gain information about idling practices at their facility. A series of questions were asked in regards to companies' existing idling policies and measures taken to ensure implementation and enforcement of these policies. Table 5-9 lists the fleet owners that were contacted by phone regarding idling policies. Information about idling practices at these facilities was applied to other known distribution centers in the AACOG 12-county region.

Table 5-9: List of Contacted Fleet Owners in the San Antonio Region

Company	Allow Extended Idling	Max. Time Allowed
UPS	No	5 Minutes
FedEx	No	5 Minutes
Home Depot	No	5 Minutes
Wal-Mart Stores, Inc.	No	5 Minutes
Walgreens	No	5 Minutes
Lowe's	No	5 Minutes
Big Red Bottling Company of San Antonio	No	5 Minutes
Integrity Delivery Services	No	15 Minutes
Lack's Distribution Center	No	5 Minutes
Frito-Lay Inc.	No	5 Minutes
Delivery Made Simple	No	5 Minutes
Lackland AFB	No	5 Minutes
Big Red Bottling Company	No	5 Minutes
Randolph AFB	No	5 Minutes

With the exception of two companies, Integrity Delivery Services and Delivery Made Simple, all of the contacted businesses stated they have a no-idling policy in effect and each of their drivers is trained to turn the engine off at arrival to the facility. In addition, supervisors at the facilities are responsible for enforcing the no-idling policy as soon as vehicles are properly parked. The contact person at Big Red Bottling Company of San Antonio stated that the company's new trucks are equipped with devices that automatically shut off the truck engine if the idling duration is longer than 10 minutes. Integrity Delivery Services and Delivery Made Simple do not have any idling restriction policies in effect, but their drivers do not practice extended idling.

Step 3: Determine the length of allowable idling and the amount of emissions due to idling.

The maximum time trucks were allowed to idle at any of the distribution centers contacted by staff was 15 minutes. This amount of time is not considered extended idling according to the EPA definition:

"For the purpose of this guidance, long duration idling is the operation of the truck's propulsion engine when not engaged in gear for a period greater than 15 consecutive minutes, except when associated with routine stoppages due to traffic movement or congestion." [23]

Any length of idling below 15 minutes is considered short term idling and is included as part of the HDDV drive cycle in the MOBILE6 emission estimates. This was verified in a telephone conversation with Dr. Perkinson of TTI during the course of data collection for this report. The emissions due to the short term idling are included in the total on-road emissions that are calculated by TTI for the San Antonio region.

Some fleet owners in the San Antonio region have an agreement with the EPA to restrict extended idling or enforce a no-idling policy at their distribution centers as part of their everyday business practice. This implemented policy was to satisfy the goals of an EPA sponsored program called the SmartWay Transport Partnership. "The SmartWay Transport Partnership is a voluntary collaboration between the U.S. EPA and the freight industry designed to increase energy efficiency while significantly reducing greenhouse gases and air pollution." [24] Today more than 400 partners participate in the SmartWay program, of which the following 38 companies are based in Texas: [25]

1.	AJ Saragusa Trucking Company Inc.	Houston, TX
2.	American Eagle Lines	Dallas, TX
3.	Andrews Logistics Inc.	Irvine, TX
4.	Barnett's Trucking, Inc.	Lyford, TX
5.	Bilbo Transports, Inc.	Irving, TX
6.	Bright Transportation, L.P.	Dallas, TX
7.	Cemex, Inc. dbaSunwest Trucking	Houston, TX
8.	Central Freight Lines	Waco, TX
9.	Dell, Inc.	Round Rock, TX
10.	Eagle Global Logistics	Houston, TX
11.	Excargo Services	Houston, TX
12.	FFE Transportation Services, Inc.	Lancaster, TX

[23] EPA. January 2004. Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/otaq/smartway/documents/420b04001.pdf
[24] EPA. August 2006. SmartWay Transportation Partnership. Available online: http://www.epa.gov/smartway/
[25] EPA. August 2007. SmartWay Transport Partners Located in Region 6. Available online: http://www.epa.gov/SmartwayLogistics/region6.htm

13.	Frito-Lay Inc.	Plano, TX
14.	Greatwide Logistics Services	Irving, TX
15.	H-E-B	San Antonio, TX
16.	JC Penney	Plano, TX
17.	Lane Freight, Inc.	Houston, TX
18.	LinkAmerica Expedited Co., Inc.	Fort Worth, TX
19.	Lisa Motor Lines, Inc.	Fort Worth, TX
20.	Logicorp Enterprises, LLC	Hidalgo, TX
21.	MDE&E Trucking	Dallas, TX
22.	MW Logistics, LLC	Dallas, TX
23.	Norco Corporation	Saginaw, TX
24.	Plains Transportation	Amarillo, TX
25.	Prime Source FSE	Dallas, TX
26.	Sagebrush Logistics, LLC	San Antonio, TX
27.	South Texas Petroleum	McAllen, TX
28.	South Texas Proppant	McAllen, TX
29.	Stevens Transport	Dallas, TX
30.	TxDOT	Austin, TX
31.	Texas Star Express	Rockwall, TX
32.	Tommy Roach Transportation	Robert Lee, TX
33.	Total Transportation Services LP	Plano, TX
34.	Trans Gulf Transportation, Inc.	La Porte, TX
35.	Transplace Texas, L.P.	Plano, TX
36.	Transport Industries, L.P.	Mesquite, TX
37.	TruckloadBroker.com, LLC	Dallas, TX
38.	USA Logistics Carriers, LLC	McAllen, TX

5.2.7: Conclusion of Calculating Idling Emissions for HDDV at Distribution Centers

AACOG staff initially anticipated identifying a considerable amount of emissions from extended idling at local warehouses and distribution centers; but telephone interviews with facility managers revealed that truck operators do not leave their engines running for extended periods of time at warehouses or during deliveries, and overnight idling does not take place. Due to recent increases in diesel fuel prices, truck owners are less inclined to idle their engines for extended periods during their daily operation. In addition, the truck industry is becoming increasingly regulated by federal agencies due to the nation's energy policies and concerns over health hazards associated with diesel exhaust emissions.

Companies contacted to develop the extended idling database for distribution centers reported either only short term idling (less than 15 minutes) or "no-idling" policies at their facilities. This sampling was determined to reflect the general extended idling policies at other distribution centers in the AACOG region. In addition, emissions from short term idling are included in the MOBILE6 on-road emission estimates calculated by TTI for the San Antonio region. Due to these two factors, AACOG staff did not calculate HDDV extended idling emissions at distribution centers.

5.3: Emission Reductions from Current Anti-Idling Programs

In May 2001, President Bush issued the *National Energy Policy* directing the EPA and the Department of Transportation (DOT) to work with the trucking industry to establish a program to reduce emissions and fuel consumption from the use of long-haul trucks. Responding to this directive, the EPA initiated a comprehensive program aimed to reduce idling and exhaust emissions from HDDVs. The EPA also initiated a study that would quantify long duration idling emissions and fuel consumption rates.[26] In January 2004, the EPA published the document, "Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity" to provide a methodology to calculate NOx and PM emissions reductions due to the use of anti-idling technologies.

5.3.1: Air Quality Benefits of Truck Stop Electrification Program

The IdleAire Technologies Corporation is one of the companies that provide truck stop electrification (TSE) technology throughout the nation. IdleAire has determined that their "…system removes 100% of emissions associated with extended diesel idling, including nitrogen oxides (NOx), particulate matter (PM), volatile organic compounds (VOC), carbon monoxide (CO) and carbon dioxide (CO2). The system has a net reduction of 98% of criteria

[26] Lim,H., October 2002. Study of Exhaust Emissions from Idling Heavy-Duty Diesel Trucks and Commercially Available Idle-Reducing Devices (EPA420-R-02-025). EPA. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/otaq/smartway/documents/epaidlingtesting.pdf

pollutants under the Clean Air Act after accounting for the electricity from the grid used to power the system." [27]

In the San Antonio region, the company provides individual electrical service for 60 parking spaces at the Travel Centers of America (TA) truck stop #147, located at the intersection of Foster Road and IH-10 East, and 72 parking spaces at TA #232, at the intersection of Conrads Road and IH-35 North in New Braunfels. The Petro Travel Plaza off IH-10 E is planning to add IdleAire services to their facility in the future.

IdleAire operations at TA #232 and the proposed operations at Petro Travel Plaza are funded by grant money through the Texas Emission Reduction Program (TERP). The funding level is listed at $1,243,950 for both projects. IdleAire services at Petro Travel Plaza were not operational as of August 2007 and the exact details of the project were unknown; therefore, emissions reductions for Petro Travel Plaza were not calculated. The NOx benefits of IdleAire facilities at the two TA truck stops in the San Antonio region have been credited to the TERP program and reported to the State. To avoid double counting of credits, the San Antonio region will not consider SIP credit for NOx from this control measure.

5.3.2: Anti-Idling Technologies

Various technologies have been developed to provide truck drivers with cleaner energy, such as electricity, at truck stops to reduce idling duration. IdleAire, Shurepower, and Auxiliary Power Units (APU) are examples of these technologies. To use IdleAire services, as shown in Figure 5-5, trucks are connected to the Service Delivery Module by means of a flexible, reinforced, concentric hose, which also houses the delivery mechanisms for the communications and entertainment packages. All TSE services, such as temperature, fan speed, and other options, are independently controlled by each individual driver in the truck cab via the Service Delivery Module.

[27] IdleAire. Environmental Benefits Fact Sheet. Retrieved March 15, 2006. Website: http://www.idleaire.com/files/newsroom/Environmental%20Benefits.pdf

Figure 5-5: IdleAire Technology Installed

Figure 5-6: Shurepower Pedestals

Another emerging technology used at truck stops is **Shurepower™**. This technology allows drivers to turn off their engines during rest stops and maintain the electricity needed for the operation of on board amenities such as heating, cooling and entertainment. Shurepower also provides drivers with access to cable TV, telephone, and Internet connections. The connections that provide drivers with the energy to run on board equipment come from 120- and 220-volt pedestals built by Shurepower. Eighteen such units are operating at a rest area in Wilton, N.Y., under the sponsorship of several state and federal agencies.[28]

Figure 5-7: Shurepower Pedestal Hook Up

A third technology option, the Auxiliary Power Unit, is externally or internally installed on trucks, removing the need for the driver to park at a TSE-equipped facility. APUs also provide electricity for heating and cooling purposes when the main engine is shut off. However, these units are equipped with internal combustion engines and run on fossil fuel; as a result, they are not pollutant free. For this reason, this anti-idling technology may not

[28] Shurepower Home Page, Retrieved May 31,2006. Available online: http://www.shurepower.com/tse.htm

gain widespread use. An APU adds to the weight of the truck, affects the fuel economy, and limits weight that trucks can carry.

5.3.3: Quantification of Emissions Reductions from Use of Existing Anti-Idling Technology

Emergence and utilization of anti-idling devices will cause a significant reduction in the amount of pollutants generated by idling heavy-duty diesel vehicles. It is the intent of this report to examine the air quality benefits of anti-idling technology currently used to reduce pollutants released into the environment by idling trucks and determine the effects of wider use of anti-idling technologies at truck stops and selected State-owned rest areas in the 12-county AACOG region.

AACOG staff, after reviewing published literature on estimating emissions benefits of anti-idling technologies and contacting EPA and TCEQ staff for recommendations, developed the following procedure for calculating emissions benefits of anti-idling technologies:

Step 1: Determine the historic utilization rate associated with truck parking spaces included in this project.[29]

After locating truck stops in the study area that use anti-idling technologies, data on truck capacity at the facilities and utilization rates were collected. AACOG Staff contacted IdleAire Technologies Corporation and obtained information on annual hourly utilization rates for the entire system installed at TA #147.[30] The Service Delivery Modules at TA #147 were used for a total of 156,482.20 hours for the year 2005. This value can be converted to a daily per space use rate as follows:

Daily Use Rate (hrs/day/sp) = AHU / DAY / PS

Where:

AHU = Annual hourly utilization (156,482,20 hrs/yr)
DAY = Number of days/year (365)
PS = Parking spaces (60 or 72)

Daily Use Rate = (156,482.20 hrs/yr) / (365 days/yr) / 60 spaces
= 7.15 hr/day/sp

AACOG staff used this utilization rate to generate total emissions reductions from anti-idling technologies for an average weekday. Since the use of anti-idling devices eliminates

[29] EPA. January 2004. Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/otaq/smartway/documents/420b04001.pdf
[30] Kenneth Carter of IdleAire (email to Isabel Martinez, March 03, 2006).

emissions from idling, the total emissions that would be generated by idling are equal to the total reductions generated by anti-idling devices. Note, for SIP purposes, only 98% of the total emission reduction should be reported for credit. The assumption is that anti-Idling devices cause a shift in the energy source from diesel engines to the grid system, and this shift would increase energy use at power plants. The remaining 2% of the total emissions represent the power plant energy increase.

Step 2: Select the emission factor for the criteria air pollutant or precursor.[31]

The EPA-recommended NOx emission factor for Class 8 truck idling is 135 grams per hour. For this report, this EF and the VOC emission factor of 42.3 grams/hour were used in the final step of the calculation.

Step 3: Multiply the emission factors in Step 2 by the utilization rate and number of equipped parking spaces to calculate daily emissions reductions.

The equation used was as follows:

Emissions Reductions = EF x UR x PS x RE / 907,184 g/ton

Where:

EF = Emission factor (VOC 42.3 g/hr and NOx 135 g/hr)

UR = Utilization rate (7.15 hr/day/sp)

PS = Parking spaces (60 or 72)

RE = Rate of emission reduction effectiveness (0.98)

Daily NOx emissions reductions for the use of IdleAire technology at TA # 147 were calculated as follows:

NOx Emissions Reductions = 135 g/hr x 7.15 hr/day x 60 x 0.98 / (907,184 g/ton)
= 0.063 tons/day

5.3.4: Annual Emission Reductions from Use of IdleAire and Associated SIP Credits

The annual emissions reductions associated with the use of IdleAir technology at TA truck stop #147, in Bexar County, and TA truck stop #232, in Comal County, can be used for SIP credit if need be. These reductions cannot be removed from the photochemical model database, as emissions from truck idling have never been included in the on-road source emission inventory. To remedy this dilemma, the IdleAire allocated parking spaces, shown in Table 5-10, were subtracted from the total parking capacity of these truck stops, shown in

[31] EPA. January 2004. Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity. Research Triangle Park, North Carolina. Available online: http://www.epa.gov/otaq/smartway/documents/420b04001.pdf

Tables 5-3 and 5-4, since the IdleAire parking spaces are not associated with any emission production. The following table shows the summary results of emissions reductions at the two IdleAire facilities in the region.

Table 5-10: Annual Emissions Reductions in San Antonio Region from Use of IdleAire Technology

County	Location	Allocated Parking Space	VOC tons/yr.	NOx tons/yr.
Comal	TA #232, Conrads Rd at I-35, New Braunfels	72	8.59	27.40
Bexar	TA #147, Foster Rd at IH-10, San Antonio	60	7.16	22.84
Total	NA	132	15.65	50.24

5.4: Emission Inventory Results for Truck Idling

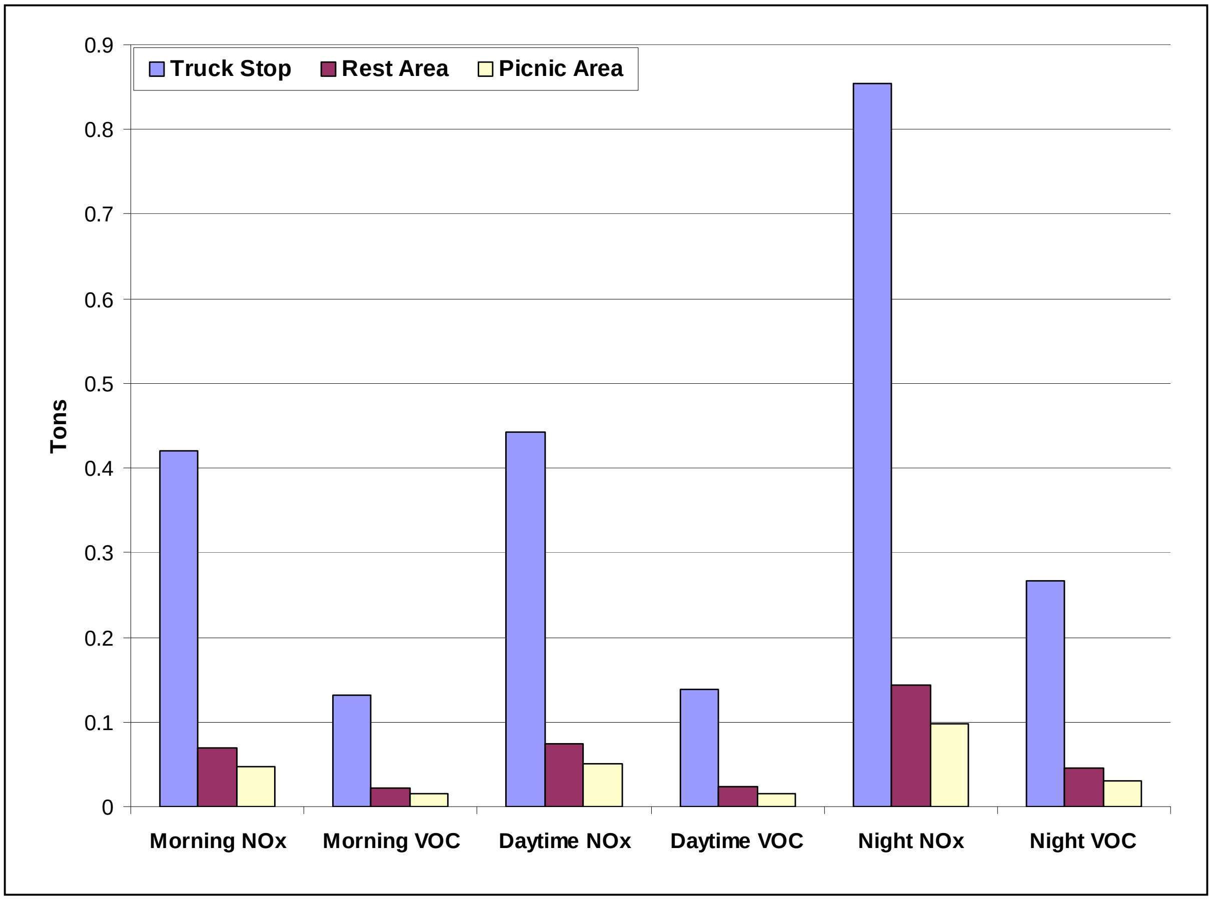
The emission inventory of truck stops and rest/picnic areas for a typical summer day are aggregated by three time periods and summarized in the following table:

Table 5-11: Total Average Summer Day Truck Idling Emissions at Truck Stops and Rest/Picnic Areas in San Antonio Region

Facility	Morning Tons		Daytime Tons		Night Tons		Total Tons	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Truck Stop	0.420	0.132	0.442	0.138	0.854	0.267	1.72	0.537
Rest Area	0.070	0.022	0.074	0.023	0.143	0.045	0.290	0.090
Picnic Area	0.048	0.015	0.051	0.016	0.098	0.031	0.197	0.062
Total	0.538	0.169	0.567	0.177	1.095	0.343	2.207	0.689

Figure 5-8 provides a visual comparison of emissions generated during the three time-of-day periods. As indicated, emissions of NOx pollutants are at the highest level during the night when idling rates are also high. Overall, VOC idling emissions are lower than NOx emissions.

Figure 5-8: Total Truck Idling Emissions in San Antonio Region by Time of Day



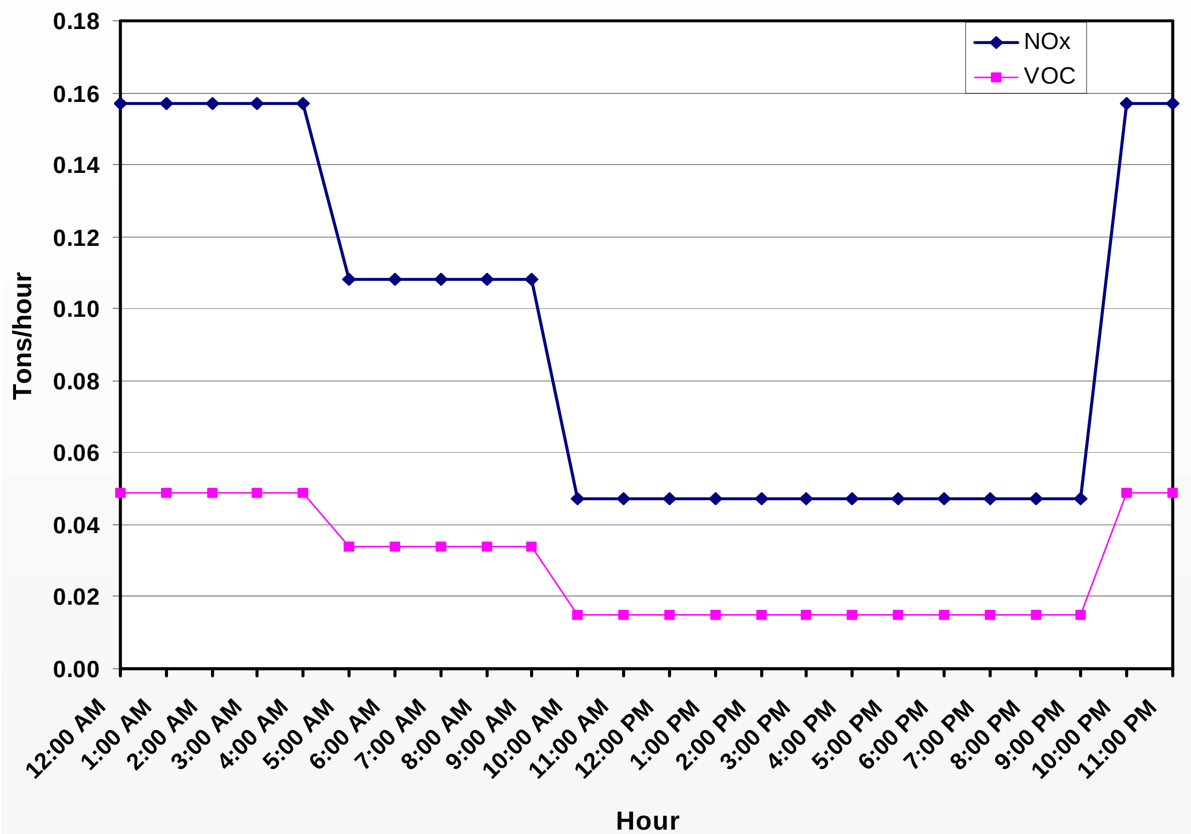
5.5: Photochemical Modeling of Emissions

One of the goals of this report is to analyze the impacts of emissions from truck idling through the use of a regional photochemical model. Photochemical models estimate the formation, dispersion, and deposition of ozone based on temporally- and geographically-allocated inputs of meteorological conditions and emissions data. This requires identifying and quantifying sources of VOC, NOx and CO emissions, because ozone forms as the result of chemical reactions between these chemical precursors. In order to prepare emissions for use in a photochemical model, the emissions are temporally allocated to account for seasonal differences in emission rates or activity, and to apportion emissions to a particular day or hour in accordance with EPA policy (EPA April 1999).

5.5.1: Temporal Allocation of Emissions

Processing emissions in a photochemical model includes such steps as chemical speciation, temporal allocation, and spatial allocation of emissions data. These steps require the conversion of total daily emissions data to hourly data and allocation to a grid-cell based modeling system. The process is done outside of the model and the results are entered into the model in the form of an input file. In Figure 5-9, the hourly distribution of total daily NOx and VOC emissions from idling trucks are displayed graphically. As indicated, the emissions of VOC and NOx are flat during the daytime, reach their pick levels at 10:00 PM, continue to remain high until 4:00 AM, and gradually decrease during the morning hours of the following day.

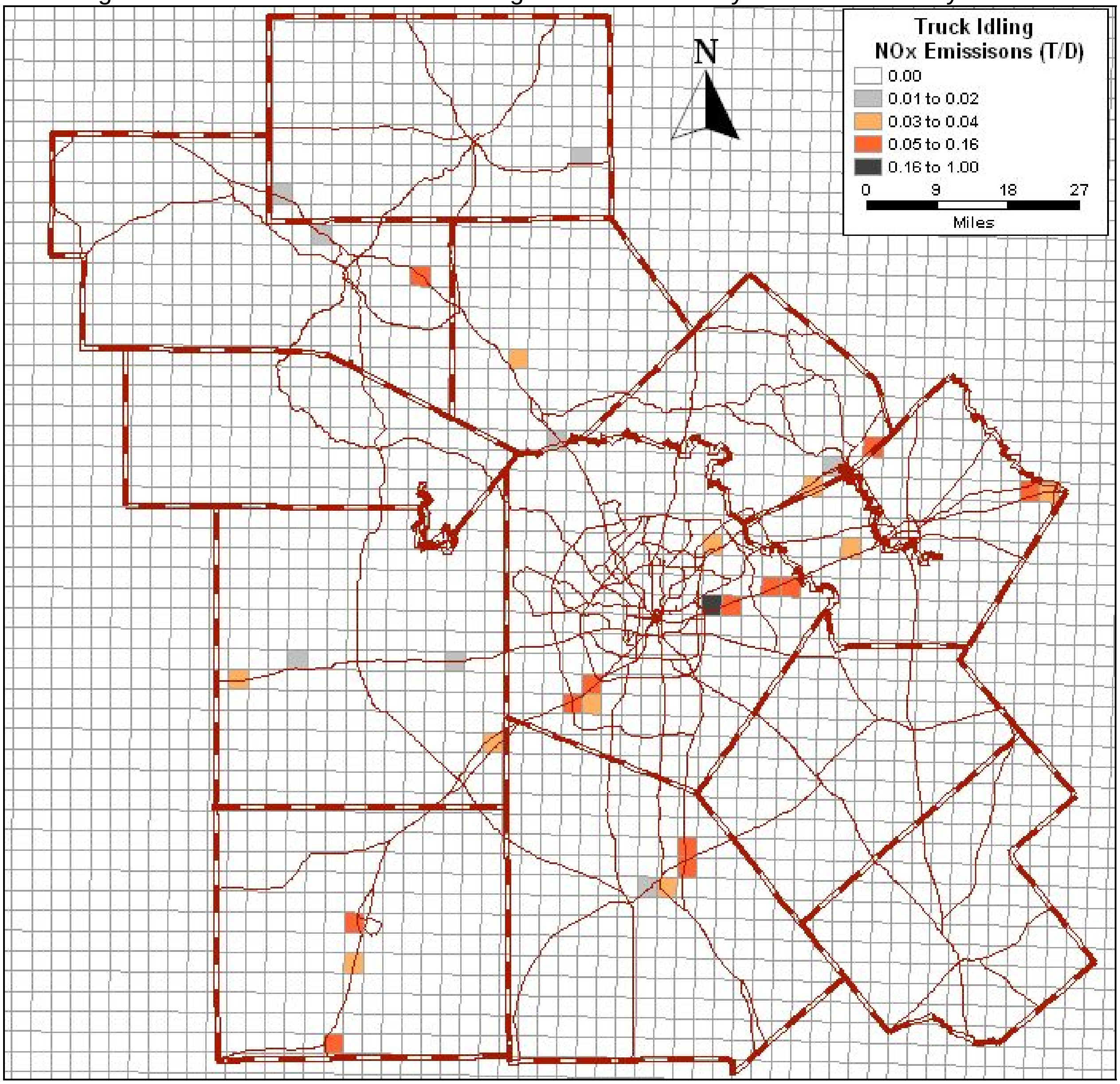
Figure 5-9: Hourly Distribution of Emissions from Idling Trucks in San Antonio



5.5.2: Spatial Allocation of Emissions

As required by the photochemical model, the locations of truck stops and rest/picnic areas, within the 12-County region, were spatially and temporally allocated to a grid-based system. This step was accomplished using TransCAD software. The CAMx grid system was imported to TransCAD and used as an overlay layer; subsequently, the NOx and VOC emissions from idling trucks at truck stops or rest/picnic areas were allocated to the grid cells that overlaid these facilities. Figures 5-10 and 5-11, which illustrate the allocation process, indicate concentrations of NOx and VOC emissions in the study area. The highest concentrations of emissions are seen around the intersection of Loop 410 and IH 10 E and generally within the Bexar County boundaries. This is due to the concentration of truck stops alongside two major transportation corridors, IH 35 and IH 10, in Bexar County.

Figure 5-10: Distribution of Truck Idling NOx Emissions by the CAMx Grid System

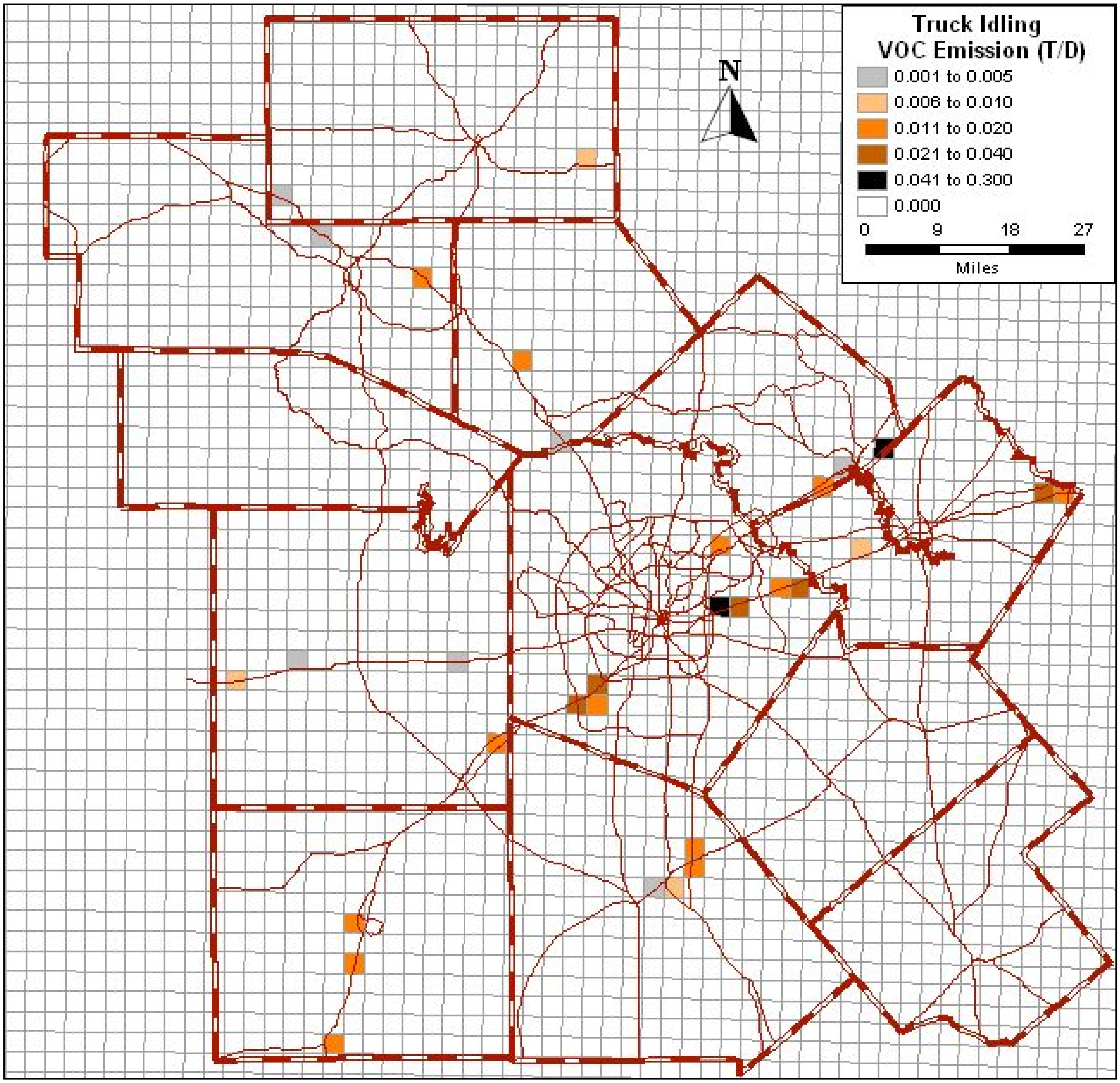


Plot Date: September 11, 2006

Map Compilation: August 24, 2006

Source: AACOG, 2000 TIGER files, Texas official travel map, aerial images.

Figure 5-11: Distribution of Truck Idling VOC Emissions by the CAMx Grid System



Plot Date: September 20, 2006
Map Compilation: September 13, 2006
Source: AACOG, Texas official travel map, aerial images, 2000 TIGER files

5.5.3: Photochemical Model Results of Idling Emissions

The emissions from truck idling were imported into the CAMx photochemical model – a State validated photochemical model for the analysis of control strategies as part of a State Implementation Plan (SIP). The model estimates control strategy effectiveness by calculating the impact of ozone precursor emission reductions on ambient ozone concentrations. Ultimately, this allows planners to determine a region's attainment status with regards to the national ambient air quality standard (NAAQS) for ozone. The emissions from truck idling in 2005 were added to the model's 2007 emission inventory. The model was run for two scenarios for the 2007 projection year; one with added truck idling emissions and one without. This provided a comparison between controlled and uncontrolled truck idling emissions in terms of estimated ozone production. All air quality control measures implemented in the region, creditable for the SIP, were included in both scenarios so that their impacts on regional ozone levels would be taken into account as well.

Based on recommendations by the EPA, the impacts of control measures are predicted for an array of grid cells surrounding the locations of air quality monitors in the region. Since the San Antonio photochemical model is organized on a 4 x 4 km grid system, and based on the EPA recommendation, the nearby cells were defined as a 7 x 7 array, with the monitor assumed to be in the central cell of the 7 x 7 cell array[32].

The following tables show the results of the two model runs and demonstrate that the addition of emissions from truck idling to the model's EI causes measurable impacts on the ozone levels throughout the San Antonio region during the modeling episode. Table 5-12 indicates the time of day when the added idling emissions affect predicted base case ozone levels. The highest increases, based on the idling emission model runs, were predicted for Sept. 18 and Sept. 19.

Table 5-12: 2007 Maximum Change in 8-Hour Ozone with Truck Idling Compared to Base Case

Date	Time of Max. Difference	Ozone (part per billion)
Sept. 15	11 a.m.	0.12
Sept. 16	5 a.m.	0.22
Sept. 17	5 p.m.	0.23
Sept. 18	7 p.m.	0.31
Sept. 19	6 p.m.	0.33
Sept. 20	11 a.m.	0.26

[32] EPA. October 2005. Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS (EPA-454/R-05-002). Research Triangle Park, North Carolina. Available online: http://www.tceq.state.tx.us/assets/public/implementation/air/am/docs/dfw/sip-bibliography/2005b_EPA_8_hour_ozone_guidance_final_version.pdf

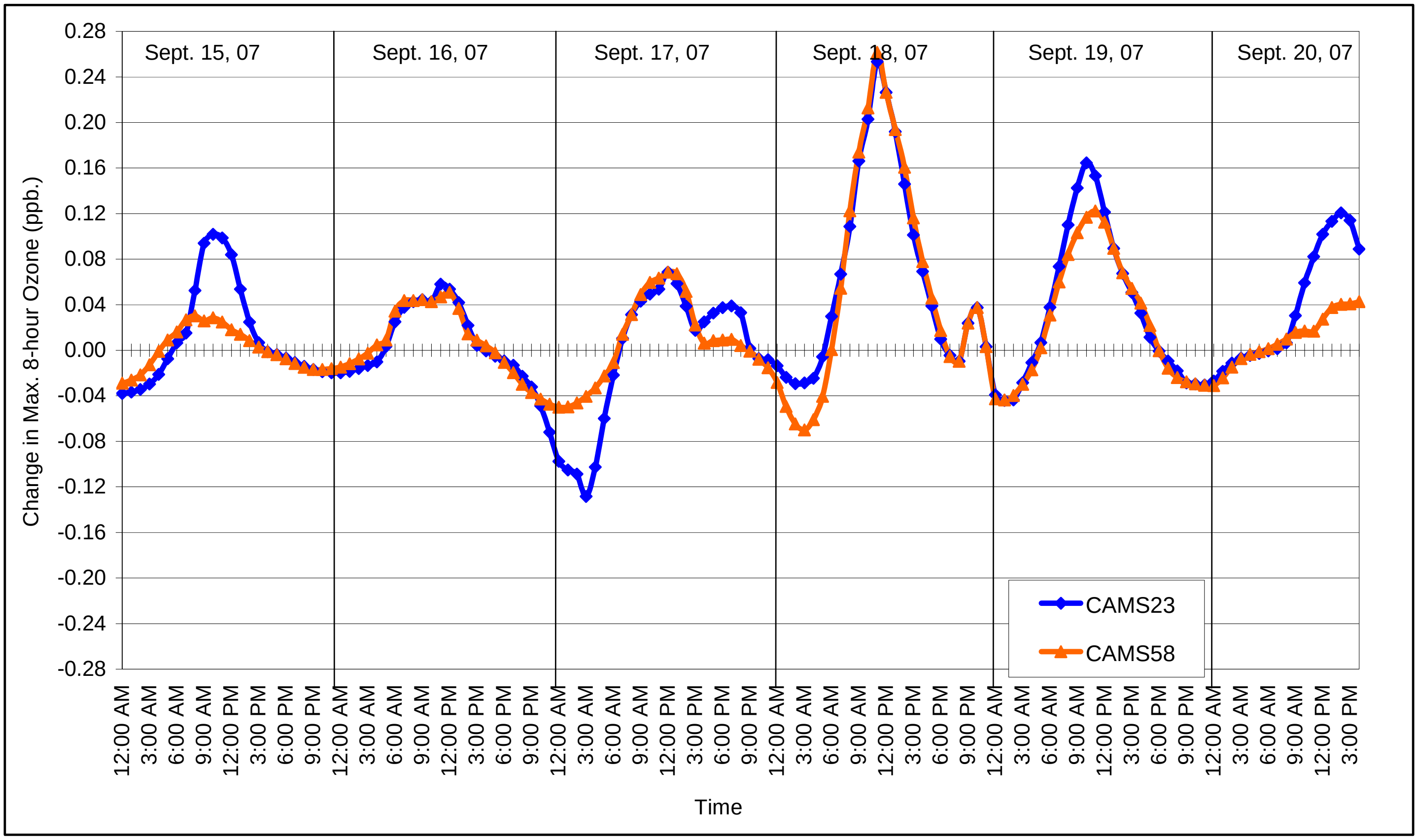
Additionally, Table 5-13 indicates these increases in ozone levels by the attributed monitor. The greatest differences in ozone concentrations, on most days, were predicted at CAMS 678, which is located closest to the cluster of truck stops off IH-10 E. For Sept. 20 however, the greatest impact was predicted at CAMS 59, located approximately 10 miles south of the cluster of truck stops on I-10.

Table 5-13: 2007 Maximum Impacts of Idling Emissions on 8-Hour Ozone Levels at Each CAMS

Date	CAMS 23 pbb	CAMS 58 pbb	CAMS 59 pbb	CAMS 678 pbb
Sept. 15	0.10	0.03	0.06	0.11
Sept. 16	0.06	0.05	0.02	0.22
Sept. 17	0.07	0.07	0.02	0.23
Sept. 18	0.25	0.26	0.05	0.31
Sept. 19	0.16	0.12	0.10	0.33
Sept. 20	0.12	0.04	0.24	0.22

Adding the emissions from extended truck idling to the emission inventory database helped improve the accuracy of the photochemical model in predicting ozone levels. The previous base case model runs, which did not take truck idling emissions into account, tended to underestimate ozone levels during the daytime peak and overestimate ozone levels at night. The addition of emissions from truck idling practices increased predicted ozone during the day and decreased predicted ozone during the night. The night time variation from the base case run is due to the fact that added overnight idling NOx emissions would chemically react with ozone and the process of ozone scavenging would occur, ultimately resulting in lower predicted ozone levels at nighttime throughout the modeling episode. These variations from the base case run at CAMS 23 and CAMS 58 by time of day are shown in Figure 5-12. This ozone scavenging process is most noticeable during the early hours of Sept. 17 for the modeled episode.

Figure 5-12: 2007 Max Impacts of Truck Idling Emissions on Ozone at CAMSs 23 and 58



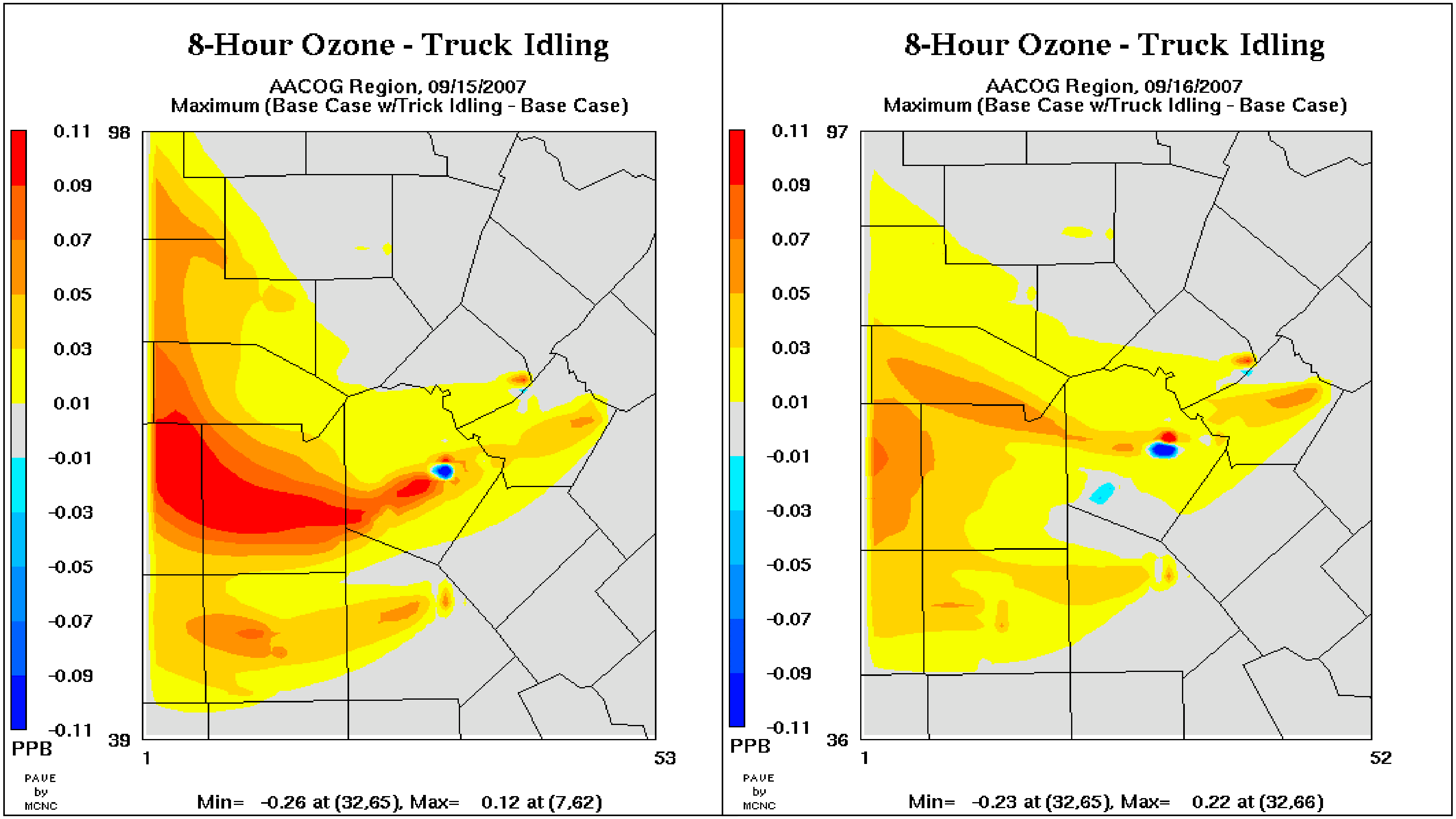
The addition of heavy-duty truck idling emissions to the regional emission inventory in the photochemical model increased the design values for 2007. As shown in Table 5-14, the highest impact of the emissions was predicted at CAMS 23, indicating this source of pollution can be controlled to help avoid violation of federal air quality standards and non-attainment status.

Table 5-14: 2007 Maximum Impacts of Truck Idling Emissions on Design Values, ppb

Site	Base Case Design Value	Design Value with Added Idling Emissions	Difference ppb
CAMS 23	84.28	84.32	0.05
CAMS 58	81.97	82.01	0.04
CAMS 59	74.34	74.37	0.03
CAMS 678	74.26	74.29	0.03

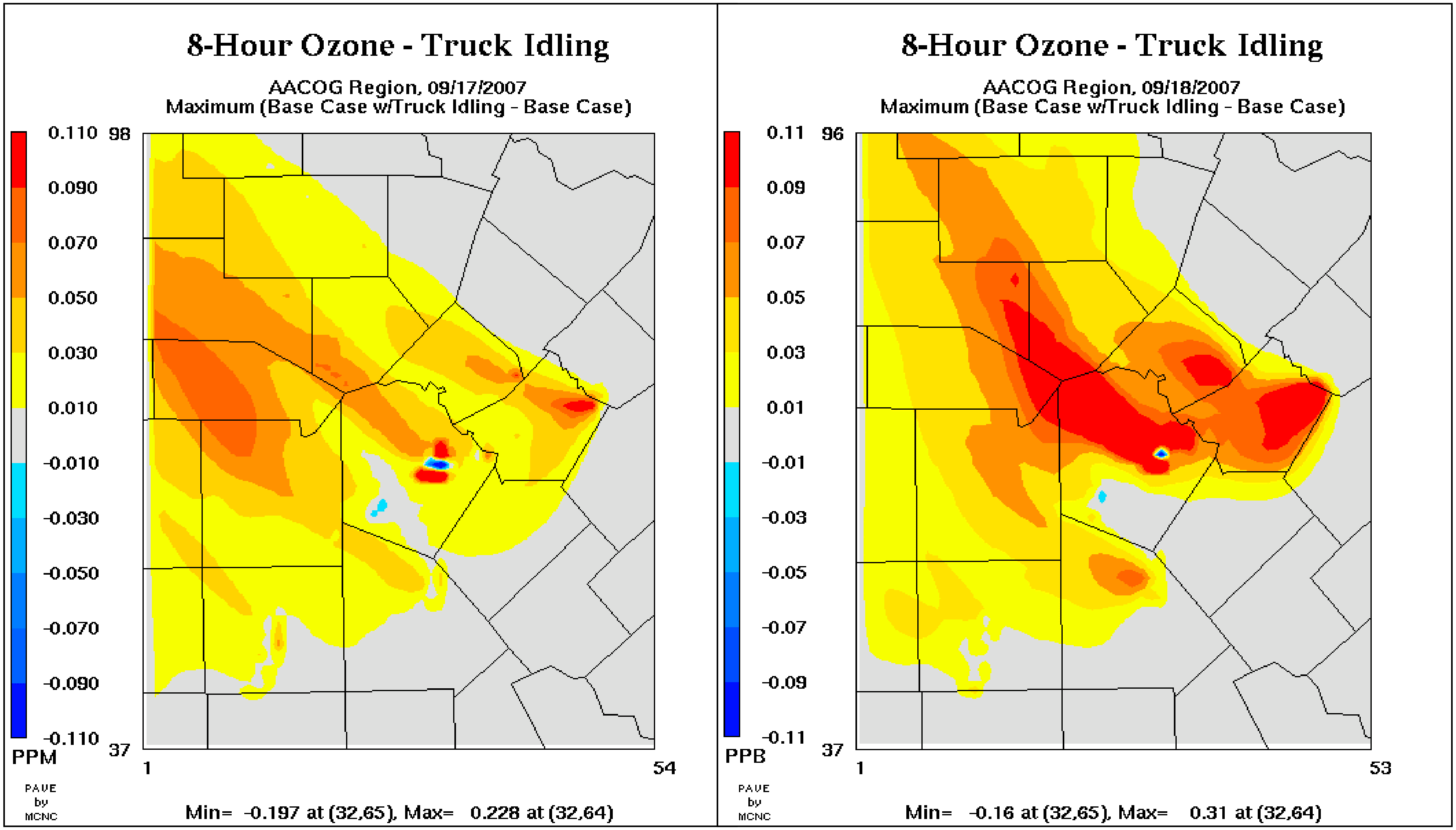
The greatest impacts of truck idling emissions during the modeling episode occur on Sept.18th at CAMS 58 and 23, as shown in Figure 5-13. This is because the model originally predicted the highest levels of ozone on the 18th, and the added idling emissions exacerbated the condition for downwind monitors. As shown in Table 5-14, the greatest impact at CAMS 59 was predicted on Sept. 20th because of transport of emissions from the truck stops at Foster Road and IH-10, which accumulated at the site when the air parcel over the monitor became stagnate. This is better illustrated in Figures 5-13, 5-14, and 5-15 where the intense blue areas represent the location of truck stops and the red shading indicates the areas of highest impact on the ozone levels in the base case scenario. Blue areas in the graphs indicate where ozone levels decreased due to ozone scavenging by NOx emissions generated from idling engines. The CAMS 59 is located in the southern section of Bexar County.

Figure 5-13: Difference in Maximum 8-hour Average Ozone, Sept 15 and 16, 2007



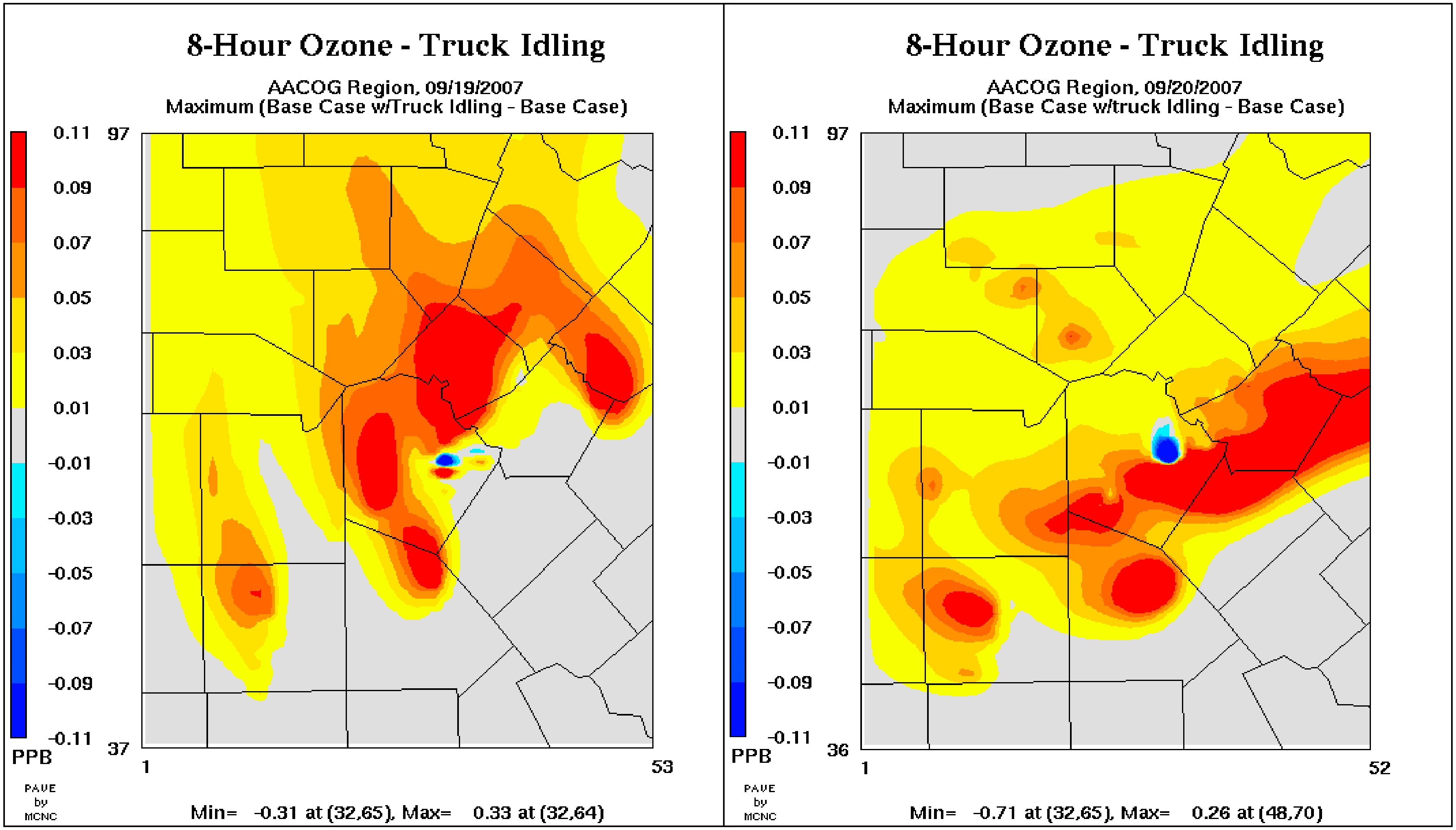
Plot Date: September 27, 2006
Map Compilation: September 27, 2006
Source: AACOG, CAMx photochemical model

Figure 5-14: Difference in Maximum Ozone, Sept 17 and 18, 2007.



Plot Date: September 27, 2006
Map Compilation: September 27, 2006
Source: AACOG, CAMx photochemical model

Figure 5-15: Difference in Maximum Ozone, Sept 19 and 20, 2007.



Plot Date: September 27, 2006
Map Compilation: September 27, 2006
Source: AACOG, CAMx photochemical model

5.6: Study of Potential Control Strategies

Faced with the importance of meeting the NAAQS and avoiding a non-attainment status, air quality analysts must search for ways to eliminate or decrease emissions of ozone precursors from local sources. Expanded use of anti-idling technologies and implementation of public policies represent an example of measurable and enforceable controls that may be considered to further decrease emissions from truck idling and improve air quality. This report will examine the following potential control strategies:

- Use of anti-idling technology at truck stops
- Use of anti-idling technology at State-owned rest areas
- Implementation of a citywide anti-idling ordinance

5.6.1: Use of Anti-Idling Technology

AACOG staff identified several truck stops and rest areas that are suitable candidates for further use of anti-idling technologies. Any environmentally clean technology that could provide truck drivers an alternative to idling can be considered for use at these locations. For this report, technologies such as IdleAire and Shurepower that replace diesel fuel with electricity are applied, because they are effective and reduce the emissions from idling by 98%.

The selected truck stop locations can be grouped in two distinctive categories. The first group consists of major commercial truck stops that belong to private owners. The motivation behind the installation of anti-idling technologies at commercial truck stops is one of profitability. The second group consists of large state-owned rest areas that are frequently used by truck drivers as places to stay for their mandatory resting period. These rest areas currently are not equipped with any anti-idling technologies and drivers typically idle their engines to maintain a comfortable environment in their cabins during the rest periods. Use of anti-idling technologies at these facilities could enhance local and regional air quality, as well as support national energy policies by avoiding unnecessary use of energy.

5.6.2: Use of Anti-Idling Technology at Truck Stops

Three truck stops in the AACOG region that are currently not equipped with anti-idling technology were selected for emissions reduction analysis because of their truck capacity and proximity to major freeways. These two factors are of interest to companies that invest in electrification of truck stops. The IdleAire Company, for example, requires a minimum of 50 parking spaces before they will consider electrification of a truck stop. Potential emissions benefits from the implementation of anti-idling technology at these three truck stops were calculated using the equations in section 5.3.4. The results of these calculations are shown in Table 5-15.

Table 5-15: Total Daily and Annual Emissions Benefits from Use of Anti-Idling Technology at Selected Truck Stops

Truck Stop	Current Capacity	Estimated # of Equipped Truck Parking Spaces	Total NOx		Total VOC	
			tons/year	tons/day	tons/year	tons/day
Love's Country Store	75	60	24.90	0.068	7.80	0.021
AAA Travel Center	57	50	20.75	0.057	6.50	0.018
Flying J Travel Plaza	228	72	29.87	0.082	9.36	0.026
Total	360	182	75.52	0.207	23.66	0.065

5.6.3: Use of Anti-Idling Technology at Rest Areas

The rest areas selected for potential emissions reductions analysis are large and located along major freeways. As part of a federally funded program referred to as the "Safety Rest Area Program", the Guadalupe County and Medina County facilities were recently constructed and made available for public use. These safety rest areas are equipped with air-conditioned lobbies, security systems, wireless Internet access, updated rest rooms, and expanded parking lots[33]. Truck drivers use these facilities for overnight and long term stay; consequently, these are sites where extended periods of engine idling frequently occur.

Use of anti-idling technology at these locations should be carefully planned at the State level so that short-term users would not be dissuaded from stopping and resting due to the lack of designated parking spaces. Installing anti-idling technology at rest areas could come at a cost to short- term users by reducing the number of parking spaces. Therefore, arrangements must be made to insure adequate accommodations for short-term users. In the following table, which indicates emissions benefits from the use of anti-idling technologies at rest areas, this concern has been addressed in the third column by allocating five truck parking spaces at each rest stop for short-term users.

[33] TxDOT, 2006, Safety Rest Areas. Available online: http://www.dot.state.tx.us/services/maintenance/rest_areas.htm

Table 5-16: Total Daily and Annual Emissions Benefits from Use of Anti-Idling Technology at Selected Rest Areas

Rest Area	Current Capacity	Potential Equipped Truck Parking Spaces	Total NOx		Total VOC	
			tons/year	tons/day	tons/year	tons/day
Bexar County Eastbound	20	15	6.22	0.017	1.95	0.005
Bexar County Westbound	20	15	6.22	0.017	1.95	0.005
Guadalupe County Eastbound	42	37	15.35	0.042	4.81	0.013
Guadalupe County Westbound	39	34	14.11	0.039	4.42	0.012
Medina County New Facility	28	23	9.54	0.026	2.99	0.008
Total	149	124	51.44	0.150	16.12	0.043

As Table 5-16 indicates, the emission benefits of installing anti-idling technologies at these selected rest areas are substantial. This control measure merits attention on the part of State air quality planners.

5.6.4: Implementation of an Anti-Idling Ordinance

Many communities throughout the nation have enacted anti-idling regulations to curb harmful emissions from heavy-duty diesel engines. The California Air Resources Board, a pioneer in anti-idling rules, in its document on HDDV idling asserts:

> Diesel exhaust is a complex mixture of thousands of gases and fine particles that contain more than 40 identified toxic air contaminants. These include many known or suspected cancer-causing substances, such as benzene, arsenic and formaldehyde. Diesel exhaust can irritate the eyes, nose, throat and lungs, and can cause coughs, headaches, light-headedness and nausea. Diesel exhaust is a major source of ambient particulate matter pollution as well, and numerous studies have linked elevated particle levels in the air to increased hospital admission, emergency room visits, asthma attacks and premature deaths among those suffering from respiratory problems.[34]

Aside from the reduction of soot, the goal of anti-idling measures is to lower oxides of nitrogen (NOx), an important component of ozone pollution, and other emissions from fuel combustion. Anti-idling measures have the added benefits of reducing truck idling noise and unnecessary fuel consumption.

[34] CARB, July 2004. Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling. Stationary Source Division. Sacramento, California. Available online: http://www.arb.ca.gov/regact/idling/isorappa.doc

Typically, anti-idling rules prohibit idling a heavy-duty vehicle engine for more than five to ten consecutive minutes when the vehicle is not in motion, unless the driver is using the engine to heat or cool his sleeper berth while taking mandatory rests. The State of California in Oct. 2005 passed a rule to restrict any type of idling by HDDVs including idling during resting periods. According to this rule, trucks equipped with sleeper berths will no longer be exempt from the state's five-minute idling restriction for heavy-duty vehicles[35]. The new rule becomes effective in 2008.

The impact of California's new anti-idling legislation is expected to save each truck and bus operator 125 gallons of diesel per year, or collectively, over one million gallons each week. Additionally, CARB estimates the measure will eliminate 166 tons of particulate matter and 5,200 tons of nitrogen oxide emissions annually.[36]

In Texas, the Austin Metropolitan Statistical Area in September 2005 adopted this measure as an additional provision to Austin's Clean Air Early Action Compact. Austin air quality planners anticipate NOx reductions of 0.67 tons per day. The methodology for calculating this NOx reduction is included in Austin's SIP document and is based on EPA's estimate that 3.4% of the total on-road emissions are caused by Class 8 heavy-duty vehicle idling. [37]

5.6.5: San Antonio Anti-Idling Ordinance

The local governments in the San Antonio region are evaluating the impact of adopting a rule that prohibits unnecessary idling by commercial heavy-duty vehicles during their daily operation. Short-duration idling generally takes place while the drivers are on-duty. This measure would further reduce emissions of toxics and criteria pollutants by limiting short-duration idling. If approved by the San Antonio City Council, the measure will amend City Municipal Code Chapter 21 *Offenses and Miscellaneous Provisions* and affect commercial vehicles with a gross vehicular weight rating (GVWR) greater than 14,000 pounds. The intention of this rule is to reduce the short-duration idling by HDDVs to five minutes per each stop when delivering cargo, taking a lunch break, and checking or refueling vehicles. This means that idling long-haul truck engines while taking federally mandated rest periods might be excluded from the rule. As described in previous sections of this report, emissions from

[35] CARB, Rulemaking: 2005-10-20 Final Statement of Reasons for Requirements to Reduce Idling Emissions from New and In-Use Trucks. Available online: http://www.arb.ca.gov/regact/hdvidle/isor.pdf

[36] CARB, July 22, 2004. News Release: ARB Adopts Heavy-Duty Diesel Idling Control Measure. Sacramento, California. Available online: http://www.arb.ca.gov/newsrel/nr072204.htm

[37] EPA. October 2005. Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS (EPA-454/R-05-002). Research Triangle Park, North Carolina. Available online: http://www.tceq.state.tx.us/assets/public/implementation/air/am/docs/dfw/sip-bibliography/2005b_EPA_8_hour_ozone_guidance_final_version.pdf

extended idling by long-haul trucks are significant, and measures such as truck stop electrification, must be implemented to eliminate them.

5.6.6: Emissions Benefits of San Antonio Anti-Idling Ordinance

An anti-idling ordinance by the City of San Antonio presumably will affect the idling patterns of HDDVs during their operation within the city limits as it will limit each idling incident to 5 minutes or less for the short duration idling practiced by local HDDV drivers. AACOG staff calculated the emission benefits of this control measure by studying reports and documents on anti-idling measures implemented in the State of California, City of Sacramento, City of Austin, and the Houston metropolitan area and incorporated ideas borrowed from these sources to create a spreadsheet that estimated the emissions benefits of San Antonio's anti-idling ordinance.

Data on vehicle hours traveled (VHT) and vehicle miles traveled (VMT) were obtained from TTI's 2007 on-road emission files in order to calculate the fleet size and idling time for each vehicle class[38]. Fleet size for each class of HDDV was determined by dividing the total daily VMT for a specific HDDV class by 81.8, which is the average daily miles traveled by an HDDV within Houston as listed in Houston's SIP document[39]. Due to the similar size of the roadway system in Houston and San Antonio, AACOG staff determined this number was applicable for the San Antonio metropolitan area as well. The short duration idling rates, which are shown in the following table, were obtained from CARB's anti-idling ordinance[40].

Table 5-17: Average Short Duration Idling Times by Affected Vehicle Class

Vehicle Class Type	Vehicle Class	Average Short Duration Idling Times
Heavy Heavy Duty Diesel Vehicles	HDDV 7 and HDDV8	0.7 hour per day
Medium Heavy Duty Diesel Vehicles	HDDV4, HDDV5, and HDDV6	0.3 hour per day

The MOBILE6 model was run using a speed of 2.5 mph – the lowest speed the model accepts – to mimic idling conditions for vehicles weighing greater than 14,000 pounds and generate ozone precursors emission factors. For Class 8 HDDVs, emission factors published by EPA were included in the spreadsheet instead of the emission factors

[38] TTI, Aug. 2003. San Antonio Metropolitan Statistical Area On-road Mobile Source, Emission Inventories for 1995,1999, 2002, 2005, 2007, and 2012. TCEQ. Austin, Texas.

[39] TCEQ. December 2000. Appendix J, Vehicle Idling Restriction Documentation, Houston/Galveston Attainment Demonstration and Post-1999 Rate-of-Progress SIP. Austin, Texas. Available online: http://www.tceq.state.tx.us/assets/public/implementation/air/sip/sipdocs/2000-12-HGB/00011sipapj_ado.pdf

[40] CARB, September 2005. Rulemaking: 2005-10-20, Final Statement of Reasons for Requirements to Reduce Idling Emissions from New and In-Use Trucks. Sacramento, California. Available online: http://www.arb.ca.gov/regact/hdvidle/isor.pdf

generated by the MOBILE6 run. According to the EPA, these factors represent more accurate emission rates for HDDV idling than the MOBILE6 factors.

Further, it was estimated that HDDV engines were idled three times per day. This is consistent with the results of literature research and limited interviews conducted with local truck drivers. The Houston SIP document assumes this number to be about 2 times per day for Class 8 trucks. However, frequency of short term idling for other classes of HDDVs is estimated to be more than 2 times per day due to the greater number of delivery trips they make within metropolitan areas. The 75 percent compliance rate in the following emission reduction calculation was based on the compliance rate used by the City of Sacramento.[41]

Sample Calculation

Equation (1)
Determining the fleet size for HDDV classes:

Fleet Size = VMT/ DAM

Where:

VMT = Total daily VMT for specific vehicle class (from Table 5-18)
DAM = Daily average miles for an HDDV (81.8)

Fleet Size for HDDV Class 4:
HDDV4 Fleet Size = 92,175 / 81.8
= 1,127 number of vehicles

Equation (2)
Determining VOC and NOx emissions reductions by HDDV class:

Emission Reduction (tons/day) = $\sum[[(IR_{VC} – PI) \times (EF \times FS_{VC})] / 907{,}184 \text{ g/ton}] \times CR$

Where:

IR_{VC} = Average idling rate for the vehicle class in hr/day (from Table 5-19)
PI = Permitted idling time (3 times per day, each time 5 minutes)
EF_{VC} = Emission factor for the vehicle class (g/hr)
FS_{VC} = Fleet size for the vehicle class (from Tables 5-18 and 5-19)
CR = Compliance rate (0.75)

[41] City of Sacramento. 10/23/2006. Sacramento Municipal Code, Title 8, Health and Safety, Chapter 8.116, Limitation on Engine Idling and the Operation of Transport Refrigeration Units. Available online: http://www.qcode.us/codes/sacramento

The VOC emission reduction for HDDV Class 4 vehicles is calculated as follows:

VOC Emission Reduction = [[(0.3 hr/day – 0.25 hr/day) x (1.8 g/hr x 1,127)]
= [101.43 g/day / 907,184 g/ton] x 0.75
= 0.0001 tons/day

The results of applying these calculations to all Heavy Duty Gasoline (HDG) and HDD vehicle classes are shown in the following tables. As Table 5-19 indicates, the fleet sizes for HDG vehicle classes are very small compared to the fleet sizes for HDDV classes. In addition, NOx and VOC emission reductions for HDGVs are smaller compared to HDDVs. Accordingly, some anti-idling ordinances implemented in the nation, such as the California ordinance, do not include HDGVs in their list of vehicles subject to idle restriction regulations.

The total daily emission reductions, anticipated by the implementation of a San Antonio Anti-idling Ordinance, from all HDD vehicle classes are 0.4 tons of VOC per day and 1.30 tons of NOx per day, respectively (assuming 75% compliance). These results are shown in Tables 5-18 and 5-19.

Table 5-18: 2007 Emission Reductions Resulting from San Antonio Anti-Idling Ordinance for HDDVs

Vehicle Class	Pollutant	Emission Factor	Baseline Emission tons/day	VMT	Total Idling hours/day	Average Time Idling hours/day	Fleet Size	Allowable Idling hours/day	Total Reduction tons/day
HDDV4	VOC	1.80	0.0007	92,175	338.05	0.30	1,127	0.25	0.0001
	NOx	16.38	0.0061	92,175	338.05	0.30	1,127	0.25	0.0010
HDDV5	VOC	2.15	0.0006	67,303	246.83	0.30	823	0.25	0.0001
	NOx	18.40	0.0050	67,303	246.83	0.30	823	0.25	0.0008
HDDV6	VOC	2.56	0.0030	291,158	1,067.82	0.30	3,559	0.25	0.0005
	NOx	22.94	0.0270	291,158	1,067.82	0.30	3,559	0.25	0.0045
HDDV7	VOC	3.30	0.0054	174,111	1,489.94	0.70	2,128	0.25	0.0035
	NOx	29.99	0.0492	174,111	1,489.94	0.70	2,128	0.25	0.0317
HDDV8a	VOC	42.30	0.1039	260,433	2,228.65	0.70	3,184	0.25	0.0668
	NOx	135	0.3316	260,433	2,228.65	0.70	3,184	0.25	0.2132
HDDV8b	VOC	42.30	0.7190	1,801,883	15,419.54	0.70	22,028	0.25	0.4622
	NOx	135	2.2946	1,801,883	15,419.54	0.70	22,028	0.25	1.4751
Total Reductions at 75% Compliance	VOC		0.83						0.40
	NOx		2.71						1.29

Table 5-19: 2007 Emission Reductions Resulting from San Antonio Anti-Idling Ordinance for HDGVs

Vehicle Class	Pollutant	Emission Factor	Baseline Emission tons/day	VMT	Total Idling hours/day	Average Time Idling hours/day	Fleet Size	Allowable Idling hours/day	Total Reduction tons/day
HDGV4	VOC	29.00	0.0065	55,131	202.19	0.30	674	0.25	0.0011
	NOx	5.57	0.0012	55,131	202.19	0.30	674	0.25	0.0002
HDGV5	VOC	81.79	0.0108	32,671	119.82	0.30	399	0.25	0.0018
	NOx	9.70	0.0013	32,671	119.82	0.30	399	0.25	0.0002
HDGV6	VOC	50.42	0.0212	104,137	381.92	0.30	1,273	0.25	0.0035
	NOx	8.54	0.0036	104,137	381.92	0.30	1,273	0.25	0.0006
HDGV7	VOC	36.00	0.0113	33,350	285.39	0.70	408	0.25	0.0073
	NOx	8.74	0.0027	33,350	285.39	0.70	408	0.25	0.0018
HDGV8a	VOC	41.51	0.0077	19,738	168.91	0.70	241	0.25	0.0050
	NOx	10.12	0.0019	19,738	168.91	0.70	241	0.25	0.0012
HDGV8b	VOC	30.44	0.0014	4,764	40.77	0.70	58	0.25	0.0009
	NOx	10.04	0.0005	4,764	40.77	0.70	58	0.25	0.0003
Total Reductions at 75% Compliance	VOC		0.06						0.02
	NOx		0.01						0.01

5.7: Results

Unnecessary idling consumes fuel, creates air and noise pollution, and is an inefficient use of the nation's energy supply. Controlling emissions from idling is particularly important for the San Antonio area as the region is nearing the end of its “deferred nonattainment” status for violation of national air quality standards. Due to the proximity of San Antonio to Interstate 35 and other major highways, combined with truck drivers’ tendency to use area truck stops, assessing idling emissions from heavy-duty diesel trucks becomes an important component of the region’s emission inventory and essential to efforts for bringing the region into attainment status. The EPA will formally declare the region’s status as non-attainment in 2008 if air quality does not improve sufficiently to meet EPA’s standards by the end of 2007.

The information presented in this report should assist air quality planners in their evaluation of various idle reduction policies. The analysis conducted as part of the project included identifying major commercial truck stops, picnic areas, and rest areas; calculating the emissions from idling heavy duty truck engines; geographically and temporally allocating the emissions estimates into a suitable software program to enable further analysis; and entering the emission program into a photochemical model to determine the impacts of idling emissions on ozone levels recorded at regional air quality monitors, CAMS 23, 59, 678, and 58. With the addition of HDV idling emissions to the regional emission inventory, the photochemical model predicted higher design values for 2007. As shown in Table 5-15, the greatest impact was estimated at CAMS 23 (0.05 ppb), indicating this source of pollution, if controlled, can help regional efforts to meet national air quality standards for ozone.

Further, truck stop electrification and anti-idling ordinances were discussed and presented as effective means of reducing idling emissions. As Table 5-16 indicates, increasing the supply of equipped parking spaces by 182 at regional truck stops can reduce NOx emissions by an estimated 75.52 tons and VOC emissions by an estimated 23.66 tons, annually. The benefits of electrification at selected state-owned rest areas would also be substantial and reduce NOx emissions by 51.44 tons and VOC emissions by 16.12 tons annually. This control measure merits attention of air quality planners at the State level, as rest areas are owned and maintained by the State of Texas. In addition, implementation of an ordinance by the City of San Antonio is expected to reduce emissions of VOC and NOx by 146 tons (0.4 tons per day) and 474.5 (1.30 tones per day) tons per year respectively. The ordinance will affect idling patterns of HDDVs during their operation within the San Antonio city limits boundaries; and it will set a limit of 5 minutes for each idling incidence to regulate short duration idling practices by the drivers of these vehicles.

Using GIS to Allocate Elevated Aircraft Emissions Associated with Arrivals and Departures

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ABSTRACT

Aircraft emissions from commercial airports are often a major source of emissions in urban centers. To accurately allocate aircraft emissions in photochemical models, temporal and spatial factors must be applied. This necessitates assigning airport emissions to 3-dimensional modeling grid cell system. Aircraft emissions vary by mode of aircraft operation: idling, landing, take off, and climb out up to 1,000 meters. By obtaining the percentage of landings, take-offs for each end of a runway, it was possible to assign aircraft emissions generated by applying the Emission and Dispersion Modeling System (EDMS 4.2) to specific runways for arrival and departure flights. The aircraft emissions for take off, climb out, and approach flight modes were then allocated to a 3 dimensional photochemical modeling grid-cell system. The height, latitude, and longitude of multiple nodes, within the grid system, were calculated at incremental ground distances from the end of the runway using Geographic Information Systems (GIS) software. The final step in this process was to allocate the emissions from the end of each runway using GIS.

INTRODUCTION

San Antonio International Airport (SAIA) is located approximately seven miles north of the San Antonio central business district. Emissions occur from daily operations of a diverse range of sources such as aircraft emissions, vehicles, boilers, and lawn and garden equipment. The first example, aircraft emissions, is the focus of this paper. These emissions include commercial, general aviation, and military operations. The Federal Aviation Administration (FAA) established routines and procedures for recording airport activities and operations. The following are excerpts from the FAA report entitled "Order 7210.3T, Facility Operation and administration" explaining key terms in regard to data used for the modeling of airport emissions.

"A: Airport Operations Count
The airport operations count is the statistic maintained by the control tower. Basically, it is the number of arrivals and departures from the airport at which the airport traffic control tower is located. Specifically, one airport operation count is taken for each landing and takeoff (LTO), while two airport operations counts; i.e., one landing and one takeoff, are taken for each low approach below traffic pattern altitude, stop and go, or touch and go (TGO) operation.

B: Categories Of Operations
The airport authorities will maintain airport operations data by the following categories:

a. ITINERANT: Operations not classified as "local," including the following subcategories:
   1. *Air Carrier (Commercial).*
   2. *Air Taxi (Commercial).*
   3. *Military: All classes of military operations.*
   4. *General Aviation: Civil operations not classified as air carrier or air taxi.*

b. LOCAL: Operations remaining in the local traffic pattern, simulated instrument approaches at the airport and operations to or from the airport and a practice area within a 20-mile radius of the tower.
    1. *Military: All classes of military operations.*
    2. *Civil: All civilian operations, including local flights by air carrier and air taxi aircraft"* (General Aviation).[1]

METHODOLOGY

In the 2005 Emissions Inventory for the San Antonio area, aircraft emissions for the SAIA were calculated using the Emission & Dispersion Modeling System (EDMS) version 4.21.[2] All emission factors and estimation techniques used in EDMS are based on EPA-approved methodologies. Data on aircraft flight activities was collected from the "FAA/FPA Terminal Area Forecast" (TAF) software and "Airport IQ Data Center" Internet site, a web-based flight activity tracking and reporting software for all U.S. airports.

Based on the information indicated in the TAF database, the airport activity levels reached a total of 244,589 operations for "local" and "itinerant" categories in the year 2005 indicating a 2.6% decline in the aircraft operations from 1999 levels. Information on local and itinerant aircraft activities gathered from these sources was entered into the EDMS model to estimate the amount of pollutants attributed to aircraft activities.

Commercial Aircraft Operations

The data collected from the Internet site "Airport IQ Data Center" included operation data on commercial and civilian aircraft by landing/take off cycles and aircraft type for 2003 and part of 2004. To project to 2005, data from the TAF software was used. The 2005 forecast total for commercial operations was compared to the 2003 commercial operations to estimate a growth ratio, which was applied to the aircraft by type.

Table A in Appendix A contains a list of the type and activity level of commercial "air carrier" and "commuter" aircraft that were used in the analysis of commercial aircraft emissions for the year 2005. In cases where the exact aircraft type was not available in the EDMS software, a comparison of aircraft types was made with those of the EDMS 4.21 default aircraft categories to match the most compatible engine types. In two instances, a user-defined aircraft was created because the EDMS database contained no equivalent aircraft types.

General Aviation Operations

Based on information extracted from TAF software, a total of 107,903 general aviation aircraft operations were forecasted for SAIA (2005). The GA operations were divided into three types, Jet[3], Turbo-Prop[4], and Piston[5], based on the percentage of total GA operations in 2003. The results are shown in Table 1.

Table 1. 2003 Percentage of GA Operations at the SAIS with 2005 LTO Cycles and Operations

Aircraft Type	2003 Percentage of Total GA Operations	2005 Total LTO Cycles	2005 Operations by Engine type
Jet	47.8%	25,783	51,566
Turbo-Propeller	15.4%	8,323	16,646
Piston	36.8%	19,844	39,688
Total	100.0%	53,950	107,900*

*Due to rounding, the total for this column may appear slightly different from that of TAF software.

Tables B, C, and D in Appendix A list the type and activity level of GA aircraft that were used in the SAIA emissions analysis for the year 2005. When the exact aircraft type was not available in EDMS, an equivalent aircraft type, which had similar engine(s), was used. In five cases, a user-defined aircraft was created for this category because equivalent aircraft were not available in the EDMS database.

Military Aircraft Operations

The military utilizes the SAIA facilities for training purposes; TAF software maintains records on military activities at SAIA. Table 2 contains flight characteristics for military operations occurring at SAIA, which were used as input data to the EDMS model for the calculation of emissions from military aircraft activities.

Table 2. 2005 Military Aircraft Activity at the SAIA

Aircraft	LTO	TGO	Total
T-43	0	4,048	4,048
T-34/T-37	238	0	238
F-16	0	1,079	1,079
C-130	39	347	386
C-21	52	90	142
Total	329	5,564	5,893

Table 3 contains the estimated emissions from aircraft listed by aircraft category. Commercial aircraft was the largest emission source followed by military and GA-jet. These emissions estimations were used to geo-code the emissions spatially and temporally.

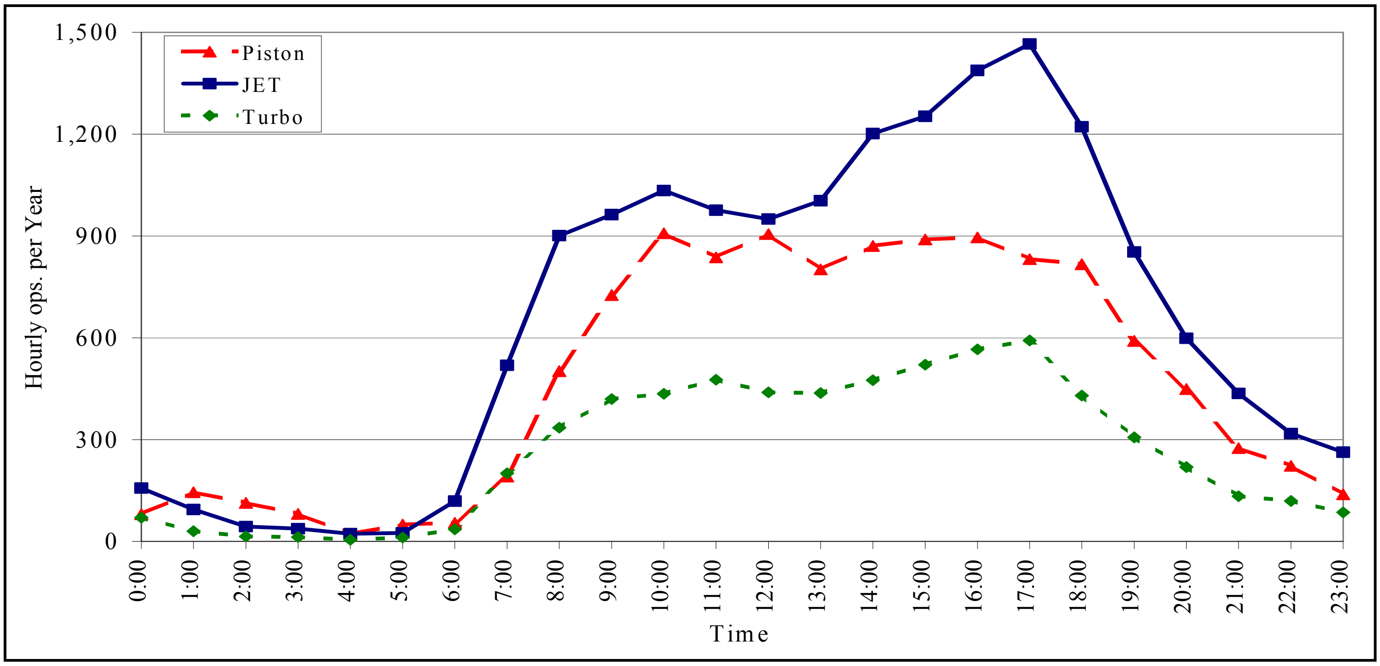
Table 3. 2005 Emissions by Aircraft Category and Mode

Aircraft Category	VOC (tons/day)			NOx (tons/day)		
	Take Off	Climb Out	Approach	Take Off	Climb Out	Approach
Commercial	0.003	0.004	0.015	0.438	0.290	0.206
Military	0.002	0.002	0.019	0.037	0.024	0.026
GA – Jet	0.001	0.001	0.014	0.035	0.022	0.021
GA – Turbo-Prop	0.000	0.000	0.004	0.002	0.001	0.004
GA – Piston	0.001	0.001	0.002	0.000	0.001	0.001
Total	0.007	0.008	0.054	0.512	0.338	0.259

Temporal Allocation

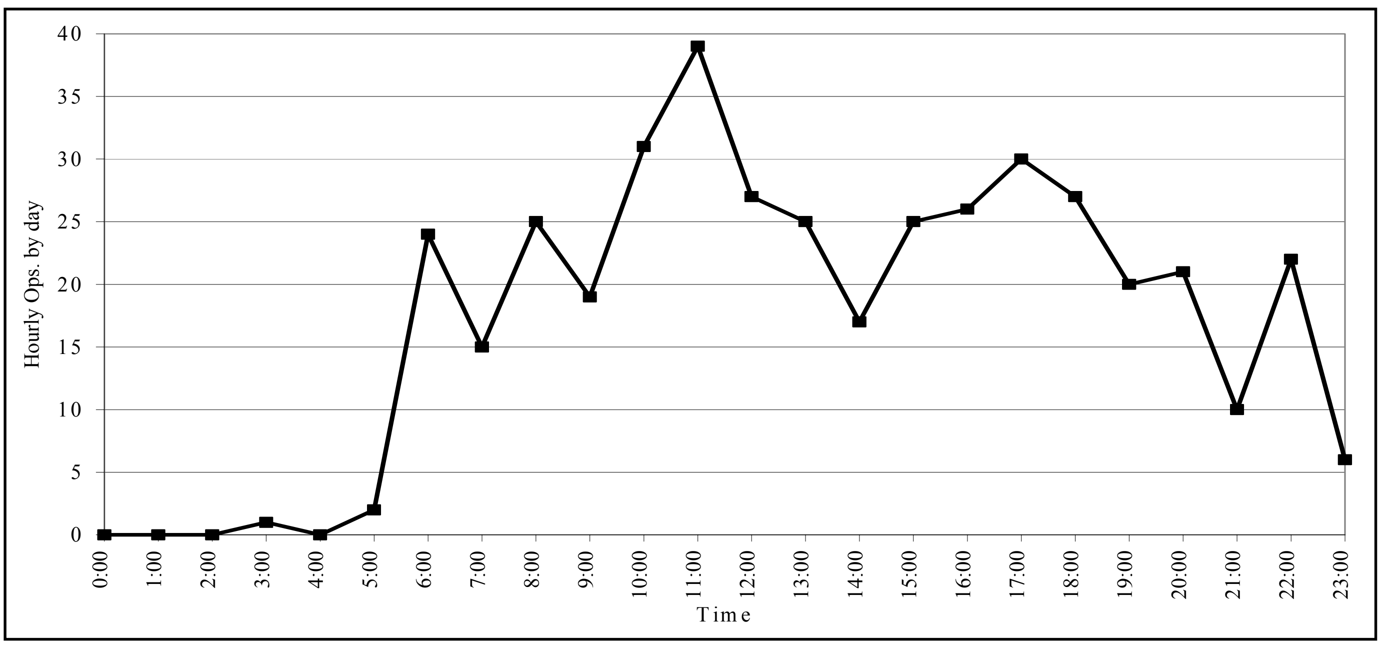
Processing emissions in a photochemical model includes such steps as chemical speciation, temporal allocation, and spatial allocation of emissions data. These steps require the conversion of aircraft emissions data to a grid-cell based modeling system and the conversion of daily emissions data to hourly data as required by the photochemical model. In Figure 1, the hourly temporal distribution of annual arrival and departure times for GA aircrafts are displayed graphically.

Figure 1. 2005 Hourly Distribution of General Aviation Operations by Aircraft Type at SAIA



Air career flight schedules for September 2005 were analyzed to determine the temporal distribution, as well as the peak hours of arrival and departure times for commercial flights. The results indicated that the commercial arrival and departure pattern varied from that of GA operations; while the peak hour for the GA flights is around 5:00 pm, the peak hour for the commercial flights is around 12:00 noon. The commercial hourly distribution is shown in the Figure 2.

Figure 2. Hourly Distribution of September 2005 Commercial Aircraft Operations at SAIA



Spatial Allocation

Information on runway patterns of specific aircraft traffic was obtained from the San Antonio Department of Aviation for use in the spatial allocation of aircraft emissions. The information provided the percentages of take off and landings that take place at each end of the runways, annually, and made it possible to assign EDMS generated aircraft emissions to each end of the runways for arrival and departure flights. Table 4 contains the breakdown by aircraft type for departure and arrival.

Table 4. Percentage of Aircraft Operations Allocated by Runway and Direction

Runway	Departure				Arrival			
	Commercial	Jet	Turbo	Piston	Commercial	Jet	Turbo	Piston
RW 12R	45%	61%	58%	51%	74%	70%	72%	58%
RW 12L	0%	3%	1%	4%	0%	2%	5%	13%
RW 21	2%	2%	2%	4%	3%	2%	2%	4%
RW 30R	0%	0%	2%	3%	0%	0%	1%	4%
RW 30L	14%	18%	14%	11%	13%	15%	11%	10%
RW 3	38%	16%	23%	27%	10%	11%	9%	11%
Total	99%	100%	100%	100%	100%	100%	100%	100%

To calculate hourly emissions by runway and aircraft classification, the following formula (Equation 1) was used:

Equation (1) Emissions in tons/hour (VOC and NOx) = PAO x EM x HR

where PAO = percentage of aircraft operations allocated by runway and aircraft category (Table 4)
EM = emission by mode for each aircraft type (Table 3)
HR = percentage of operations for each hour (Figure 2)
= (operations per desired hour ÷ total operations per day)

Example (1) Take off emissions calculation for commercial flights at 12:00 noon on runway 12R (NOx Emissions):

12R Take off Emissions (12 p.m.) = 45% x 0.438 tons/day x (27 ops/hr ÷ 409 ops/day)
= 45% x 0.438 tons/day x 0.066 days/hr
= 0.013 tons NOx/hour at 12:00 noon

In the next step, aircraft emissions for flight modes of take-off (0 – 1,000 feet ≅ 0 – 305 meters), climb out (1,000 – 3,000 feet ≅ 305 – 914 meters), and approach (3,000 – 0 feet ≅ 914 – 0 meters), were allocated to the Comprehensive Air Quality Model with Extensions (CAMx)[6] photochemical grid-cell system. Emissions from aircraft above 3,000 feet in elevation were not calculated. At those elevations, aircraft are usually above the mixing height for San Antonio and emissions would have a minor impact on ground-level ozone formation.

To allocate emissions to the CAMx grid cells, height, latitude, and longitude were calculated for 8 nodes at incremental ground distances from the ends of each runway. The GIS software TransCAD[8] was utilized for this purpose. Figure 3, which provides a diagram of the layout and dimensions of runways at SAIA, was used to calculate the latitude and longitude of each node.[7] The diagram also shows the location of each runway used in the calculations.

Figure 3. SAIA Runway Schematic

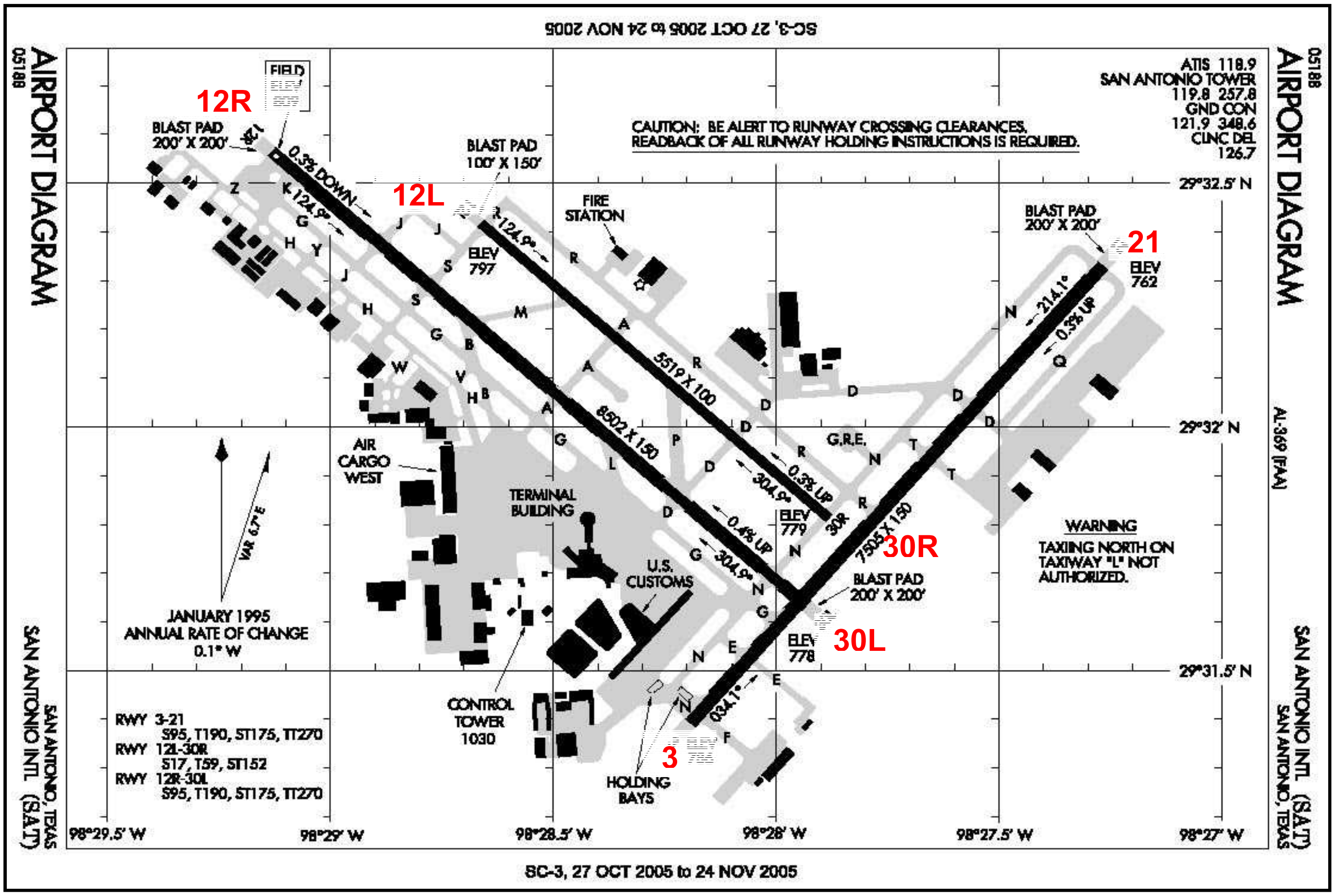


Figure 4. Aerial View of Calculated Nodes

Figure 4 was generated as part of the quality assurance process. The figure shows the nodes superimposed on an aerial photo of the airport, illustrating the horizontal location and distance of these nodes relative to both ends of each runway. In addition, grid cells are displayed in light green. As anticipated, the nodes form straight lines from the ends of the runways; planes usually do not bank (turn) until the plane is at least 5 km from the airport.

After consulting with staff of the Texas Commission on Environmental Quality (TCEQ) and applying EDMS defaults for landing, aircraft landing angles were set at 3º and departure angles were set at 9º. These angles are the same as those used previously in versions of the Dallas State Implementation Plan for the Dallas/Fort Worth International Airport.

This information, in addition to the formula below, was used in TransCAD to locate 8 nodes within the CAMx horizontal and vertical grid cells to replicate the 3-dimensonal paths of aircraft. The aircraft emissions per runway were then equally distributed and allocated to these nodes.

Equation (2) $\text{Node Height} = D \times \text{TAN}(9 \times \text{PI} \div 180)$

where D = ground distance from the runway end point
TAN = tangent of 9° for take off and climb out; tangent of 3° for landing
PI = mathematical constant pi (≈3.14159)

Table 5 contains the height, latitude, and longitude of nodes for runway 3/21. Four nodes were used to allocate take off and climb out emissions. For landing emissions, six nodes were used. These were spaced in 1,000-meter increments from the end of the runway. The height of the landing nodes starts at 264 meters (which is the height of the plane at 5,000 meters ground distance from the airport) due to the uncertainty of aircraft direction before the aircraft gets within this distance of the airport.

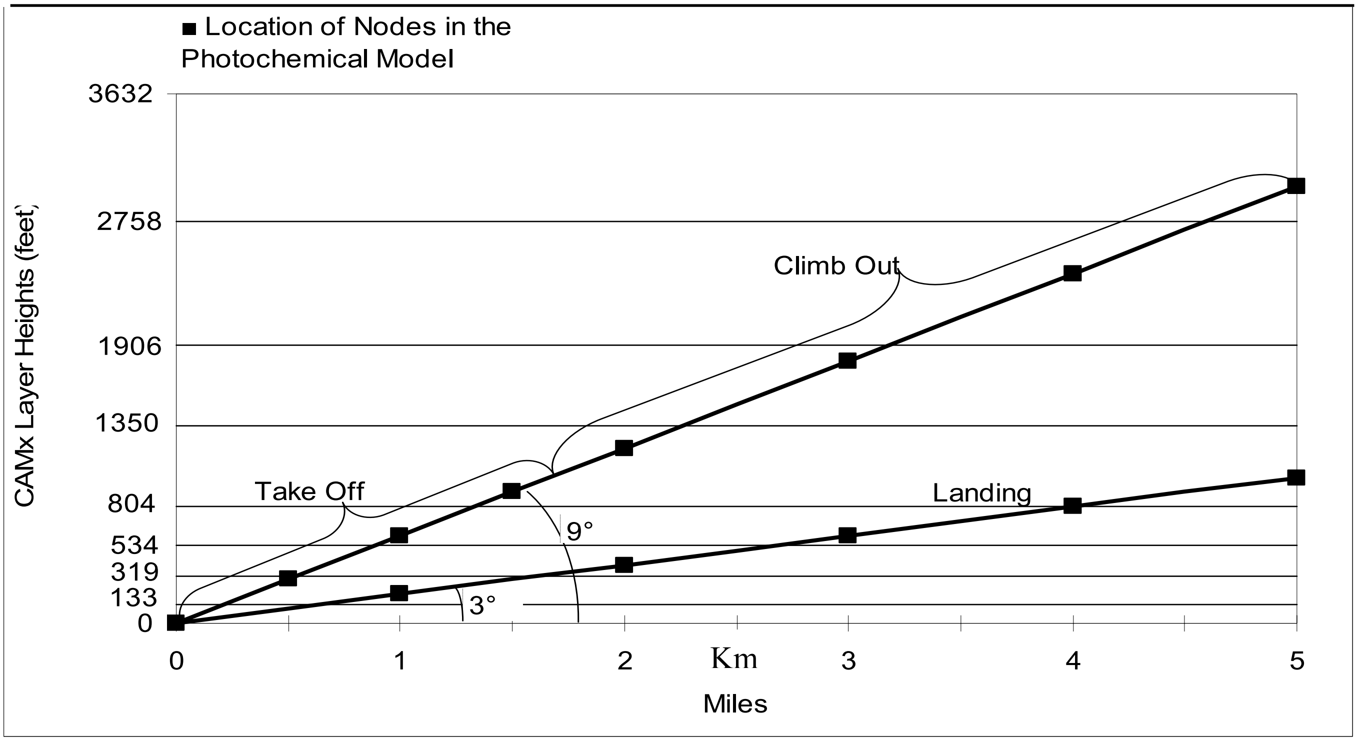
Table 5. Heights of Selected Nodes for Take off and Landing Operations at Runway 3/21

Runway Nodes (Direction)	Distance from End of Runway (m)	Latitude (Y coordinate)	Longitude (X Coordinate)	Node Height (m) for 9º - Take off	Node Height (m) for 9º - Climb out	Node Height (m) for 3º - Landing
Runway 3 Nodes (Northeast)	0	-1157.69	150.96	0	N/A	0
	500	-1157.31	151.27	79	N/A	N/A
	1,000	-1156.94	151.58	158	N/A	53
	1,500	-1156.56	151.89	238	N/A	N/A
	2,000	-1156.18	152.20	N/A	317	106
	3,000	-1155.43	152.83	N/A	475	158
	4,000	-1154.68	153.45	N/A	634	211
	5,000	-1153.92	154.08	N/A	792	264
Runway 21 Nodes (Southwest)	0	-1159.41	149.53	0	N/A	0
	500	-1159.79	149.22	79	N/A	N/A
	1,000	-1160.17	148.90	158	N/A	53
	1,500	-1160.54	148.59	238	N/A	N/A
	2,000	-1160.92	148.28	N/A	317	106
	3,000	-1161.67	147.66	N/A	475	158
	4,000	-1162.43	147.03	N/A	634	211
	5,000	-1163.18	146.41	N/A	792	264

N/A: these nodes were not used to allocate emissions

A graphic illustration of the vertical height by the three different aircraft modes and CAMx vertical grid layers is shown in Figure 5. Aircraft emissions were allocated to the first 8 vertical layers of the CAMx modeling grid system. Once the emissions were geocoded to correct location and height, the data was converted to a format suitable for photochemical modeling.

Figure 5. Calculated Heights of Nodes for LTO Operations at End of Runways*



*Note: Angles in diagram are for illustration purposes only and are not to scale.

CONCLUSION

Aircraft operations at the SAIA are a major source of emissions in the region. Aircraft emissions were found to vary by hour and location, depending on flight schedules and runways in use. By utilizing temporal and spatial factors obtained from TransCAD, the accuracy of aircraft emission allocations used in the photochemical modeling grid-system was improved. Allocating aircraft emissions to a 3-dimensional photochemical modeling grid system, through the use of GIS software, increases the accuracy of the model's predictive capabilities in terms of ozone formation and the effectiveness of control strategies.

The emission estimation methodology described in this paper is applicable to all airports, regardless of size. However, improvements to emission methodologies at larger airports, such as John F. Kennedy International Airport in New York and Hartsfield-Jackson Atlanta International Airport, are particularly crucial since the heavy traffic associated with these airports means larger aircraft emission inventories. Three-dimensional modeling improves the accuracy of aircraft emissions estimates at these airports, as well as smaller airports. Further research on this topic should include examining the impact of elevated aircraft emissions on photochemical modeling results.

APPENDIX A
Aircraft Types used in the Calculations

Table A. 2005 Commercial Aircraft Type and Arrival Activity at SAIA

Type	Number of LTO Cycles	Aircraft Name	Number of Engine	Engine Type	Equivalent Aircraft Used in Modeling
A306	550	AIRBUS - A-300B4 - 600	2J/H		
A30B	1	AIRBUS - A-300B4 - 600b	2J/H		A306
A310	107	AIRBUS - A-310 (CC-150 Polaris)	2J/H		
A319	2,640	AIRBUS - A-319, ACJ	2J/L		
A320	87	AIRBUS - A-320	2J/L		
A321	9	AIRBUS - A-321	2J/L		
A331	1	AIRBUS - A-331	2J/L		A-330
AC11	1	Rockwell - Commander	1P/S		
AC90	1	Gulfstream - 690 Jetprop Commander	2T/S	TPE 331	Swearingen Merlin
AC9L	1	Gulfstream Aerospace	2T/S	TPE 331	Swearingen Merlin
AT43	7	Aerospatiale - ATR-42-200/300/320	2T/L		ATR42
B190	276	Beech - 1900 (C-12J)	2T/S+	PT6A-65B	BH-1900
B350	14	Beech - B300 Super King Air 350	2T/S+		
B712	691	Boeing - 717-200	2J/L		
B721	8	Boeing - 727-100 (C-22)	3J/L		
B722	218	Boeing - 727-200	3J/L		
B727	6	Boeing – 727	3J/L		B721
B72Q	569	Boeing - 727 Stage 3 (-100 or -200)	3J/L		B721
B732	1,581	Boeing - 737-200 (Surveiller, CT-43)	2J/L		
B733	11,094	Boeing - 737-300	2J/L		
B734	12	Boeing - 737-400	2J/L		
B735	3,527	Boeing - 737-500	2J/L		
B737	2,971	Boeing - 737-700	2J/L		
B738	972	Boeing - 737-800, BBJ2	2J/L		
B739	94	Boeing - 737-900	2J/L		
B73Q	5,793	Boeing - B737 Stage 3	2J/L		B737
B741	5	Boeing - 747-100	4J/H		
B742	11	Boeing - 747-200 (E-4, VC-25)	4J/H		
B744	4	Boeing - 747-400 (International, winglets)	4J/H		
B752	1,566	Boeing - 757-200 (C-32)	2J/L		
B753	165	Boeing - 757-300	2J/H		
B757	1	Boeing – 757	2J/H		B752
B762	172	Boeing - 767-200	2J/H		
B763	9	Boeing - 767-300	2J/H		
B764	6	Boeing - 767-400	2J/H		
B772	2	Boeing - 777-200	2J/H		
BE10	1	Beech - 100 King Air	2T/S		
BE18	102	Beech - Twin Beech 18/Super H18	1P/S	O-200	Cessna 150
BE19	1	Beech - 19 Musketeer Sport, Sport	1P/S	IO-360-B	Cessna 172
BE20	63	Beech - 200 Super King Air	2T/S+		
BE30	2	Beech - Super King Air300	2T/S+		
BE33	2	Beech - 33 Debonair	1P/S	IO-360-B	Cessna 172
BE35	9	Beech - 35 Bonanza	1P/S	O-200	Cessna 150
BE36	20	Beech - 36 Bonanza	1P/S	IO-360-B	Cessna 172
BE3B	1	Beech - B300 Super King Air 350	2T/S+		
BE40	285	Beech - 400 Beechjet	2J/S+		
BE55	5	Beech - 55 Baron	2P/S	IO-360-B	Cessna T337
BE58	13	Beech - 58 Baron	2P/S	IO-360-B	Cessna T337
BE60	1	Beech - 60 Duke	2P/S	IO-360-B	Cessna T337

Type	Number of LTO Cycles	Aircraft Name	Number of Engine	Engine Type	Equivalent Aircraft Used in Modeling
BE90	1	Beech - King Air C-90	2P/S	IO-360-B	Cessna T337
BE9L	11	Beech - 90, A90 to E90 King Air (T-44)	2T/S		
C172	8	Cessna - 172	1P/S		
C177	1	Cessna - 177, Cardinal	1P/S	O-200	Cessna 150
C182	6	Cessna - 182	1P/S	O-200	Cessna 150
C206	14	Cessna - 206, Super Skywagon	1P/S	O-200	Cessna 150
C208	1,472	Cessna - 208 Caravan 1	1T/S		
C210	20	Cessna - 210, T210, Centurion	1P/S	O-200	Cessna 150
C310	6	Cessna - 310, T310 (U-3, L-27)	1P/S	IO-360-B	Cessna 172
C340	1	Cessna – 340	2P/S	IO-360-B	Cessna T337
C401	127	Cessna – 401	2P/S	IO-360-B	Cessna T337
C402	325	Cessna - 401, 402, Utililiner, Businessliner	2P/S	IO-360-B	Cessna T337
C404	4	Cessna - 404 Titan	2P/S	IO-360-B	Cessna T337
C414	2	Cessna - 414	2P/S	IO-360-B	Cessna T337
C421	2	Cessna - 421, Golden Eagle	2P/S	IO-360-B	Cessna T337
C425	1	Cessna - 425, Corsair, Conquest 1	2T/S	PT6A-112	User Defined Aircraft
C500	2	Cessna - 5000 Citation, Citation 1	2J/S		
C501	1	Cessna - 501 Citation 1SP	2J/S		C500
C525	62	Cessna - Citationjet 525	2J/S	FJ44-1A	C500
C550	127	Cessna – Citation 2	2J/S+		
C56	2	Lockheed - C-56 Loadstar	2T/S+	ARMY - Historical	Beech - B300 Super King Air 350
C560	354	Cessna - 560 Citation 5	2J/S+		
C56X	280	Cessna - 560 Citation 5	2J/S+		C560
C650	197	Cessna – Citation 3	2J/S+	CF34-3A	CL601-3A
C72R	1	Cessna - 172RG, Cutlass RG	1P/S		C172
C750	377	Cessna - 750 Citation 10	2J/S+		
CJR9	1	Unknown	0		Cessna 172
CL30	1	Bombardier – BD-100 Challenger 300	2J/S+	AS-907	400 Beechjet
CL60	111	Canadair - CL-600 Challenger	2J/L	CF34-3A	CL601-3A
CL64	1	Canadair - CL-600 Challenger	2J/L	CF34-3A	CL601-3A
CR2	1	Crossair	2J/S+		400 Beechjet
CRJ	1	Canadair - 850 Bombardier	2J/L		CL601-3A
CRJ1	299	Canadair - CL-600 Regional Jet CRJ-100	2J/L		
CRJ2	5,611	Canadair - Regional Jet 100/200	2J/L		CRJ1
CRJ7	584	Canadair - CL-600 Regional Jet CRJ-700	2J/L		
CRJ9	950	Canadair - CL-600 Regional Jet CRJ-900	2J/L		
CVLT	8	Convair - CV-580	2T/S+	NAVY - Historical	Beech - B300 Super King Air 350
D328	5	Dornier – 328	2T/S+		
DC10	270	McDonnell-Douglas - DC-10	3J/H		
DC3	1	McDonnell-Douglas - Skytrain	2P/S+	PT6A-65B	BH-1900
DC8	4	McDonnell-Douglas - DC-8	4J/H		
DC87	1	McDonnell-Douglas - DC-8-70	4J/H		
DC8Q	224	McDonnell-Douglas - DC-8 Stage 3	4J/H		DC8
DC9	12	McDonnell-Douglas - DC-9	2J/L		DC91
DC91	15	McDonnell-Douglas - DC-9-10	2J/L		
DC93	166	McDonnell-Douglas - DC-9-30 (C-9)	2J/L		
DC94	12	McDonnell-Douglas - DC-9-40	2J/L		
DC95	12	McDonnell-Douglas - DC-9-50	2J/L		

Type	Number of LTO Cycles	Aircraft Name	Number of Engine	Engine Type	Equivalent Aircraft Used in Modeling
DC9Q	358	McDonnell-Douglas - DC-9 Stage 3	2J/L		DC91
DR20	1	Unknown	0		Cessna 172
E110	503	Embraer - 110/111 Bandeirante (C-95)	2T/S+		
E120	4	Embraer - EMB-120 Brasilia (VC-97)	2T/S+		
E135	33	Embraer - EMB-135	2J/L		
E140	1	Embraer - EMB-140	2J/L		
E145	1,868	Embraer - EMB-145, ERJ-145	2J/L		
E45X	735	Embraer - EMB-145XR	2J/L		E145
F100	627	Fokker - 100	2J/L		
F2TH	87	Dassault - Breguet - Falcon 2000	2J/S+		
F900	2	Dassault – Falcon 900	3J/L	TFE731	Falcon 20 - 3
FA10	2	Dassault – Falcon (Mystere) 10	2J/S+		FA20
FA20	82	Dassault – Falcon (Mystere) 20	2J/S+		
FA50	38	Dassault – Falcon 50	3J/S+		
FJ2	1	Hawker Sea Fury	1T/S+	ARMY - Historical	Porter PC6/B2
GALX	40	Israel IAI-1126 Galaxy - 1126	2J/S+		
GL25	1	F 104 Starfighter	1J/S+	ARMY - Historical	A-7E Corsair
GLEX	1	Bombardier - BD-700-1A10	2J/S+		
GLF2	2	Gulfstream Aerospace - C-20J,/VC-111	2J/L		
GLF3	2	Gulfstream Aerospace	2J/L		
GLF4	25	Gulfstream Aerospace	2J/L		
GLF5	1	Gulfstream Aerospace G-V Gulfstream V	2J/L		
GLS4	1	Unknown	0		Cessna 172
H125	1	British Aerospace - Hawker Siddeley 125	2J/S+		
H25	2	British Aerospace	2J/S+		
H25A	8	British Aerospace - BAe HS 125 Series	2J/S+		
H25B	238	British Aerospace - BAe-125-700/800	2J/S+		
H25C	77	British Aero. - Hawker Siddel. HS 125	2J/S+		
HS25	1	British Aero. - Hawker Siddel. HS 125	2J/S+		
J328	4	Fairchild Dornier - 328JET, Envoy 3	2J/S+		
LJ23	1	Bombardier - Learjet 23	2J/S	TFE731-2-2B	Learjet 35/36
LJ24	28	Bombardier - Learjet 24	2J/S+		
LJ25	75	Bombardier - Learjet 25	2J/S+		
LJ31	28	Bombardier - Learjet 31	2J/S+		
LJ35	498	Bombardier - Learjet 35	2J/S+		
LJ36	1	Bombardier - Learjet 36	2J/S+		Learjet 35/36
LJ45	79	Bombardier - Learjet 45	2J/S+	TFE731-2-2B	Learjet 35/36
LJ55	39	Bombardier - Learjet 55	2J/S+	TFE731-2-2B	Learjet 35/36
LJ60	110	Bombardier - Learjet 60	2J/S+	TFE731-2-2B	Learjet 35/36
LR24	1	Bombardier - Learjet 24	2J/S		
LR25	1	Bombardier - Learjet 25	2J/S+		
LR31	2	Bombardier - Learjet 31	2J/S+		
LR35	6	Bombardier - Learjet 35	2J/S+		Learjet 35/36
LR36	1	Bombardier - Learjet 36	2J/S+		Learjet 35/36
LR45	1	Bombardier - Learjet 45	2J/S+	TFE731-2-2B	Learjet 35/36
LR60	2	Bombardier - Learjet 60	2J/S+	TFE731-2-2B	Learjet 35/36
M20	1	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172
M20J	1	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172

Type	Number of LTO Cycles	Aircraft Name	Number of Engine	Engine Type	Equivalent Aircraft Used in Modeling
M20K	1	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172
M20P	6	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172
MD10	141	McDonnell-Douglas - MD-10	3J/H		DC10
MD11	28	McDonnell-Douglas - MD-11	3J/H		
MD80	1,763	McDonnell-Douglas - MD-80	2J/L		
MD81	46	McDonnell-Douglas - MD-81	2J/L		
MD82	6,489	McDonnell-Douglas - MD-82	2J/L		
MD83	1,388	McDonnell-Douglas - MD-83	2J/L		
MD87	13	McDonnell-Douglas - MD-87	2J/L		
MD88	8	McDonnell-Douglas - MD-88	2J/L		
MD90	1	McDonnell-Douglas - MD-90	2J/L		
MO20	1	Mooney Aircraft - Mark 20	1P/S	IO-360-B	Cessna 172
MU2	504	Mitsubishi Aircraft - MU-2, Marquise	2T/S	PT6A-65B	BH-1900
MU2B	1	Mitsubishi Aircraft - MU-2, Marquise	2T/S	PT6A-65B	BH-1900
MU30	1	Mitsubishi Aircraft - MU-300 Diamond	2J/S+		
MX7	1	Mitsubishi Aircraft - Super Rocket, Star	1P/S	0-360-C1F	Cessna 172
P180	1	Piaggio - P-180 Avanti	2T/S	PT6A-66	BH-1900
P28A	8	Piper - Archer, Cadet, Cherokee	1P/S		
P28R	2	Piper - Archer, Cadet, Cherokee	1P/S		
P32T	1	Piper - Lance 2	1P/S	IO-360-B	Cessna 172
P46T	12	Piper - PA-46-500TP Malibu Meridian	1P/S	IO-360-B	Cessna 172
PA24	1	Piper - Comanche	1P/S	IO-360-B	Cessna 172
PA27	5	Piper - PA-23-235/250 Aztec	2P/S		
PA28	4	Piper - Archer, Cadet, Cherokee	1P/S		
PA30	8	Piper - PA-30/39 Twin Comanche	2P/S	IO-360-B	Cessna T337
PA31	11	Piper - Navajo, Navajo Chieftain, Chieftain	2P/S		
PA32	39	Piper - PA-32 Cherokee Six, Six, Saratoga	1P/S	IO-360-B	Cessna 172
PA44	1	Piper - Seminole, Turbo Seminole	2P/S	IO-360-B	Cessna T337
PA46	9	Piper - Malibu, Malibu Mirage	1P/S	IO-360-B	Cessna 172
PA60	1	Piper - Aerostar	2P/S	IO-360-B	Cessna T337
PAY2	1	Piper - PA-31T-620.T2-620	2T/S	PT6A-45	ATR42-400
PC12	40	Pilatus Flugzaugwerke PC-12, Eagle	1T/S	PT6A-67B	User Defined Aircraft
PRM1	18	Beech - Premier 1, 390	2J/S+	FJ442A	400 Beechjet
R722	2	Boeing - 727-200RE Super 27	3J/L		
SBR1	6	Rockwell - NA-265 Sabre 40/60/65	2J/S+	JT8D-7	400 Beechjet
SF34	428	Saab - SF-340	2T/S+		
SH36	6	Short Brothers - 360, SD3-60	2T/S+		
SR20	1	Cirrus - SR20	1P/S	IO-360-B	Cessna 172
SW2	4	Fairchild - Merlin 2	2T/S	TPE 331	Swearingen Merlin
SW3	92	Fairchild - Merlin 3, Fairchild 300	2T/S+	TPE 331-3	Swearingen Metro 2
SW4	344	Fairchild - SA-226AC, SA-227 Metro	2T/S+	TPE 331-3	Swearingen Metro 2
T38	2	Northrop - T-38, AT-38 Talon	2J/S+	TFE731-2-2B	Learjet 35/36
TB7	1	Grumman – Avenger	1T/S+	ARMY - Historical	Porter PC6/B2
WW24	2	IAI/Gulfstream - 1124 Westwind	2J/S+		
Total	62,452*				

*Due to rounding of aircraft operations, this total is slightly different than the total operations used in the EDS model.

Table B. 2005 GA Operations for Jet Engines at SAIA

Aircraft Name	Engine Type	Number of LTO Cycles
Bell 206 (Helicopter)	250B17B	170
Beechjet 400	JT15D-5 (A & B)	874
Premier 1390	JT15D-5 (A & B)	64
B747-200	JT9D-7Q	21
B737-700	CFM56-7B22	43
B757-200	PW2037	43
Bombardier CRJ700	CF34-8C1	362
Learjet 24D	CJ610-6	213
Learjet 25B	CJ610-6	852
Learjet 31	TFE731-2	916
Learjet 35/36	TFE 731-2-2B	3,346
BAE 125-700	TFE731-3	2,131
CL601-3A	CF34-3A	511
560 Citation V	JT15D-5 (A & B)	3,260
CITATION X	AE3007C	469
CL601-3A	CF34-3A	767
500 Citation	JT15D-1A & 1B	5,114
Falcon 2000EX	PW308C	170
Falcon 20	CF700-2D	1,214
Falcon 50	TFE731-3	490
Gulfstream V	BR700-710A1-10 Gulf V	256
Gulfstream IV	TAY Mk611-8	1,108
IAI 1124	TFE731-3	1,215
C-141	TF33-P-3/103	192
MU-300	JT15D-4 (B, C, D)	234
Rockwell 265 Sabre	JT15D-5 (A & B)	256
Galaxy (IAI) G200	PW306A	1,492
Total		25,783

Table C. 2005 GA Operations for Turbo-Prop Aircraft at SAIA

Aircraft Name	Engine Type	Number of LTO Cycles
TBM TB-700 Aerosp	User Defined Aircraft	602
Beech King Air 100	PT6A-28	498
Beech King Air 200	PT6A-41	1,432
Beech King Air 90	PT6A-28	2,926
Beech King Air 350	PT6A-60, -60A, -60AG	851
C425	User Defined Aircraft	228
Cessna 441 Conquest2	TPE331-8	602
Swearingen Metro 2	TPE331-3	436
Swearingen Merlin	TPE331-3	394
BH-1900	PT6A-65B	333
PC12	User Defined Aircraft	21
TBM TB-700 Aerosp	User Defined Aircraft	602
Total		8,323

Table D. 2005 GA Operations for Piston Aircraft at SAIA

Aircraft Name	Engine Type	Number of LTO Cycles
Aztec	TIO-540-J2B2	32
Cessna T337	IO-360-B	6,335
Cherokee six	TIO-540-J2B2	645
Twin Comanche	IO-320-D1AD	129
Twin Beech 18	User Defined Aircraft	97
Cessna 150	O-200	3,224
Cessna 172 Skyhawk	IO-360-B	7,625
Cessna 208 Caravan	PT6A-114	113
Piper PA-28	O-320	951
PA-31T Cheyenne	PT6A-28	580
Rockwell Commander	IO-360-B	113
Total		19,844

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KEY WORDS

Aircraft
Upper Aircraft Emissions
Emission Inventory
GIS

Refining Commercial Lawn and Garden Equipment Population and Emission Estimates

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ABSTRACT

In the past, San Antonio region off-road emission inventories of commercial lawn and garden equipment contained inaccuracies in equipment counts and usage rates. A wide variety of businesses and agencies use lawn and garden equipment, causing the NONROAD model default values for emissions calculations to be inappropriate in some cases. The accuracy of lawn and garden equipment counts and usage rates increases with the use of local data acquired through surveys. Additionally, the accuracy of emissions calculations for this category also increased with the subdivision of the category into user types, such as commercial business, golf courses, or public schools. User types were then surveyed to determine local lawn and garden usage rates and equipment population in the San Antonio region for the year 2005.

Through analysis of the surveyed data, usage rates were found to differ significantly from usage rates provided through NONROAD model defaults. Survey results from some categories, such as Turf and Tiller equipment, reflected usage rates less than 10% of those of the NONROAD model defaults; whereas, categories such as Rear Mowers and Front Mowers, surveyed equipment usage was 200% more than that of the NONROAD model defaults. Thus, adjustments were made to the equipment populations in the NONROAD 2004 model based on the percent difference between the survey results and the NONROAD model defaults. Emissions were then geocoded by user type locations.

INTRODUCTION

In the past, off-road emission inventories of commercial lawn and garden equipment frequently contained inaccuracies in equipment counts and usage rates. In the San Antonio region, NONROAD model[1] default values for lawn and garden emission calculations were found to be inappropriate due to varying usage rates and the wide variety of businesses and agencies using lawn and garden equipment. However, the accuracy of lawn and garden equipment counts and usage rates can be increased with the use of local data acquired through surveys.

Facility types may use selected equipment at differing rates; for example, chainsaws are used more heavily in parks. When considering daily allocation of equipment usage, some sources, such as Public Schools, do not use lawn and garden equipment on weekends, while the opposite is true for other sources, such as Golf Courses. Consequently, when comparing usage rates determined by survey to usage rates determined by NONROAD model defaults, various equipment categories exhibited significant differences. Since commercial lawn and garden equipment emits over 6 tons of volatile organic compounds and almost 2 tons of nitrogen oxides a day in the San Antonio area, it is important to develop a methodology that produces accurate emissions estimations.

Commercial Lawn and Garden equipment for San Antonio was divided into the following 10 usage types as part of the process to increase equipment counts and usage estimates:

- Commercial Lawn and Garden Companies (both for residential properties and commercial properties),
- Golf Courses,
- Public Schools,
- Universities/Colleges,
- Non-Military Government Facilities, Parks, and Hospitals,
- Other Commercial Companies,
- Cemeteries,
- Private Airports,
- Commercial Airports, and
- Military Facilities (Army and Air Force Bases).

This paper will cover lawn and garden equipment emissions from commercial companies, golf courses, public schools, universities/colleges, non-military government facilities, other commercial companies, private airports, and commercial airports. Cemetery lawn and garden equipment was not calculated because emissions are insignificant, as cemeteries do not cover a large improved land area in the San Antonio region. Also, the low survey response rate from cemeteries would not provide a statistically significant difference. Emissions from military lawn and garden equipment are based on a different methodology and are also not included in this paper.

Lawn and garden equipment emissions estimates for volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) for the San Antonio region were calculated for non-road equipment in the following categories:

- 2260004016 2-stroke commercial rotary tillers
- 2265004016 4-stroke commercial rotary tillers
- 2260004021 2-stroke commercial chain saw
- 2260004026 2-stroke commercial trimmer/Edger/Brush Cutter
- 2265004026 4-Stroke commercial trimmer/Edger/Brush Cutter
- 2260004030 2-stroke commercial leaf blower/vacuums
- 2265004030 4-stroke commercial leaf blower/vacuums
- 2260004071 2-stroke commercial turf equipment
- 2265004071 4-stroke commercial turf equipment
- 2270004071 Diesel commercial turf equipment
- 2265004011 4-stroke commercial lawnmower
- 2265004041 4-stroke commercial rear engine riding mower
- 2265004046 4-stroke commercial front mower
- 2265004051 4-Stroke commercial Shredder
- 2265004056 4-Stroke commercial Lawn and Garden Tractors
- 2270004056 Diesel commercial Lawn and Garden Tractors
- 2265004066 4-Stroke commercial Chipper/Stump Grinder
- 2267004066 LPG commercial Chipper/Stump Grinder
- 2270004066 Diesel commercial Chipper/Stump Grinder
- 2265004076 4-stroke commercial other lawn and garden equipment
- 2270004076 Diesel commercial other lawn and garden equipment
- 2270007010 Diesel shredders > 6 HP

METHODOLOGY

The methodology used in producing commercial Lawn and Garden equipment emission estimates for the San Antonio region is based on local data collected from surveys and aerial photographs, or on national data from the EPA NONROAD 2004 emission inventory model, in the absence of reliable local data. The methodology involves the following steps:

1) Conducting a survey to request equipment population, usage rates, and equipment characteristics
2) Determining equipment population and activity for sites without survey data
3) Conducting a second survey with pre-filled data obtained from the first survey for golf courses and private airports
4) Estimating VOC, NOx, and CO annual emissions for a typical ozone season weekday (tons/day) using survey responses and NONROAD model defaults
5) Spatially allocating emissions to 4km photochemical modeling grids with TransCAD 4.7 GIS software

Step 1: Conduct a Survey of Local Commercial Lawn and Garden Equipment Activity

The preferred method of calculating commercial lawn and garden equipment emissions involves conducting a survey of equipment use within the San Antonio region (Appendix A). The survey form requested the following information:

- Activity Rates (HRS) – Total annual hours of use by type of equipment
- Temporal Profiles – Equipment use on weekdays and equipment use on weekend days for all types of equipment
- Engine Characteristics:
  1) Engine Type – 2-stroke gasoline, 4-stroke gasoline, or diesel
  2) Engine Horsepower – rated power of the engine

Step 2: Determining Lawn and Garden Equipment Population for Commercial Equipment Without Survey Data

To determine total equipment for each county, the equipment counts reported in the survey responses were multiplied by the allocation factors listed in Table 1.

Table 1. Factors used to allocate survey responses by county.

Category	Equipment Allocation by County
Commercial Lawn and Garden Companies	Number of Companies
Golf Courses	Golf Course Acres
Public Schools	Number of Public School
Universities/Colleges	University/College Acres
Non-Military Government Facilities, Parks, and Hospitals	Allocated to the location reported in the survey response
Other Commercial Companies	Allocated to the location reported in the survey response
Cemeteries	No Emission Calculation
Private Airports	Airport Acres
Commercial Airports	Allocated to the location reported in the survey response
Military Bases	Allocated to the location reported in the survey response

Total equipment population was then adjusted by a factor based on the average hours of use per year from the survey data. Some equipment sources, for example front mowers, chainsaws and shredders, had higher activity rates than the NONROAD default hours, while other equipment types had lower. Equation 1 was used to calculate total equipment population for the San Antonio region.

Equation (1) $TPOP_A = SPOP_A \text{ X } TOL \text{ X } (SHR / NRHR) / SUR$

where

$TPOP_A$ = Total population of equipment A (Table 2)
$SPOP_A$ = Survey population of equipment A
TOL = Total number of commercial companies, acres, or schools
SHR = Average annual hours for each equipment type from survey responses
NRHR = Default annual hours for each equipment type from the NONROAD model
SUR = Number of survey respondents

Example 1: Equipment Population of Commercial Companies' Chainsaws in the San Antonio region

= 221 chainsaws X 290 companies X (1408.5 survey hours / 303 default hours) / 54 survey responses
= 5,518 chainsaws

Example 2: Equipment Population of Golf Courses' Chainsaws in the San Antonio region

= 7 chainsaws X 8887 acres X (57.4 survey hours / 303 default hours) / 1316 acres of surveyed golf courses
= 9.0 chainsaws

Follow the methodology used by the ERG report "Development of Commercial Lawn and Garden Emission Estimations for the State of Texas and Selected Metropolitan Areas"[2], a 10% SWAG Factor was applied to the other equipment category for lawn and garden equipment used by commercial companies.

Step 3: Conduct a Second Survey of Golf Courses and Private Airports

After determining equipment populations for each golf course and private airport, a second survey was sent out with the estimations of their equipment population, HP, and activity hours to achieve a higher response rate. The second survey used the same format as the initial survey. Companies were asked to correct estimations and to send the surveys back to AACOG. The response rates for all surveys are listed below.

- Commercial Lawn and Garden Com: 19% Response Rate
- Golf Courses: 15% Response Rate
- Public Schools: 43% Response Rate
- Universities/Colleges: 62% Response Rate
- Gov. Fac., Parks, and Hospitals: Not Calculated
- Other Commercial Companies: Not Calculated
- Cemeteries: No Emission Calculation
- Private Airports: 21% Response Rate
- Commercial Airports: 100% Response Rate
- Military Bases: 100% Response Rate

Step 4: Estimating Annual Emissions of Ozone Precursors (tons/yr.)

Once county level equipment populations were determined, emissions of volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) were calculated using NONROAD Model 2004 based on the following equation:

Equation (3) Emissions in g/yr. (VOC/CO/NOx) = EP x HP x HRS x LF x EF

where
EP = equipment population (Table 2)
HP = horse power (Table 3)
HRS = hours per piece of equipment (Table 4)
LF = load factor (NONROAD model default)
EF = emission factor for VOC/CO/NOx (NONROAD model default)

The values for the LF and EF were obtained from the EPA NONROAD Emission Inventory Model. Equipment population, horsepower, annual hours, weekday adjustment factor, and allocation by county were developed using the local data described above for each category. There were several adjustments made to account for local conditions in using the NONROAD Model: update to the population file and updates to the HP within the population file.

Population File

The equipment population for each type of equipment was summed based on the AACOG survey response (Table 2). This master spreadsheet was then converted into the population file for the NONROAD model for each category. Also, the population file was updated with the horsepower (HP) estimates from the survey. Table 3 lists the default NONROAD 2004 default HP and the calculated average HP from the survey responses. For the NONROAD run, equipment populations were allocated to horsepower bins based on survey responses.

In most cases, equipment horsepower were very similar or slightly lower between the default values and the survey responses. However, commercial companies used higher HP rotary tillers, rear riding mowers and shredders. Golf courses tended to use larger front-engine mowers, commercial turf equipment and lawn and garden tractors. Public schools tended to use larger rear-engine rider mowers and shredders, but smaller gasoline lawn and garden tractors and chainsaws. Universities/colleges tended to use smaller chainsaws and larger lawn and garden tractors.

Table 2. Total Equipment Population Estimations from the AACOG Survey Compared to EPA's NONROAD Default Equipment Population, 2005.*

Equipment Type	2005 EPA NONROAD Model Default Population	Commercial Lawn and Garden Companies	Universities/ Colleges	Public Schools	Golf Courses	Government Facilities/ Parks/ Hospitals	Other Companies	Commercial/ Private Airports	Percent of NONROAD Model Population
Lawn Mowers	11,020	3,131	20	475	44	175	34	12	35%
Tillers	4,054	113	3	5	4	7	0	2	3%
Chainsaws	5,258	5,518	26	50	9	551	9	3	117%
Trimmers	13,402	5,876	320	4,060	321	2,294	70	132	98%
Blowers	7,636	4,443	82	379	253	524	15	26	75%
Rear Mower	339	774	77	139	582	154	1	10	513%
Front Mower	2,764	4,548	61	232	1,795	225	3	16	249%
Shredder	2,127	2,403	31	202	0	16	8	7	125%
Tractor	2,719	111	8	416	113	83	3	10	27%
Chippers	682	470	0	7	4	49	0	0	78%
Turf	6,827	78	1	14	360	29	0	22	7%
Other	5,084	3,904	5	0	0	60	43	0	79%
Total	58,051	31,367	634	5,979	3,485	4,167	187	239	79%

*Does not include military Lawn and Garden Equipment.

Table 3. HP estimations for commercial companies, golf courses, public schools, universities/colleges, and private airports' commercial lawn and garden equipment in the San Antonio region, 2005.

Commercial Lawn & Garden Equipment	Engine Type	SCC	NONROAD Default HP	Commercial Lawn and Garden Comp.	Golf Courses	Public Schools	University/ College	Private Airports
Chain Saws	Gas. 2-cycle	2260004021	3.5	1.9	3.5	2.2	1.8	-
Trimmers/ Edgers/ Brush Cutters	Gas. 2-cycle	2260004026	1.5	1.5	1.5	1.4	1.3	0.9
Leaf Blowers/ Vacuums	Gas. 2-cycle	2260004031	2.0	1.8	2.0	2.1	2.3	1.0
Lawn Mowers	Gas. 4-cycle	2265004011	4.1	4.1	3.7	5.3	5.1	4.4
Rotary Tillers	Gas. 4-cycle	2265004016	4.7	8.0	4.7	4.6	6.0	-
Rear Engine Riding Mowers	Gas. 4-cycle	2265004041	10.7	21.2	10.7	19.6	16.8	-
Front Mowers	Gas. 4-cycle	2265004046	13.5	15.0	27.6	19.0	13.5	15.0
Shredders	Gas. 4-cycle	2265004051	4.2	4.2	-	38.0	-	-
Lawn and Garden Tractors	Gas. 4-cycle	2265004056	14.4	12.6	-	6.7	68.0	48.0
Other Lawn and Garden Eq.	Gas. 4-cycle	2265004076	5.4	5.4	-	-	8.0	-
Commercial Turf Eq./ Sod Cutters	Gas. 4-cycle	2265004071	12.6	3.1	18.1	25.0	-	-
Shredders	Gas. 4-cycle	2265007010	8.6	50.0	-	-	8.0	-
Chippers/Stump Grinders/Mulchers	Gas. 4-cycle	2265004066	28.0	28.0	-	-	-	-
Commercial Turf Eq./ Sod Cutters	Diesel	2270004076	48.8	48.8	-	23.4	28.0	-
Commercial Mowers	Diesel	2270004046	29.1	21.0	26.0	22.2	27.3	-
Lawn and Garden Tractors	Diesel	2270004056	21.0	13.0	47.9	21.6	29.6	-
Chippers/ Stump/ Grinders/Mulchers	Diesel	2270004066	93.4	93.4	142.4	40.0	-	-
Shredders	Diesel	2270007010	N/A	110.0	-	60.0	200.0	15.0

Season File

A final step in the calculation was to determine the percent of weekday versus weekend emissions. Equipment hours of operation on weekdays for all survey responses were added and divided by the total number of hours. A weekday versus weekend adjustment factor was calculated separately for each piece of equipment based on the survey responses (Table 4). On average, 92.6 percent of the equipment hours of operation are during weekdays and 7.4 percent of the equipment hours of operation occur during the weekend. The weekday survey results are much higher than the NONROAD default of 80% commercial lawn and garden usage on the weekdays. Many San Antonio companies that operate commercial lawn and garden equipment are not open on the weekends. The exceptions are golf courses (73% weekdays) and private airports (39% weekdays) that had lower usage of Lawn and garden equipment on weekdays compared to the default value.

Allocation File

An allocation file was created to properly allocate emissions to each county. To create this file, the values for all counties except those in the study area were replaced with zero in the default landscape allocation file for Texas (TX_LSCAP.AOL). The values for the San Antonio region were allocated based on the allocation listed in Table 5 for Commercial Companies, Golf Courses, Public Schools, Universities/Colleges, and Private Airports. For government facilities, commercial airports, and other commercial companies, the allocation was based on the location of the survey respondent. The values for each county were added up and the total was used as the value for the State of Texas. This allowed the NONROAD model to calculate emissions for the San Antonio region as a whole and distribute the emissions to each county appropriately.

Once the lawn and garden equipment was summed up for all categories, a comparison was done between the NONROAD 2004 defaults and the results from the survey. Table 2 shows the breakdown by category. Overall, the NONROAD model over predicted the number of lawn and garden equipment in the AACOG survey. AACOG survey indicates that local commercial lawn and garden equipment was only 79 percent of the NONROAD defaults. There were more rear-engine mowers and chippers in the AACOG survey than indicated by the NONROAD model. At the same time, the NONROAD model over predicted the number of tillers and turf equipment. These results do not include the lawn and garden equipment at military bases that would increase the total percentage of equipment.

Step 5: Spatially Allocating Emissions to 4km Photochemical Modeling Grids

Emissions were geocoded to locations of commercial companies, golf courses, public schools, universities/colleges, private airports, and population using TransCAD GIS software[3]. Emissions were aggregated to the 4km photochemical model grid system, as shown in Figure 2. The 4km grid system is based on the September 1999 modeling episode used in the San Antonio Early Action Compact (EAC) State Implementation Plan (SIP). Allocating emissions to actual facility locations increases the accuracy of ozone predictions in the photochemical model. Figures 1 and 2 show examples of this allocation for NOx emissions from diesel commercial land and garden equipment used by golf courses and public schools.

Table 4. Weekday/weekend allocation of commercial companies, golf courses, public schools, universities/colleges, and private airports' commercial lawn and garden equipment in the San Antonio region, 2005.

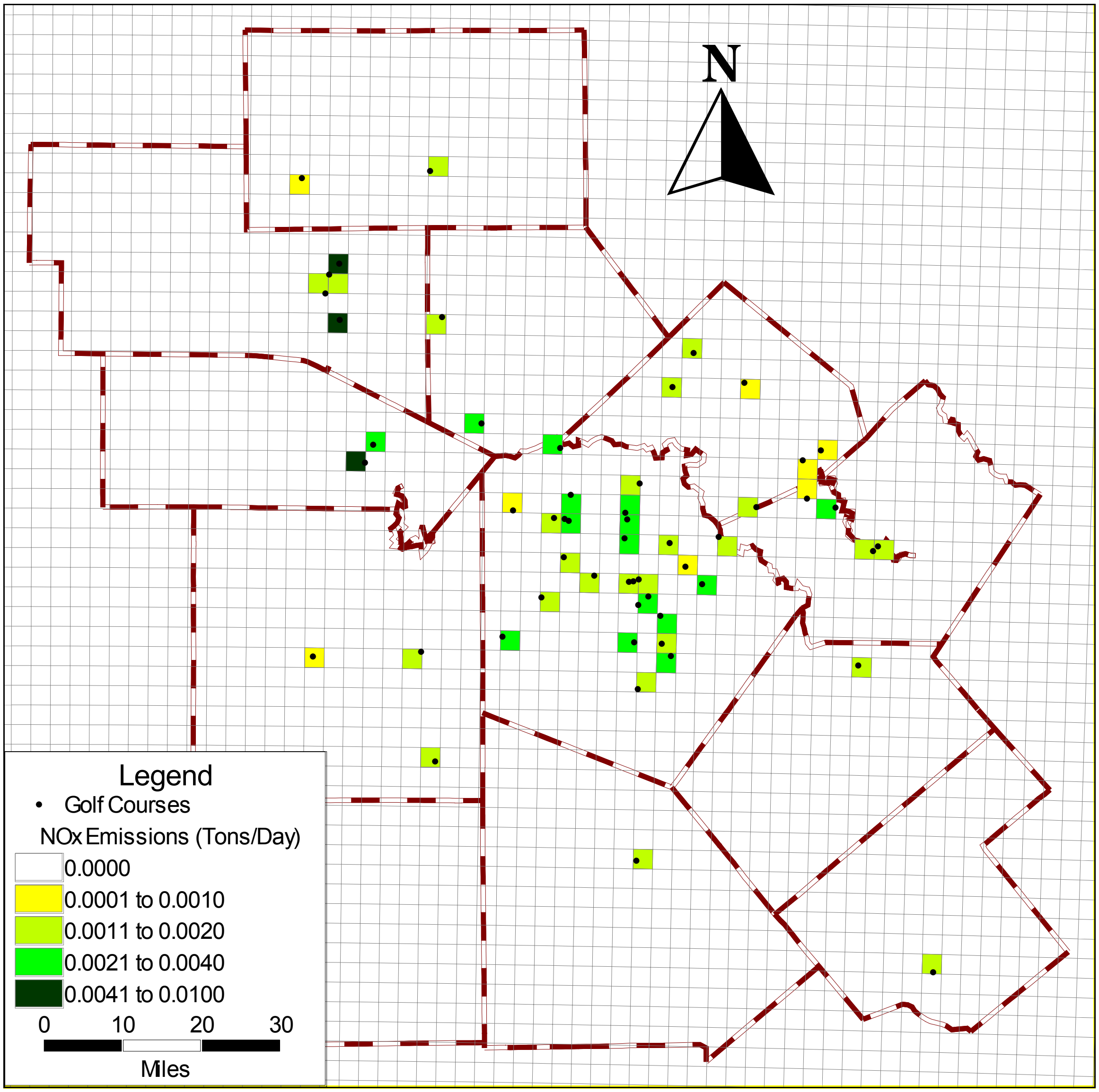
Commercial Lawn & Garden Equipment	Engine Type	Commercial Lawn and Garden Comp.		Golf Courses		Public Schools		University/College		Private Airports	
		Weekday	Weekend	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
Chain Saws	Gas. 2-cycle	5.5	0.0	0.2	0.1	0.9	0.0	1.7	0.0	-	-
Trimmers/ Edgers/ Brush Cutters	Gas. 2-cycle	6.1	0.1	1.7	0.3	4.0	0.0	3.8	0.0	0.3	1.4
Leaf Blowers/ Vacuums	Gas. 2-cycle	4.8	0.1	2.8	0.1	1.9	0.0	2.6	0.3	0.0	3.0
Lawn Mowers	Gas. 4-cycle	7.7	0.1	1.4	1.3	3.0	0.0	1.4	0.0	0.1	1.1
Rotary Tillers	Gas. 4-cycle	2.5	0.0	0.5	0.0	0.7	0.0	1.3	0.1	-	-
Rear Engine Riding Mowers	Gas. 4-cycle	4.8	0.2	4.0	3.5	5.6	0.0	3.5	0.3	-	-
Front Mowers	Gas. 4-cycle	5.6	0.0	4.0	1.7	5.4	0.1	2.7	0.0	0.3	0.0
Shredders	Gas. 4-cycle	5.5	0.0	-	-	4.5	0.0	-	-	-	-
Lawn and Garden Tractors	Gas. 4-cycle	1.9	0.0	-	-	4.2	0.0	2.7	0.0	2.1	0.2
Other Lawn and Garden Eq.	Gas. 4-cycle	6.0	0.0	-	-	-	-	1.6	0.0	-	-
Commercial Turf Eq./ Sod Cutters	Gas. 4-cycle	4.7	0.0	4.1	1.8	5.0	0.0	-	-	-	-
Shredders	Gas. 4-cycle	4.7	0.0	-	-	-	-	0.8	0.0	-	-
Chippers/Stump Grinders/Mulchers	Gas. 4-cycle	4.5	0.0	-	-	-	-	-	-	-	-
Commercial Turf Eq./ Sod Cutters	Diesel	4.7	0.0	-	-	4.5	0.0	2.0	0.0	-	-
Commercial Mowers	Diesel	3.0	0.0	-	-	4.8	0.0	5.0	0.0	-	-
Rear Engine Riding Mowers	Diesel	8.3	0.7	4.4	0.8	-	-	-	-	-	-
Lawn and Garden Tractors	Diesel	6.0	0.0	2.9	0.3	3.9	0.0	4.3	0.0	-	-
Chippers/ Stump/ Grinders/ Mulchers	Diesel	4.3	0.0	0.5	0.0	2.5	0.0	-	-	-	-
Shredders	Diesel	4.7	0.0	-	-	6.5	0.0	4.0	0.0	2.2	0.3
Average		5.0	0.1	2.4	0.9	3.8	0.0	2.7	0.1	0.8	1.0

Table 5. Allocation of commercial companies, golf courses, public schools, universities/colleges, and private airports' commercial lawn and garden equipment in the San Antonio region, 2005.

County	Commercial Lawn and Garden Companies		Golf Course		Public Schools		Universities/Colleges		Private Airports	
	Number of Employees	Percentage	Total Acres	Percentage	Number of Schools	Percentage	Total Acres	Percentage	Number of Private Airport	Percentage
Atascosa	7	0.2%	142	1.6%	28	4.5%	5	0.5%	1	5.5%
Bandera	8	0.2%	595	6.7%	7	1.1%	0	0.0%	0	0.0%
Bexar	3402	90.9%	4075	46.0%	412	66.0%	906	82.7%	5	27.8%
Comal	74	2.0%	511	5.8%	33	5.3%	0	0.0%	2	11.1%
Frio	0	0.0%	0	0.0%	10	1.6%	0	0.0%	2	11.1%
Gillespie	17	0.5%	210	2.4%	9	1.4%	0	0.0%	1	5.5%
Guadalupe	74	2.0%	687	7.8%	35	5.6%	184	16.8%	2	11.1%
Karnes	0	0.0%	160	1.8%	14	2.2%	0	0.0%	1	5.5%
Kendall	83	2.2%	300	3.4%	13	2.1%	0	0.0%	0	0.0%
Kerr	62	1.7%	1673	18.9%	18	2.9%	0	0.0%	1	5.5%
Medina	10	0.3%	335	3.8%	20	3.2%	0	0.0%	3	16.7%
Wilson	8	0.2%	165	1.9%	25	4.0%	0	0.0%	0	0.0%
Total	3744	100.0%	8852	100.0%	624	100.0%	1095	100.0%	18	100.0%

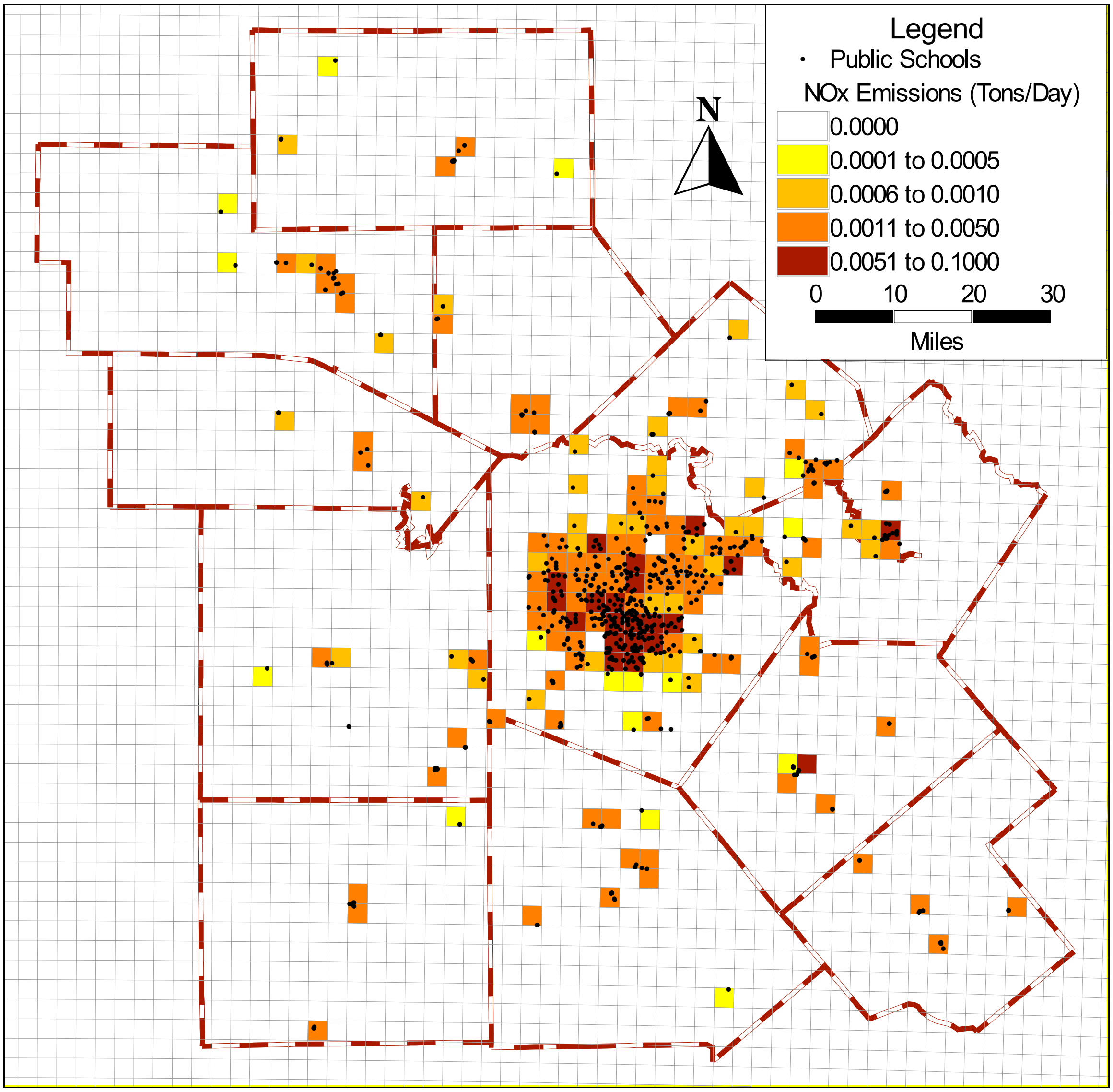
*Military Base Schools are not included (these schools are in the Miltary/Airport section)

Figure 1. NOx emissions from diesel lawn and garden equipment at golf course, 2005.



Plot Date: November 9, 2005
Map Compilation: October 12, 2005
Source: Aerial Photography, District Appraisal Data, and Telephone Survey

Figure 2. NOx emissions from diesel lawn and garden equipment at public schools, 2005.



Plot Date: November 9, 2005
Map Compilation: October 6, 2005
Source: School locations are from the National Center for Education Statistics, 2002. Available online: http://nces.ed.gov/ (20 July 2004)[4]

CONCLUSION

The NONROAD model default values proved inappropriate for commercial lawn and garden equipment and contained inaccuracies in equipment counts and usage rates, due to the wide variety of businesses and agencies using lawn and garden equipment. When comparing usage rates determined by survey to usage rates determined by NONROAD model defaults, various equipment categories and types of businesses exhibited significant differences.

Table 6 provides a detailed list of the emission inventory results compared to the NONROAD model default run. By using a detailed survey methodology, calculated emissions were 50% lower then the NONROAD model estimated. Since San Antonio has dry and hot weather and some commercial lawn and garden equipment population was greatly overestimated by the NONROAD model, may cause emissions from the equipment be less then NONROAD model prediction. Also, average equipment hp was lower than the NONROAD model prediction. Emissions from universities/colleges, other commercial companies, private airports, and commercial airports were insignificant; however, commercial companies, golf course, public schools, government facilities, and military bases are important sources of emissions in the San Antonio region.

Table 6. Emissions from lawn and garden equipment in the San Antonio region compared to the NONROAD model defaults, 2005.

Emission Source	VOC	NOx
Commercial	4.957	1.486
Golf Courses	0.212	0.166
Public Schools	0.505	0.027
University/Colleges	0.060	0.022
Government/Hospitals	0.564	0.073
Other Commercial Companies	0.016	0.018
Cemeteries	0.000	0.000
Private Airports	0.002	0.001
Commercial Airports	0.016	0.018
Military Bases	0.223	0.053
Total	6.556	1.864
NONROAD Default Emissions	14.262	2.654

Conducting a detailed survey of commercial lawn and garden equipment usage enabled significant improvements to the accuracy of emission inventory estimates. Using GIS software to allocate emissions to the photochemical model grid systems improves the accuracy of predicting ozone formation and the effectiveness of control strategies. Further research on this topic includes expanding the survey to increase the responses from cemeteries and updating emission results with NONROAD model 5.0 or MOVES.

Appendix A
Survey used to determine lawn and garden equipment population, horsepower, and hours

Alamo Area Council Of Governments

October 3, 2004

[COMPANY NAME]
[STREET ADDRESS]
[CITY] [STATE] [ZIP]

ATTENTION: OPERATIONS MANAGER

Re: San Antonio Regional Emissions Inventory

The Alamo Area Council of Governments (AACOG) requests your assistance in the development of the air quality emission inventory for Bexar County and the surrounding counties. AACOG is conducting this inventory in order to assess and quantify local air quality within the metropolitan area of San Antonio and contiguous counties. This inventory is especially significant because the San Antonio region has been declared in non-attainment deferred of federal air quality standards, the National Ambient Air Quality Standards.

AACOG will calculate the equipment source component of this inventory from information submitted by local organizations involved in landscaping, lawn and garden and such activities in and around the San Antonio region using the enclosed survey. With this survey, we are requesting information on any lawn and garden, construction, or industrial equipment used during the 2004 calendar year within Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. The purpose of this survey is to provide better information and services to the region, as well as help minimize additional regulation on the community.

Your input is vital to this process and will serve to achieve a true and correct emissions inventory. Please provide your responses on the attached survey and return it to us in the self-addressed envelope by the date indicated. The information you provide will be considered strictly confidential and unavailable to public information requests. Please submit your response by October 20, 2004.

Thank you for your time and participation. If you have any questions or comments please feel free to contact Steven Smeltzer at (210) 362-5266.

Regionally yours,

Al J. Notzon III
Executive Director

Enclosures (2)

	Internal Combustion Equipment Type	Engine Type Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas Electric	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
COMMERCIAL LAWN AND GARDEN EQUIPMENT						
1	Lawn Mowers					
2	Rear Engine Riding Mowers					
3	Front Mowers					
4	Rotary Tillers					
5	Chain Saws					
6	Chippers/Stump Grinders/Mulchers					
7	Trimmers/Edgers/ Brush Cutters					
8	Commercial Turf Equipment/ Sod Cutters					
9	Leaf Blowers/ Vacuums					
10	Lawn and Garden Tractors					
11	Shredders					
12	Other Lawn and Garden Equipment: (Please Describe): ________________					

REFERENCES

[1]U.S. Environmental Protection Agency, *National Nonroad Emissions Model 2004: Draft Version*, 2005, Ann Arbor, MI.

[2]Rick Baker and Sam Wells, *Development of Commercial Lawn and Garden Emission Estimations for the state of Texas and Selected Metropolitan Areas*. Nov. 24, 2003, Prepared for Texas Commission on Environmental Quality by Eastern Research Group and Starcrest Consulting Group.

[3]Caliper Corporation, *TRANSCAD: Transportation GIS Software Version 4.7,* 2005, Newton MA.

[4]National Center for Education Statistics, *Search for Public School Districts*, 2002. Available online: http://nces.ed.gov/ (20 July 2004).

KEY WORDS

Lawn and Garden Equipment
Emission Inventory
GIS
NONROAD model
Lawnmowers

Using Aerial Photography and GIS Data to Improve Quarry Equipment Emissions Inventories

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ABSTRACT

In the past, off-road emission inventories of quarries were frequently incomplete or contained inaccuracies. The NONROAD model default values were inappropriate for quarry emission calculations in the San Antonio region due to the larger construction equipment in use and almost constant usage rates at these sites. The accuracy of these calculations increases with the use of local data acquired through surveys and aerial photography. Local quarry equipment activity was requested in a two-stage survey to determine equipment population, usage rates, and equipment characteristics at quarries in the San Antonio region for the year 2005. Because of a low response rate to the initial survey and large variations in quarry sizes and production rates, further analysis was necessary to improve the results of the equipment inventory and increase accuracy of the emissions calculations. Aerial photography was used to determine equipment populations of all quarries in the San Antonio area. The equipment for each quarry was identified, marked, and counted using 6-inch resolution imagery with Geographic Information Systems (GIS) software. Once emissions were calculated using survey data, aerial counts, and the NONROAD 2004 model, the emissions were geo-coded to each quarry site. The GIS software was then used to allocate emissions to the grid systems used by photochemical models to improve the accuracy of predicting ozone formation and the effectiveness of control strategies.

INTRODUCTION

Most emission inventories of quarries contain point sources such as cement kilns and hot asphalt plants. However, quarry equipment is a major source of emissions that is often overlooked or not accurately estimated. A variety of minerals are mined in the San Antonio region: limestone, aggregate, granite, sand and gravel, and lignite. Current methodologies, including the use of NONROAD model factors, have proven unreliable in developing an accurate emissions inventory for the San Antonio region. Since quarry equipment emits 3.2 tons of nitrogen oxides (NOx) a day in the San Antonio area, it is important to have a methodology that produces accurate emissions estimations.

In the San Antonio region, there are 29 large quarries that contain a wide assortment of equipment in use nearly 24-hours a day, every day of the week. However, getting access to equipment population and usage rates is difficult; quarry companies are reluctant to release this data. Many of the companies are wary that competitors will have access to data that would give competitors a market advantage. Because of the reluctance to release information, other methods of obtaining this data, such as the utilization of aerial photography and GIS software, are necessary to increase the accuracy of an emission inventory. These tools can be used to determine equipment populations at each quarry.

Emission estimates for volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) for the San Antonio region were calculated for diesel vehicles in the following categories of quarry equipment:

- 2270002018 Scrapers
- 2270002036 Excavators
- 2270002048 Graders

- 2270002051	Off-highway Trucks (rock trucks)
- 2270002060	Rubber Tire Loaders
- 2270002066	Tractors/Loaders/Backhoes
- 2270002069	Crawler Tractor/Dozers

METHODOLOGY

The methodology used in producing quarry equipment emission estimates for the San Antonio region is based on local data produced from surveys and aerial photographs, or on national data used in the EPA NONROAD 2004 Emission Inventory Model, in the absence of reliable local data. The methodology involves:

1) Conducting a survey to request equipment population, usage rates, and equipment characteristics from local quarries
2) Analyzing aerial photographs to identify equipment in use and equipment populations
3) Determining equipment populations for quarry sites without survey data
4) Conducting a second survey with pre-filled data obtained from the first survey or data estimated with the use of aerial photography of quarry equipment activity at each quarry
5) Estimating VOC, NOx, and CO annual emissions for a typical ozone season weekday (tons/day) using survey responses and NONROAD model defaults
6) Spatially allocating emissions to 4km photochemical modeling grids with TransCAD 4.7 GIS software

Equipment emissions were calculated for quarries with more than 9 employees, only. Smaller quarries do not have a significant amount of equipment usage. There are 29 quarries in the San Antonio region that have more then 9 employees (Table 1). The steps used to calculate emissions are outlined following table 1.

Table 1. Allocation of quarries in the San Antonio region, 2005

County	FIPS code	Number of Large Quarries*
Atascosa	48013	1.5
Bexar	48029	15.0
Comal	48091	8.0
Gillespie	48171	2.0
Kerr	48265	1.0
Medina	48325	1.5
Total		29.0

Note: Two quarries cross county boarders. For these two quarries, 50 % of the emissions were allocated to each county.

Step 1: Conduct a Survey of Local Quarry Equipment Activity

The preferred method of calculating quarry equipment emissions involves conducting a survey of equipment use within the San Antonio region (Appendix A). The survey form requested the following information:

- Activity Rates (HRS) – total annual hours of use by type of equipment
- Temporal Profiles – equipment use on weekdays and equipment use on weekend days for all types of equipment
- Engine Characteristics:
  1) Engine Type –diesel

2) Engine Horsepower – rated power of the engine

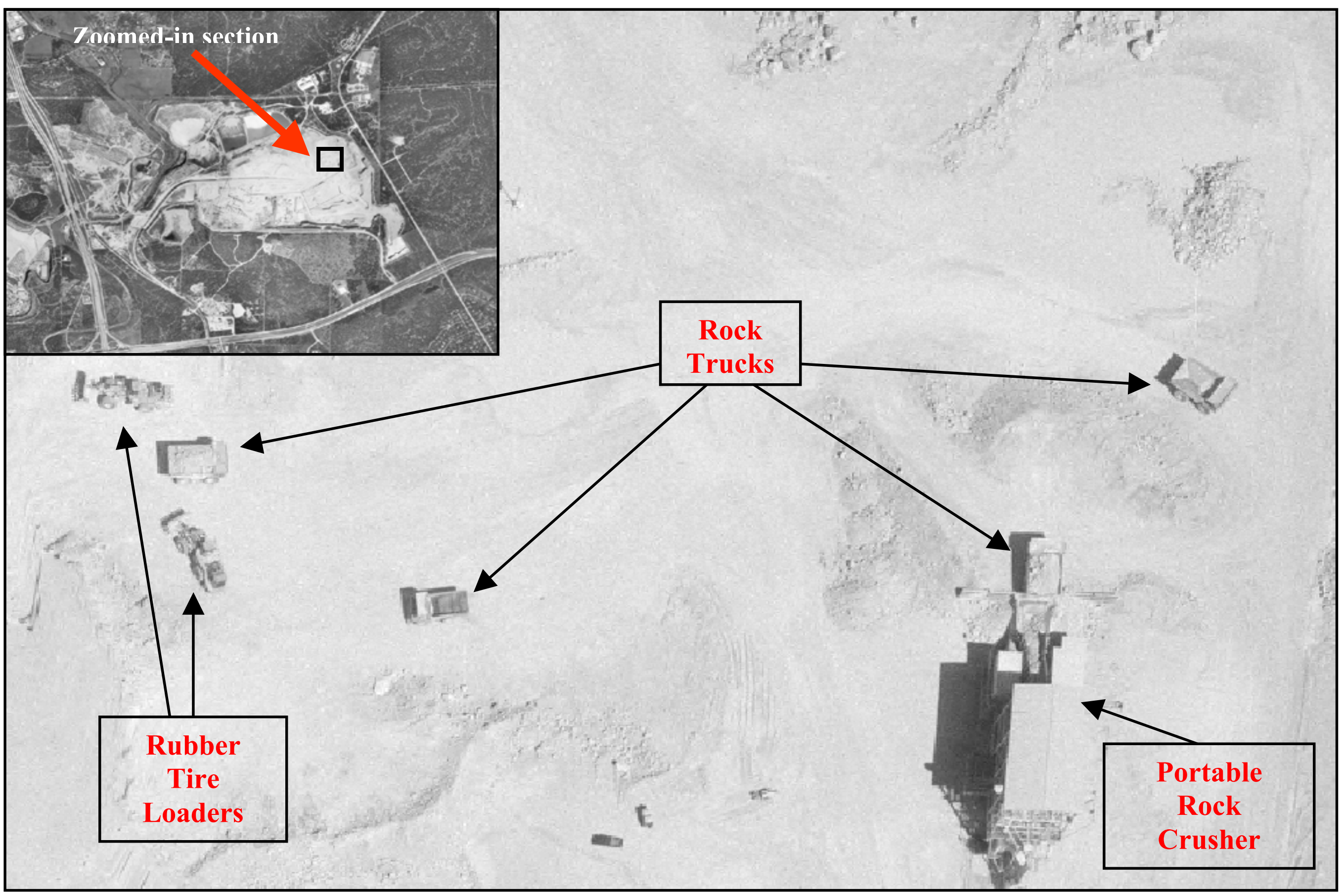
Step 2: Analysis of Aerial Photography

Due to the low response rate (only two quarries responded), an analysis of aerial photography was performed to determine the types and populations of equipment in use for all the quarries. Available imagery of 6-inch resolution sufficient for analysis was available for Bexar County, only. The aerial photography was projected on State Plane, NAD83, Texas South Central. The equipment for each quarry located in Bexar County was identified, marked, and counted in TransCAD.

Figure 1 clearly shows 4 rock trucks and 2 rubber tire loaders active in quarry operations in the aerial photograph. At the bottom of the figure, there are two pickups and a flatbed truck for comparison. The image also shows a portable rock crusher that could be a significant source of air pollutants. The zoomed-in image is only a small fraction of the total quarry shown in the upper left hand corner of the figure. For example, the aerial photography of one quarry in Bexar County revealed 3 scrapers, 8 excavators, 1 grader, 11 off-highway (rock) trucks, 18 rubber tire loaders, and 3 tractors/loaders/ backhoes working in the quarry. These equipment counts were used as the equipment population for that quarry, in the absence of survey data.

For quality assurance purposes, aerial counts for the two quarries that responded to the initial survey were compared with the survey responses. In both cases the types and counts of equipment determined through the use of aerial photography was almost identical to the data provided by the quarries.

Figure 1. Aerial photography of a quarry showing rock trucks and front-end loaders



Step 3: Determining equipment population for quarry sites without local data

As aerial photographs were available for Bexar County only, the equipment populations for quarries outside Bexar County were estimated based on number of employees. To estimate equipment populations for these facilities, all quarries were separated into two categories: quarries with kilns and/or asphalt plants and quarries without kilns or plants.

An employee to equipment ratio was calculated for kiln/asphalt sites and non-kiln sites by dividing the total pieces of equipment counted (at quarries within Bexar County) for the category by the total number of employees (at quarries within Bexar County). The ratio was then used to calculate estimated equipment populations for the remaining quarry sites. The number of employees at a quarry was multiplied by the equipment ratio and the result was rounded to the nearest whole number. Equation 1 is an example of the calculation used to determine the ratio for rubber tire loaders/employee at a quarry with kiln(s).

Equation (1) EE Ratio = EP ÷ EMP

where
EE Ratio = Equipment to employee ratio
EP = Equipment population at quarries with kilns
EMP = Number of employees at quarries with kilns

EE Ratio for Rubber Tire Loaders
= 32 Rubber Tire Loaders ÷ 541 Employees
= 0.05915 Rubber Tire Loaders per employee

The population of each equipment type for quarries without survey data was estimated through the use of Equation 2.

Equation (2) POP = EMP x EE Ratio

where
POP = Estimated population of equipment at the quarry (rubber tire loaders)
EMP = Number of employees at the quarry
EE Ratio = Equipment to employee ratio (rubber tire loaders at sites with kilns)

Rubber tire loaders at Quarry "A"
= 118 employees at Quarry "A" x 0.05915 rubber tire loaders/employee
= 6.9797 rubber tire loaders
= 7 estimated rubber tire loaders at Quarry "A" (after rounding)

Step 4: Conduct a Second Survey of Local Quarry Equipment Activity

After analyzing aerial photographs and determining equipment populations for each quarry, a second survey was sent out to the local quarries with the estimations of their equipment population, HP, and activity hours. This survey used the same format as the initial survey. Completed analysis of aerial photography allowed Alamo Area Council of Governments (AACOG) to provide accurate equipment counts on the second survey in Bexar County. Companies were asked to correct estimations and to send the surveys back to AACOG.

There was a 34 percent response rate to the second survey. Aerial photography provided equipment populations data on 28 percent of the remaining quarries. The combined survey and aerial photography analysis (62 percent of quarries) provided an excellent guide for equipment population, activity, and horsepower estimates for the remaining quarries.

Step 5: Estimating Annual Emissions of Ozone Precursors (tons/yr.)

Equipment population, horsepower, and annual hours of use were developed with local data described above for each quarry. In the absence of reliable local data, the values for HP were taken from an Eastern Research Group (ERG) study "Diesel Construction Equipment Emissions in the Austin Region" for backhoe and Dozer equipment categories. Table 2 lists estimated HP ratings, by type of equipment used in this study, and the NONROAD 2004 default value for HP. NONROAD defaults had lower horsepower for Excavators and Front-end loaders compared to the survey responses. Off-Road Trucks had lower horsepower compared to NONROAD defaults. For each type of equipment at each quarry, VOC, NOx, and CO emissions were calculated using Equation 3.

Equation (3) Emissions in g/yr. (VOC/CO/NOx) = EP x HRS x HP x LF x EF

where
EP = equipment population
HRS = hours per piece of equipment
HP = horse power
LF = load factor
EF = emission factor (VOC/CO/NOx)

Local surveys indicated that the values for HP used in the ERG study were too low for scrapers and rock trucks, while the estimates for loaders were too high for the San Antonio region. In all three cases, the HP was changed based on the average HP from the returned surveys. For other categories, AACOG survey responses were similar to the results of the ERG survey.

Table 2. Estimated HP by equipment type for San Antonio quarries, 2005

Equipment Type	SCC	NONROAD Model Default HP	ERG Austin Study Estimated HP	AACOG Study Estimated HP
Scrapers	2270002018	409	250	**400**
Excavators	2270002036	171	500	500
Graders	2270002048	204	200	200
Trucks	2270002051	783	400	**411**
Loaders	2270002060	243	500	**400**
Backhoes	2270002066	93	80	80
Dozers	2270002069	260	250	250

Equipment type hours per year were updated in the NONROAD model based on the survey responses. Table 3 lists the hours per year used when survey responses were not available. In almost all cases, local activity rates were greater than provided by the NONROAD model. Quarry operations tend to have longer operating hours than other facilities that use these types of equipment. Also, there is a significant amount of equipment usage on the weekends because quarries operate nearly constantly to meet the demands of cement kilns and hot asphalt plants.

Table 3. Annual hours of use by equipment type, 2005

Equipment Category	SCC	NONROAD Model Default Hours/year	AACOG Study Estimated Hours/Year
Scrapers	2270002018	914	**2208**
Excavators	2270002036	1092	1092*
Graders	2270002048	962	**1135**
Trucks	2270002051	1641	**2138**
Loaders	2270002060	761	**1692**
Backhoes	2270002066	1135	**1172**
Dozers	2270002069	936	**1467**

* The NONROAD Model default for hours/year was used for excavators; survey responses were not statistically significant.

The values for the load factor (LF) and emission factor (EF) were obtained from the EPA NONROAD Emission Inventory Model. LF values were easily obtainable from the data files of this model. The values for EF had to be calculated by first determining the default input values used in the model, performing a run, and then using the results of the run to work in reverse through the formula to determine what Efs were used by the model for an average ozone season day. The equation below provides an example of how emissions were calculated for 7 rubber tire loaders at Quarry A. These rubber tire loaders are operated an average 1,692 hrs/yr. (HRS), and are 400 HP. From the NONROAD Model, the typical LF for front-end loaders is 0.59 and the 2005 NOx EF, during the ozone season, is 5.8320 g/hp-hr. Equation 3 provides an estimate of NOx emissions in tons/year generated by the 7 rubber tire loaders at Quarry A.

NOx Emissions = EP x HRS x HP x LF x EF
= 7 x 1,692 hrs/yr. x 400 hp x 0.59 x 5.8320 g/hp-hr
= 16,301,513 g/yr.
= 17.97 tons/yr.

A final step in the calculation was to determine the percent of weekday versus weekend emissions. Equipment hours of operation on weekdays for all survey responses were added and divided by the total number of hours. It was determined that 78.1 percent of the equipment hours of operation are during weekdays and 21.9 percent of the equipment hours of operation occur during the weekend. Emissions for an average ozone season weekday were calculated using Equation 4.

Equation (4) Emissions in g/day (VOC/CO/NOx) = Emissions (g/yr.) x WA ÷ WD

where WA = Weekday adjustment factor from survey responses
WD = Weekdays per year

NOx Emissions = 17.97 tons/yr. x 0.781 ÷ 261 weekdays/year
= 0.0538 tons/weekday

This same procedure was used for CO and VOCs to produce estimates of pollutants by quarry. Emission estimates were added up for each quarry in a county to determine total county emissions. A summary of the results is provided in Table 4.

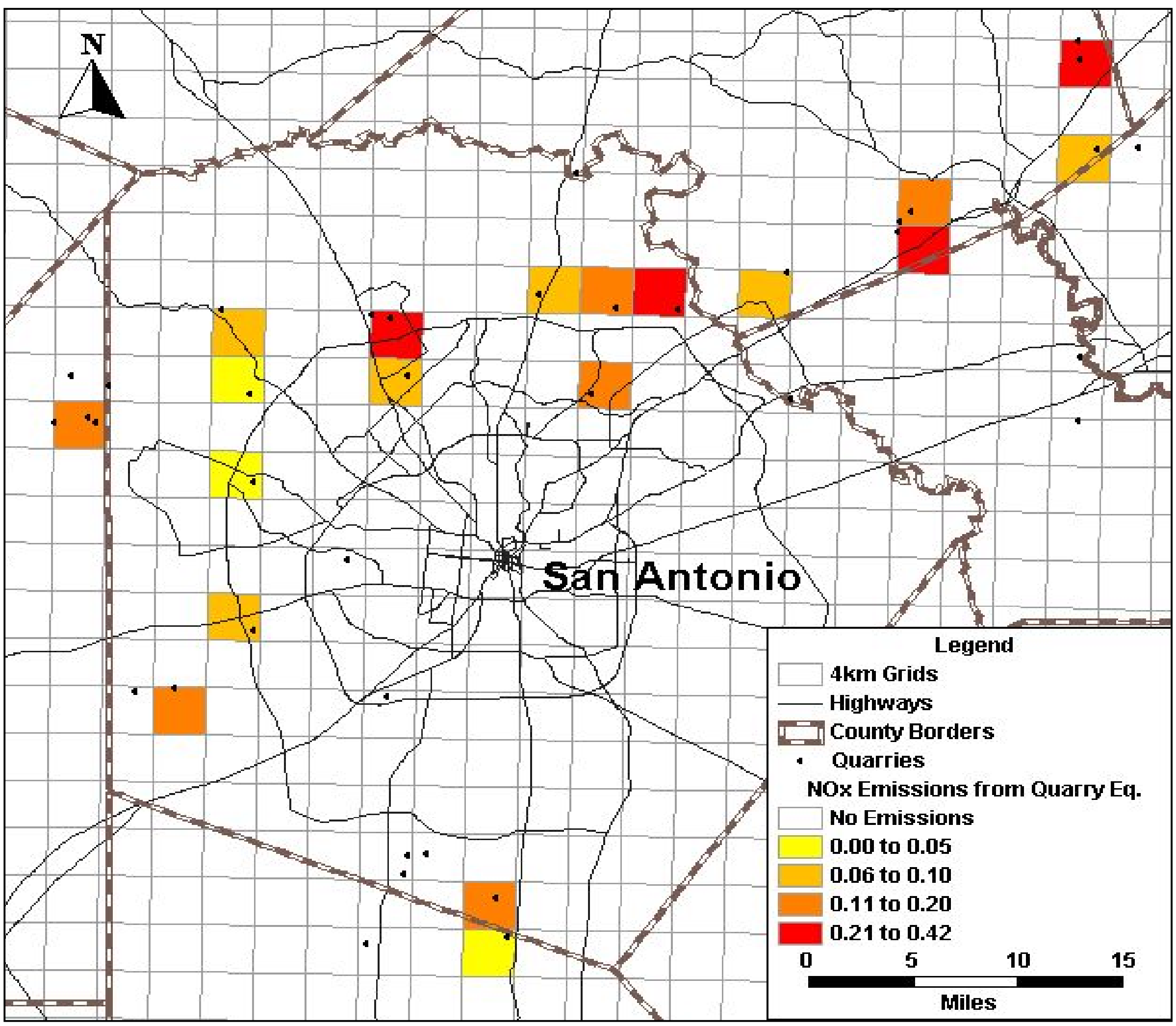
Table 4. Quarry equipment emissions by county in the San Antonio region, 2005

County	VOC (tons/day)	NOx (tons/day)	CO (tons/day)
Atascosa	0.00	0.06	0.02
Bexar	0.13	1.88	0.71
Comal	0.08	1.15	0.43
Gillespie	0.00	0.06	0.02
Kerr	0.00	0.01	0.00
Medina	0.01	0.09	0.04
Total	0.23	3.24	1.22

Step 6: Spatial Allocation

Emissions were geo-coded to quarry locations using TransCAD. As Figure 2 shows, emission were aggregated to the 4km photochemical model grid system. The 4km grid system is based on the September 1999 modeling episode used in the San Antonio Early Action Compact (EAC) State Implementation Plan (SIP).

Figure 2. Allocation of quarries and quarry equipment emissions to photochemical model grids



Only quarries with more then 9 employees had emissions allocated to the 4km grids. As shown in the figure, most of the quarry emissions were generated in north San Antonio as well as to the northeast of the City. By allocating emissions to actual quarry sites, ozone predictions in the photochemical model are more accurate.

CONCLUSION

The NONROAD model default values proved inappropriate for quarry equipment in the San Antonio region because local quarries usually operated larger construction equipment and nearly constant usage rates compared to the data in the model. For some equipment, horsepower estimates were higher for quarry equipment as compared to the NONROAD construction equipment defaults. Whereas for rock trucks, the NONROAD defaults had the higher horsepower estimations compared to the survey responses. Although the survey results are different then the NONROAD defaults, the hp values were similar to the ERG study in Austin.

Survey responses indicate that equipment hours at quarry sites are much higher than NONROAD defaults. Similarly, because quarries operate almost constantly to meet the demands of the cement kilns and hot asphalt plants, equipment is used often on weekends.

By using aerial photography, accurate equipment counts at each quarry could be determined. Quarry equipment is a significant part of the emission inventory and companies are reluctant to release data; thus, reliable equipment counts are essential for an accurate emission inventory. For one quarry, the equipment was covered with dust from the quarry that made the equipment harder to detect on the aerial photography. However, with the constant improvements in aerial and satellite imagery, this limitation will be less significant over time.

Using GIS software to allocate emissions to the photochemical model grid systems improves the accuracy of predicting ozone formation and the effectiveness of control strategies. This methodology can be used to improve estimations for other categories of the emission inventory including landfill equipment, above ground storage tanks, crops, open pit lignite mining, other open pit mining activities, etc. Further research on this topic includes examining the impact of the improved quarry emission inventory on photochemical modeling results.

Appendix A
Survey used to determine quarry equipment population, horsepower, and hours

Alamo Area Council Of Governments

May 1, 2003

[COMPANY NAME]
[STREET ADDRESS]
[CITY] [STATE] [ZIP]

ATTENTION: OPERATIONS MANAGER

Re: 2002 San Antonio Emissions Inventory

The Alamo Area Council of Governments (AACOG) requests your assistance in the development of a 2002, air quality emission inventory for San Antonio and the surrounding counties. AACOG is conducting this inventory in order to assess and quantify local air quality within the San Antonio Metropolitan area and contiguous counties. This inventory is especially significant because the San Antonio region currently risks being declared in non-attainment of federal air quality standards (NAAQS).

AACOG will calculate the equipment source component of this inventory from information submitted by local organizations involved in equipment activities in and around the San Antonio region using the enclosed survey. With this survey, we are requesting information on equipment used during the 2002 calendar year within Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. The purpose of this survey is to provide better information and services to the region, as well as help minimize additional regulation on the community.

Your input is vital to this process and will serve to effect a true and correct emissions inventory for 2002 that will be delivered to the EPA. Please provide your responses on the attached survey and return it to us in the self-addressed envelope by the date indicated. The information you provide will be considered strictly confidential and unavailable to publ ic information requests. Please submit your response by, May 30, 2003.

Thank you for your time and participation. If you have any questions or comments please feel free to contact Steven Smeltzer, Environmental Manager at (210) 362-5266.

Regionally yours,

Al J. Notzon III
Executive Director
Enclosures (2)

Alamo Area Council of Governments
Equipment Environmental Impact Survey
Internal Combustion Engine

The Alamo Area Council of Governments (AACOG) is conducting a study to assess and quantify local air quality within the San Antonio Metropolitan area and contiguous counties by performing an emission inventory. AACOG has defined the study area to include Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson counties. Our goal is to provide better information and services to businesses and individuals, and help minimize additional regulation on the community. The purpose of this survey is to gather data on emissions produced by several types of equipment in the region.

The study area does not presently exceed Environmental Protection Agency (EPA) air quality standards. However, if the standards are exceeded in the future we will be classified as nonattainment, which will result in expensive and stringent regulations for your business and the community. By filling out this confidential survey, you will be providing valuable data that will be used to evaluate cost-effective approaches to pollution control. Thank you for taking the time to provide this information.

Instructions:
1. Please look through the equipment types shown on the following page.
2. List any of the equipment types regularly operated at your business.
3. Fill in the appropriate figures for each equipment type you listed. (Estimates are acceptable.)

If you have other internal combustion equipment that is not shown, please include it as well.

NOTE: IF YOUR BUSINESS HAS MORE EQUIPMENT THAN WILL FIT IN THE SPACE PROVIDED, PLEASE MAKE ADDITIONAL COPIES OF THE SURVEY.

Completed surveys can be faxed to (210) 225-5937, or mailed to:
Alamo Area Council of Governments
8700 Tesoro, Suite 700
San Antonio, Texas 78217
Attn: Chris Langston

If you have any questions or comments, please call us at (210) 362-5270.

SURVEY STARTS ON THE OTHER SIDE OF THIS PAGE

	Internal Combustion Equipment Type	Engine Type Gasoline 2-cycle Gasoline 4-cycle Diesel Propane Natural Gas	Approx. Horse-Power Rating	Number of Units Typically Operated	Avg. No. of Hours and Time of Day Each Unit Operated (MON-FRI)	Avg. No. of Hours and Time of Day Each Unit Operated (SAT & SUN)
Construction Equipment						
1	Bore/Drill Rigs					
2	Excavators					
3	Concrete & Mortar Mixers					
4	Cranes					
5	Graders					
6	Crushing/Processing Eqmt.					
7	Rough Terrain Forklifts					
8	Rubber Tire Loaders					
9	Other Loaders					
10	Dozers					
11	Tractors/Backhoes					
12	Scrapers					
13	Rollers					
14	Trenchers					
15	Pavers					
16	Other Construction Equipment Type: ___________					

REFERENCES

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Caliper Corporation, *TRANSCAD: Transportation GIS Software Version 4.7,* 2005, Newton MA

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U.S. Environmental Protection Agency, *National Nonroad Emissions Model 2004: Draft Version*, 2005, Ann Arbor, MI.

KEY WORDS

Aerial Photography
Construction Equipment
Emission Inventory
GIS
Non-road
Quarries
Quarry Equipment