APPENDIX D

1999 BASE CASE MODELING EMISSIONS INVENTORY DEVELOPMENT

SAN ANTONIO EAC REGION ATTAINMENT DEMONSTRATION

MARCH 2004

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INTRODUCTION

Four South Texas near nonattainment areas[1] (NNA) and Texas Commission on Environmental Quality (TCEQ) sponsored the development of a computer model simulating the high-ozone episode that occurred between September 15th and 20th, 1999. The intent of developing the 1999 simulation was to provide a means of projecting air quality conditions to the year 2007 so that pollution control measures could be modeled and analyzed for their effectiveness in that future time period.

Environmental Protection Agency (EPA) draft guidance provides a detailed process for developing and analyzing model simulations from the planning stages through control strategy development and evaluation. These steps were followed in developing an air quality simulation for the September 1999 episode.

The following is a list of county regions this appendix, as well as Appendix F, will refer to in the body as well as various tables, charts, or figures.

- AACOG 12-county region: Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, & Wilson counties.
- 4-county San Antonio Early Action Compact Region (SAER): Bexar, Comal, Guadalupe, & Wilson counties.
- AACOG Rural Counties: Atascosa, Bandera, Frio, Gillespie, Karnes, Kendall, Kerr, & Medina counties.
- Austin 3-county region: Hays, Travis, & Williamson counties.
- Austin 5-county MSA: Bastrop, Caldwell, Hays, Travis, & Williamson counties.
- Capital Area Planning Council (CAPCO) 10-county region: Bastrop, Blanco, Burnet, Caldwell, Fayette, Lee, Llano, Travis, & Williamson counties.
- CAPCO non-MSA counties: Burnet, Blanco, Fayette, Lee, & Llano counties.
- Corpus Christi 2-county Region: Nueces & San Pratricio counties.
- Houston/Galveston 8-county (non-attainment) region: Brazonia, Chambers, Fort Bend, Galveston, Harris Liberty, Montgomery, & Waller counties.
- Beaumont/Port Arthur (BPA) 3-county region: Hardin, Orange, and Jefferson counties.
- Tyler/Longview 2-county region: Smith & Gregg counties.
- Victoria 7-county region: Calhoun, De Witt, Goliad, Jackson, Lavaca, Refugio, & Victoria counties.

GENERAL REFINEMENTS TO THE 1999 EMISSION INVENTORY (EI) INPUTS

During the March 6, 2003 Texas Near Nonattainment Areas meeting, ENVIRON, TCEQ and NNA stakeholders recommended refining the following list of input categories to improve the 1999 episode base case:

- On-road data for urban areas of Texas – refinements to be calculated using MOBILE6 (Replacing MOBILE5 on-road files with MOBILE6 files in urban areas is also a requirement of the Early Action Compact)
- Texas stationary point source data
- Texas area and non-road data
- Louisiana Emission Inventory data

Other changes

[1] The regions of Austin, Corpus Christi, San Antonio, and Victoria.

- National Emission Trends (NET) data for regional inputs to the model
- New Regional Emission Inventory (EI) – includes Area, Non-road, On-road, and Point sources.

The air quality model methodologies are based on a nested grid, discussed further in Appendix E. This appendix will focus on the development or origin of the files used in the 1999 Emissions Inventory photochemical model base case development.

Adjustments to Temporal Input Data
All values were provided by ENVIRON, TCEQ, EPA, or were local-survey based. EPA default data can be found online.[2] Local weekly and monthly adjustment values were based on survey results from the 1999 NET Emissions Inventories for AACOG and CAPCO. All hourly data were either provided by ENVIRON or extracted from TCEQ files; survey data were not used for adjustment of the hourly data. The temporal adjustments for tank truck unloading, Source Classification Codes (SCC) 2501060053, were provided by the EPA. These temporal allocations are contained in the following files:

- month_prof_042902.db
- temporal.pdf
- tprl_xref_030701.dbf
- tprl_xref_0307 01.xls
- week_prof_121400.dbf
- wkd_diurnal_prof_121400.dbf[3]

BIOGENIC SOURCE EMISSIONS FOR 1999 BASE CASE
Emission rates that result from natural processes in vegetation and soils were developed for the year 1999 by ENVIRON, "Final Report Emissions Processing for the Joint Comprehensive Air Quality Model with Extensions (CAMx) Photochemical Modeling of Four Southern Texas Near Non-Attainment Areas" (p. 10 & p. 17). The emissions were calculated for all regions in the 36-km grid.

POINT SOURCE EMISSSIONS FOR 1999 BASE CASE
An additional modeling consideration for point sources is spatially allocating emissions to the correct vertical layer. Plants and facilities that emit pollutants through stacks present spatial allocation challenges since stacks can release emissions many meters above the surface. Depending on wind speed and other climatic conditions, this may allow the plants effluent to travel much greater distances than pollutants released at the surface. Point sources are sub-divided between electric generating units (EGUs) and non-electric generating units (NEGUs).

Regional
Emissions for all states, within the 36-km grid except Texas and Louisiana, used data from EPA's National Emission Inventory for 1999 (NEI99) version 2. Louisiana emissions were originally from the Louisiana EI which contained updated local data processed by ENVIRON (2002). Texas offshore point source emissions were also processed by ENVIRON. Emissions data for Texas were gathered from several sources are explained in more detail by region.

[2] Available at: http://www.epa.gov/ttn/chief/emch/temporal/
[3] University of Texas at Austin (UT), email from Gary McGaughy received on 2/9/04, "Fwd: latest draft 2007 files."

San Antonio Region

The photochemical model's EGU point source file was updated for the local San Antonio area with information from City Public Service (CPS), the utility provider for the City of San Antonio and portions of surrounding counties. This is in keeping with a recommendation from the EPA that "use of local speciation information, especially for major emitters, is preferable to national default profiles." [EPA, 1991a]

CPS provided emission rates in tons/day by power plant stack for the September 13 – 20, 1999 episode.[4] Table D-1 lists the refined NOx emission rates and table D-2 lists the refined VOC emission rates, by power plant stack, for each of the ramp-up and episode days. These emissions were spatially allocated based on the geographic locations of the plants.

Plant acronyms on the following tables are defined as:

JKS - JK Spruce
JTD - JT Deely
AVR - A. von Rosenburg
OWS - OW Sommers
VHB - VH Brauning
WBT - WB Tuttle
LCP - Leon Creek Plant

Table D-1. NOx Emissions from CPS Power Plant Units in Bexar County, Tons per Day September 13 – 20, 1999 episode.

Unit	9/13/99	9/14/99	9/15/99	9/16/99	9/17/99	9/18/99	9/19/99	9/20/99
JKS1	13.1	13.5	13.4	14.4	17.8	13.7	14.0	16.7
JTD2	13.6	14.0	14.4	13.6	13.8	25.6	25.4	26.1
JTD1	13.6	14.0	14.4	13.6	13.8	25.6	25.4	26.1
AVR1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OWS1	5.8	5.0	4.7	4.8	5.2	4.4	3.6	4.6
OWS2	5.7	2.7	0.0	0.0	5.5	3.7	3.1	4.6
VHB3	17.1	14.7	14.9	15.9	18.8	15.6	11.7	14.0
VHB1	5.2	4.9	4.5	5.2	5.3	4.3	3.9	3.1
VHB2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WBT	6.3	4.7	4.2	3.8	4.1	2.3	2.6	2.6
LCP	4.1	1.5	1.2	1.0	1.1	0.0	0.0	0.0
Total	84.5	61.5	71.7	72.4	85.4	69.7	64.2	71.9

Source: City Public Service

[4] City Public Service (CPS), email from Joe Fulton received 04/14/03, "AACOG submittal of CPS emissions.xls CONFIDENTIAL DATA."

Table D-2. VOC Emissions from CPS Power Plant Units in Bexar County, Tons per Day September 13 – 20, 1999 Episode.

Unit	9/13/99	9/14/99	9/15/99	9/16/99	9/17/99	9/18/99	9/19/99	9/20/99
JKS1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
JTD2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2
JTD1	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2
AVR1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OWS1	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
OWS2	0.2	0.1	0.0	0.0	0.2	0.1	0.1	0.2
VHB3	0.8	0.7	0.7	0.7	0.8	0.7	0.5	0.6
VHB1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1
VHB2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WBT	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LCP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	2.1	1.9	1.8	1.8	2.2	1.8	1.5	1.7

Source: City Public Service

Houston/Galveston & Beaumont/Port Arthur Regions

The emissions for the 8-county and 3-county regions were obtained from the TCEQ point source database, described below in the *Other Texas Urban Counties and Texas Rural Counties* section. These NEGU and EGU emissions were not backcast from 2000 to 1999. The 2000 emission estimates were preserved to avoid possible adjustment errors. Use of the 2000 emission rates is also justified due to the small change in these emissions from one year to the next. TCEQ performed extensive quality assurance (QA) on the Houston point source data after refinements to emissions were made. The data are considered accurate and were used in the Houston SIP.

Victoria Region

Emissions for the Victoria 7-county region were processed using local data by UT and were obtained from the Texas Near Non-Attainment (txnna) server.[5]

Other Texas Urban Counties and Texas Rural Counties

TCEQ maintains a point source database (PSDB) for the State of Texas. The database, which contains emission rates and spatial allocation information for EGUs and NEGUs, underwent re-evaluation and refinement in the spring of 2003 in preparation for use in the 1999 Dallas-Fort Worth (DFW) modeling episode. The data are available in model-ready files from TCEQ's file ftp web site.[6] These emission rates were incorporated into the refined 1999 photochemical model with the exception of the Bexar County EGUs, for which AACOG had received data from the source and the Victoria region's point sources, as described previously. This is the same data used in the DFW State Implementation Plan (SIP).

[5] Available on txnna server: air.tamuk.edu/data/VCT/1999/emiss/VCT_1999_emiss_02262004.tar.gz
[6] Available: ftp://ftp.tceq.state.tx.us/pub/OEPAA/TAD/Modeling/DFWAQSE/Modeling/EI (Accessed: 05/22/03.)

Table D-3. Photochemical Model Jobs & Files for 1999 Development of Point Sources.

Counties/Regions	Job Script	Input Files	Description
Regional: Outside Texas (no Louisiana)	pts.regional.net99.a	nei99ver2_point.afs	Processing the hourly egu & negu point sources for the region.[7]
		ctl.zero.louisiana	Removes Louisiana emissions (In another script).
Regional: Louisiana		emiss.pt.LA_EI99.negu.xxx elvems.pt.LA_EI99.negu.xxx emiss.pt.LA_hourly_egu.9909xxx.PO elvems.pt.LA_hourly_egu.9909xxx.PO emiss.pt.LA_hourly_egu.yyyyyy.noPO elvems.pt.LA_hourly_egu.yyyyyy.noPO	Point source emissions for the Regional Grid (hourly & daily).[8]
Texas Offshore	pts.TX_offshore	afs.offshore.lcp.93_2.srt	Processing of Texas offshore PO point sources (ENVIRON, 2002).
Texas counties (without Houston/ Galveston, Beaumont/ Port Arthur, or Victoria regions)	pts.TX_minor.99po.a	afs.0813-2299minorpts_nna.lcp.srt	Processing of minor PO point sources, no elevated sources (ENVIRON, 2002).
	pts.TX_negu.99po.b	TX_noHGBPA_negu.afs.txt	TCEQ processing of non-egu point sources.[9]
	pts.TX_hrly_egu.0913_2099	TX_noHGBPA_hrly_egu_S_afs.txt	Processing of Texas hourly EGU point sources.[10]
	Pt.TX_hrly_egu.9013_2099.PO	TX_noHGBPA_hrly_egu_PO_afs.txt	Processing of Texas daily EGU point sources.[11]
Houston/Galveston 8-county Region & Beaumont/Port Arthur 3-county Region	pts.houston_hrly_egu.0913_2099.job	hourly_Txegu_0913_2099.afs_Rev6b.lcp.srt_v2.noPO	TCEQ processing of hourly egu point sources, no PO.[12]
		ctl.zero_non.houston.bpa	Removes counties other than Houston/Galveston & Beaumont/Port Arthur counties (in diff. script).
	pts.houston_hrly_egu.PO.0913_2099.job	hourly_Txegu_0913_2099.afs_Rev6b.lcp.srt_v2.PO	TCEQ processing of PO egu point sources.[13]

[7] UT; email from Gary McGaughey received 11/4/03, "EGU and NEGU NEI99 AFS Data files." [based on EPA's NEI ver. 2]
[8] UT; email from Alba Webb received 03/11/04, "1999 EI Comparison."
[9] UT; email from Gary McGaughey received 03/05/03, "RE: 1999 EI." [TCEQ based data (Dallas SIP)]
[10] UT; email from Gary McGaughey received 03/05/03, "RE: 1999 EI." [TCEQ based data (Dallas SIP)]
[11] Texas Commission on Environmental Quality (TCEQ), email from Ron Thomas received 5/22/03, "RE: DWF 1999 AFS files." [TCEQ based data (Dallas SIP)]
[12] TCEQ; email from Ron Thomas received 05/22/03, "RE: DFW 1999 AFS files."
[13] TCEQ; email from Ron Thomas received 05/22/03, "RE: DFW 1999 AFS files." [for Houston Sip]

(cont.) Houston/Galveston 8-county Region & Beaumont/Port Arthur 3-county Region		ctl.zero_non.houston.bpa	Removes counties other than Houston/Galveston & Beaumont/Port Arthur counties (in diff. Script).
	pts.houston_negu.99po.job	afs.tx_negu.agg_re.000818_000906.vlsp.3pols.lcp	TCEQ processing of non-egu point sources.[14]
		ctl.zero_non.houston.bpa	Removes counties other than Houston/Galveston & Beaumont/Port Arthur counties (in diff. Script).
Victoria 7-county region		emiss.pt.vic_egu.99nopo.yyyyy elvems.pt.vic_egu.99nopo.yyyyy emiss.pt.vic_egu.99po.xxx elvems.pt.vic_egu.99po.xxx	UT processing of hourly & daily egu point sources.[15]
		emiss.pt.vic_negu.99po.xxx elvems.pt.vic_negu.99po.xxx	Processing of daily non-egu point sources. [16]
		emiss.pt.TX_negu.yyyyyy.BP_daily.vic_updates.ph50 elvems.pt.TX_negu.yyyyyy.BP_daily.vic_updates.ph50 emiss.pt.TX_negu.yyyyyy.Dow-UC_upsets.vic_updates.ph50 elvems.pt.TX_negu.yyyyyy.Dow-UC_upsets.vic_updates.ph50 emiss.pt.TX_negu.yyyyyy.Dupont_hourly.vic_updates.ph50 elvems.pt.TX_negu.yyyyyy.Dupont_hourly.vic_updates.ph50 emiss.pt.TX_negu.yyyyyy.Dupont_upsets.vic_updates.ph50 elvems.pt.TX_negu.yyyyyy.Dupont_upsets.vic_updates.ph50 emiss.pt.TX_negu.yyyyyy.Koch_daily.vic_updates.ph50 elvems.pt.TX_negu.yyyyyy.Koch_daily.vic_updates.ph50	Processing of hourly non-egu point sources.[17]

[14] TCEQ; email from Ron Thomas received 05/22/03, "RE: DFW 1999 AFS files." [for Houston Sip]
[15] UT; email from Gary McGaughey received 03/10/04, "1999 VCT Point data."
[16] UT; email from Gary McGaughey received 03/10/04, "1999 VCT Point data."
[17] UT; email from Gary McGaughey received 03/10/04, "1999 VCT Point data."

AREA SOURCE EMISSIONS FOR 1999 BASE CASE

Area source emissions were developed using a variety of sources from national EIs to the use of local data. Local data were used to calculate emissions where available, chiefly in urban areas. Minor refinements to these inventories are explained further under the county/regional sections that follow.

Regional

For states other than Texas in the 36-km grid, emissions were based on the NEI99 version 2, emissions inventory database maintained by the EPA. The database contains point, area, and mobile 1999 emission rates of VOCs, NOx, and CO for all 50 states.

Texas Rural Counties

Updated area source emissions files were downloaded for rural counties in Texas from TCEQ's ftp web site. In addition, updated area emissions were obtained from EPA's "Clearinghouse for Inventories & Emission Factors" web site.[18]

Alamo Area Council of Governments (AACOG) staff used the Texas Air Quality Study (TexAQS) Emissions Inventory for attainment counties.[19] This EI was later updated with a refined temporal allocation methodology, discussed further in the Temporal Adjustments section. The EI matches the emissions in the Houston SIP; Houston also used the TexAQS EI. The EI contains new emissions data for Houston that were not available previously; the data are more accurate, especially in upwind sites of Houston. The TexAQS EI contains improved emissions source data, as well as calculations.

For the urban regions of Texas, emissions data were gathered from several organizations and government agencies or developed with the use of models, local surveys, and/or local data.

San Antonio Region

Surveys and local inputs were used to determine emission rates when available. In the absence of local data, surrogate data were used to calculate emission rates. Surrogate data may include gross state product, employment, national/state sales estimates, sales tax rates, or population estimates.

The data collected for and contained within the 1999 AACOG EI were used for most of the area sources in AACOG's 12-county region. Temporal adjustments were incorporated into the photochemical model to account for the 1999 Sept. 13-20th dates.

<u>Wastewater</u>

The San Antonio Water System (SAWS) provided AACOG with updated emission estimates and methodologies in January 2004. The information sent contained several documents:

- "Permit by Rule Submittal for San Antonio Water System's Dos Rios Water Recycling Center" (Ewen, 2003)
- monitoring samples for Dos Rios dating back to September 1997, Salado Creek dating back to November 1997, Medio Creek dating back to September 1997, and Leon Creek dating back to June 1998

[18] Available: ftp://ftp.epa.gov/EmisInventory/finalnei99ver2/criteria/datafiles/

[19] TCEQ; email received 03/26/03, "Modeling EI for the Houston." Available online at: ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/HGAQSE/Modeling/EI

- "VOC Emissions from Wastewater Treatment Plants." (Prakasam, 2003)
- "Predicting VOC Emissions from Wastewater Processes using General Fate Models (GEMs)," (Curto, 1996).
- Salado Creek, Dos Rios, and Medio Creek flow data

SAWS estimated their VOC Emissions to be:

Dos Rios WRC	8.51 tons/yr.
Salado Creek WRC	1.36 tons/yr.
Leon Creek WRC	1.70 tons/yr.
Medio Creek WRC	0.07 tons/yr.
WW Total	11.6 tons/yr.

Austin Region
Surveys and local inputs were used to determine emission rates when available. In the absence of local data, surrogate data were used to calculate emission rates. Surrogate data may include gross state product, employment, national/state sales estimates, sales tax rates, or population estimates.

This data, collected for and contained within the 1999 CAPCO EI, were used for most of the area sources in CAPCO's 10-county region. Temporal adjustments were incorporated into the photochemical model to account for the 1999 Sept. 13-20th dates.

Houston/Galveston Region
Area source emissions developed for counties in the Houston/Galveston region were downloaded from TCEQ's web site[20] on March 17, 2003. These emission files were used to perform the photochemical modeling included in the most recent SIP revision for the Houston area. The emissions were calculated for August 2000. To estimate 1999 emissions from the 2000 data, version 4.0 of the Economic Growth Analysis System (EGAS) was used to backcast the emissions to September 1999 (PECHAN, 2001). EGAS is an EPA-recommended model used to project emissions (backward or forward) based on economic forecasts.

Other Urban Regions
The Corpus Christi and Victoria regions were processed for 1999 by UT and contain local data.

[20] Available: ftp://ftp.tceq.state.tx.us/pub/OEPAA

Table D-4. Photochemical Input Files Used for 1999 EI Development of Area Sources

Counties/Regions	Job Scripts	Input Files	Description
Regional Outside Texas	ar.regional.net99	nei99ver2_area.ams	Process regional ams area based on EPA's NEI99 ver2.[21]
Regional	mrguam.ar.all_reg99po	emiss.ar.reg_tx.net99.xxx emiss.ar.houston.net99.xxx emiss.nr.reg_tx.net99.xxx emiss.ar.reg.net99.xxx emiss.nr.reg.net99.xxx	Merge Area and Non-road emissions for the Regional Grid.
Texas Counties (excludes San Antonio, Austin, Houston/Galveston, Corpus Christi, and Victoria regions.)	ar.texas.net99	ams.TX_00.area_base2	Process ams emissions.[22]
		ctl.area.00.to.99	Backcast area source emissions from 2000 to 1999 using EGAS (Pechan, 2001) factors.
AACOG 12-county region	ar.sa.99.a0	ams.aacog.area.b	Process the ams area sources with local data (AACOG, Aug. 2001).
	afsar.sa.99.a	afs.capco.aacog.area	Process the afs (geo-coded) area sources for AACOG counties with local data (AACOG, Aug. 2001).
CAPCO 10-county region		emiss.artnr.Aus99.ams.xxx	Process the ams area sources with local data.[23]
		emiss.artnr.Aus99.afs.xxx	Process the afs (geo-coded) area sources with local data.[24]
Houston/Galveston 8-county region	ar.houston.net99*	ams.TX_00.area_base2	Process ams emissions.[25]
		ctl.houston.00.to.99	Backcast Houston area source emissions from 2000 to 1999 using EGAS (Pechan, 2001) factors.

[21] TCEQ; "TCEQ Modeling EI August 27, 2003 based on EPA's NIF version 2." (ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/)
[22] TCEQ; 3/26/03. "TCEQ Modeling EI for Houston SIP" (ftp://ftp.tceq.state.tx.us/pub/OEPAA/TAD/Modeling/DFWAQSE/Modeling/EI)
[23] UT; email: from Gary McGaughey received 03/08/04, "RE: San Antonio ar+nr emiss files?"
[24] UT; email: from Gary McGaughey received 03/08/04, "RE: San Antonio ar+nr emiss files?"
[25] TCEQ; 3/26/03. "TCEQ Modeling EI for Houston SIP" (ftp://ftp.tceq.state.tx.us/pub/OEPAA/TAD/Modeling/DFWAQSE/Modeling/EI)

Corpus Christi 2-county region	ar.cc.99	ams-area-nsp.prn	Process the ams area sources with local data (ENVIRON, 2002).
Victoria 7-county region		emiss.artnr.vic.99ams_nomil.a0.xxx emiss.vic.Fire.yyyyyy	Process the area emissions with local data.[26]

[26] UT; email: from Gary McGaughey received 03/08/04, "RE: San Antonio ar+nr emiss files?"

NON-ROAD SOURCE EMISSIONS FOR 1999 BASE CASE

Non-road source emissions were developed using a variety of sources, from national EIs to the use of local data. Local data were used to calculate emissions where available, chiefly in urban areas. Minor refinements to these inventories are explained further under the county/regional sections.

Regional

Non-road data from the EPA SCRAM site (NEI99 version 2 data), downloaded in March 2003, were used to update the off-road emissions for the states other than Texas, within the 36-km grid.

Texas Rural Counties

The off-road equipment files contained on TCEQ's web site were used to update the 1999 base case for the rural counties of Texas.

San Antonio Region

The data collected for and contained within the EPA-approved 1999 AACOG EI (AACOG, 2001) were used for most of the non-road sources in the 12-county AACOG region. The information included in the AACOG EI has been gathered through the use of a local survey, available employment data, and application of EPA's NONROAD model. In addition, adjustments were made to the temporal allocation of non-road data in the photochemical model for the 1999 EI Sept. 13-20th dates.

Diesel Construction Equipment

The EI for diesel construction equipment in the AACOG region was updated using surrogate factors obtained by the same means as in a Houston-Galveston area study conducted by Eastern Research Group (ERG), (Eastern, 2000). This methodology was also used in two other studies conducted by ERG for the CAPCO and DFW regions. Where data were not obtainable, the NONROAD Model was used instead.

The surrogate factors for various categories of diesel construction equipment were calculated as folloows:

- *Highway:* AACOG obtained highway construction lettings in the 1999 District and County Statistics (DISCOS) from the Texas Department of Transportation.

Surrogate Factor = SA Hwy Construction Lettings / Houston Hwy Construction Lettings
= $171,059,013.76 / $629,586,701.01
= 0.2717

- *Municipal & Utility:* MSA populations were used to calculate the surrogate factors. MSA populations for 1999 were obtained from the AACOG 1999 Emissions Inventory (AACOG, Aug. 2001).

Surrogate Factor = 1,637,460 (San Antonio MSA Pop.) / 4,490,310 (Houston MSA Pop.)
= 0.3647

- *Commercial:* Construction employee populations (NAICS 23), were used for the calculation of commercial construction equipment. Employee populations for the San Antonio and Houston MSAs were collected from the US Census Bureau 1999 County Business Patterns (US Census, 2001).

Surrogate Factor = 40,909 SA MSA commercial construction employees /
153,981 Houston MSA commercial construction employees
= 0.2657

- *Residential:* The number of single family dwelling permits for metropolitan areas were used as a comparison to calculate the factor for this category. The data were collected from the Texas A&M Real Estate Center (Texas A&M, 2003)

Surrogate Factor = 8,678 (San Antonio MSA single-family housing building permits) / 22,248 (Houston MSA single-family housing building permits)
= 0.3901

- *Rental:* In the creation of a surrogate factor for rental equipment, the employee populations, NAICS 42181 and 53249 were obtained for the San Antonio and Houston metro areas from the US Census Bureau's 1999 County Business Patterns (US Census, 2001)

Surrogate Factor = 1335 (San Antonio Employees) / 5013 (Houston Employees)
= 0.2663

- *>25 horsepower*: To maintain consistency in a comparison between construction equipment inventories, it was necessary for AACOG to add back in the 12,615 engines under 25 horsepower in Texas thus allocating 1,015 to the San Antonio MSA or 8.05% of the Texas equipment population
- *Landfill Equipment*: To adjust for local landfill equipment data, AACOG applied the same equipment configuration used in the CAPCO study (Eastern, 2001).
- *Quarry Equipment:* This category was calculated separately. Data for horsepower, hours of use, and equipment population were obtained from local survey results and applied to the study. In the absence of local survey data, default values from the NONROAD Model were used. Although the survey data were obtained from a 2002 survey, it was assumed that operations have not changed drastically in the 3 years in between the studies. There were investigations on quarries to see if they were still in operation in 1999. Three quarries were shown not to be in operation and were discarded from the study. The emissions were calculated by using the following formula:

EP*HRS*HP*LF*EF = Tons per year
Where,
EP = Equipment population
HRS = Annual hours of use
HP = Average rated horsepower
LF = Typical load factor
EF = Average emission of pollutant per unit of use

Quarry equipment was geocoded according to each site location so emissions could be calculated with site specific accuracy in the photochemical model. The resulting emissions from quarry equipment for the region was 0.3483 tons per day of VOC and 2.8909 tons per day of NOx. The resulting emissions are the combination of all points discussed in this section.

Quarry Equipment

This category consists of emissions produced from equipment used in quarry and mining activities. The methodology used in estimating quarry equipment emissions for the AACOG region is based on the local data extracted from aerial photographs and surveys, and EPA's NONROAD model. The NONROAD model was used in the absence of reliable local data. The methodology involved:

1. Conducted a survey of local quarry equipment activity and determined local equipment population, usage rates, and equipment characteristics.
2. Analysis of aerial photography was conducted as a result of a low response to surveys. Quarry equipment was identified and quantified using available imagery of quarry sites.
3. County equipment populations for quarry sites without local data were calculated by applying an average employee to equipment ratio of those quarry sites with available equipment population data to those quarry sites without data.
4. Estimated VOC, NOx, and CO annual emissions by multiplying the county equipment populations by the average annual hours of use, average rated horsepower, typical load factor, and the EF for each type of equipment. The EPA's NONROAD Emission Model (EPA, 2000) was used to provide the average hours of use and load factor for the seven quarry equipment categories.
5. Converted the tons/year estimate into an estimate for a typical weekday (tons/day), and a typical weekend day (tons/day).

Austin Region

CAPCO developed the non-road emissions for the Austin 10-county region which were based on data collected for and contained within the EPA-approved 1999 CAPCO EI (AACOG, 2001). The information included in the CAPCO EI was gathered through the use of local survey, available employment data, and application of the NONROAD model. In addition, temporal adjustments were incorporated within the photochemical model to account for the 1999 EI Sept. 13-20th episode.

Houston/Galveston Region

Non-road emissions for the counties in the Houston-Galveston region were downloaded from TCEQ's web site[27] on March 17, 2003. The Houston-Galveston non-road emissions were for the year 2000; therefore, the EPA's NONROAD model was used to estimate the emissions for September 1999. This model can be used to estimate past, current, and future inventories for most off-road equipment categories. The model produces emission estimates for all criteria pollutants, as well as carbon dioxide, down to the county level.

The NONROAD runs were conducted for a typical summer day (weekday and weekend day) in 1999 and in 2000 (EPA, 2000). The percent differences between 1999 and 2000 statewide emissions on a typical summer day, by SCC code, were used to develop weekday and weekend adjustment factors for each equipment type. These factors were applied to the 2000 Houston data to estimate 1999 non-road emissions.

Other Urban Regions

The non-road emissions for the Corpus Christi 2-county region were developed by ENVIRON and processed in three files: geocoded military, geocoded commercial airport, and the remaining sources, non-geocoded. The Victoria region's emissions were developed and supplied by UT and were made available in one file containing all non-road emissions.

[27] Available at: ftp://ftp.tceq.state.tx.us/pub/OEPAA/TAD/Modeling/HGAQSE/Modeling/EI/

Table D-5. Photochemical Model Jobs & Files for 1999 EI Development of Non-road Sources.

Counties/Regions	Job Scripts	Input Files	Description
Regional	nr.regional.net99	nei99ver2_nonroad.ams	Process of emissions based on EPA's NEI99 version 2.[28]
Texas (Rural Counties)	nr.texas.net99	ams.TX_00.NR_base2	Process of 2000 non-road source file for Texas.
		ctl.nr.tx.00.to.99	Backcast them to 1999[29] using NONROAD Model.
San Antonio (AACOG) 12-county region	afs.quarry.99	afs.quarry.aacog	Process of geo coded quarry emissions including local data (AACOG, 2001) and NONROAD Model.
	afs_nr.sa.a.99	afs.nonroad.capco.aacog.a	Process of afs file for non-road emissions including local data for all the AACOG counties.
		ctl.construction	Adjusts construction diesel engines emissions to demonstrate the re-calculation of equipment population for 4-county SAER.
	afs_tractors.combine.sa.99	afs.tractors_combines.sa	Geo-coded tractor /combine emissions including local data for Bexar, Wilson, Comal, Atascosa, Medina, Guadeloupe, and Fayette counties
	tractors_combines.sa.au	ams.tractors_combines.sa.au	Process of ams tractor & combine emissions (non-geocoded), includes local data.
	airport.sa.99	ams.airport.sa	Process of civilian airport emissions with local data for all the AACOG counties (geo coded to its location using the grdsrg file in grdem).
	military.sa.99	ams.military.sa	Process of military airport emissions including local data (geo coded to location using the grdsrg file in grdem).
	nr.sa.99.a0	ams.aacog.nonroad.b	Process of ams file for non-road sources including local data.
Austin (CAPCO) 10-county region		emiss.nr.Aus99.ams.xxx emiss.nr.Aus99.afs.xxx (geo-coded)	Process of afs file non-road emissions including local data (includes temporal adjustment for day of the week).[30]
	ma.austin.99	airport-military.austin	Process of ams file for civilian & military airport emissions geo coded to its location using the grdsrg file in grdem (AACOG, Jun. 2001)
Corpus Christi 2-county region	ma.cc.99	afs-ma-nsp.txt.a0	Process of military emissions including local data (ENVIRON, 2002).
	ca.cc.99	afs-ca-nsp.txt.a0	Process of commercial airport emissions including local data (ENVIRON, 2002).

[28] TCEQ, "Modeling EI," Aug. 27, 2003. Available online at: ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/HGAQSE/Modeling/EI
[29] TCEQ, March 26, 2003 "Modeling EI for the Houston SIP," ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/HGAQSE/Modeling/EI
[30] UT; email: from Gary McGaughey received 03/08/04, "RE: San Antonio ar+nr emiss files?"

Corpus Christi 2-county region	nr.cc.99	ams-nonroad-nsp.prn	Process of ams file non-road sources including local data (ENVIRON, 2002).
Victoria 7-county region		emiss.vic.nonroad.yyyyyy	Process emissions.[31]

[31] UT; email: from Gary McGaughey received 02/26/04, "1999 vct emiss files"

ON-ROAD SOURCE EMISSIONS FOR 1999 BASE CASE

Emissions from on-road sources are calculated using the EPA's MOBILE model. AACOG staff integrated MOBILE6 on-road files into the photochemical model for all major urban areas of Texas, when available.

Regional

Outside of Texas, emissions data were developed by TCEQ based on the EPA's NIF version 2.0, and is available on the ftp web site.[32]

Texas Counties

MOBILE6 input files have only been completed for certain counties within nonattainment and near-nonattainment areas. Therefore, on-road inputs were updated using the gridded MOBILE6 files when available; otherwise MOBILE5 emission inventories were used. The methodology is the same as in the Houston SIP which used MOBILE5 for counties outside of the Houston area[33].

The TCEQ directory, MOBILE6 On-Road Emission Data for Texas Near Nonattainment Area Ozone Episodes Emissions for 1999 Base Case & 2007 Future Case (Updated on December 5, 10, and 13, 2002. Originally posted on October 2, 2002.), contains MOBILE6-based on-road mobile source emissions data that are being used to support photochemical modeling efforts for the Texas near nonattainment areas of:

- Austin 3-county Region
- Corpus Christi
- San Antonio (Bexar County only)
- Tyler-Longview
- Victoria

The ozone episode for the Austin, Corpus Christi, San Antonio, and Victoria areas extends from Monday September 13, 1999 through Monday September 20, 1999. The ozone episode for the Tyler-Longview area extends from Friday August 13, 1999 through Sunday August 22, 1999. Inventory data exist for both the 1999 "base cases" and 2007 "future cases" of these episodes. Four "day type" inventories are provided for each area and calendar year:

- Weekday (Monday-Thursday)
- Friday
- Saturday
- Sunday

The inventories were developed under contract to the TCEQ by the Texas Transportation Institute (TTI) and converted into a photochemical model-ready format by TCEQ staff using the 2X version of the Emissions Preprocessor System (EPS2X).

MOBILE6 was not used for rural counties because the 1999 MOBILE6 estimates, as well as, 2007 MOBILE6 emissions estimates were not available in time. In addition, emissions from

[32] Available at: ftp://ftp.tceq.state.tx.us/pub/OEPAA/TAD/Modeling/DFWAQSE/Modeling/EI

[33] Houston SIP used adjusted MOBILE5a-h data in Houston's Mid-Course Review Phase I: Attachment 3 - Emissions Inventory Development and Modeling for the August 25 - September 1, 2000, p. A3 – 79. Episode. Available http://www.tnrcc.state.tx.us/air/aqp/airquality_photomod.html#tsd2

on-road sources in these counties are not significant and would have minimal impact on the San Antonio ozone level.

San Antonio Region
In August 2003, TTI completed the MOBILE6 version 2 gridded on-road input files for Bexar County. The files were made available by the TCEQ and provided in model-ready format on that agency's file transfer protocol (ftp) web site.[34]

Before entering the on-road network data file in the photochemical model, TTI's Bexar County MOBILE6 file was updated in one primary way. The TTI files provided on-road emissions for an average September weekday, Friday, Saturday, and Sunday. These files were adjusted by the University of Texas at Austin (UT) to calculate emissions for the individual episode days of September 13-16, 1999 and September 20, 1999. Temperature and humidity differences between weekdays, as well as, differences in VMT were used for these.

The SAER MOBILE5 emissions estimates were converted to MOBILE6 v. 2 values with day-specific, pollutant-specific factors.

Austin Region
On-road data for the Austin region was also developed by TTI and made available by TCEQ in model-ready format on that agency's file transfer protocol (ftp) web site.[35] This data includes the MoPac/IH-35 adjustment. An estimated 45% of the MoPac NOx emissions were moved to IH-35 to account for the lesser emissions on MoPac freeway as compared to the greater emissions on the IH-35 expressway. This adjustment was made because the two roads were both categorized as freeways, exaggerating the NOx emissions on MoPac.

Houston/Galveston Region
MOBILE6 on-road files were also obtained for the Houston area.[36] However, the Houston on-
road emission rates were estimated for an August 2000 timeframe. Therefore, several adjustments were necessary to make the files suitable for use in the September 1999 episode.

The 2000 Houston episode spanned 8 days, from Wednesday, August 23, 2000 through Wednesday, August 30, 2000, so an initial step in the adjustment process involved selecting appropriate 2000 episode days to backcast to 1999. Since the number of vehicle-miles-traveled (VMT) and vehicle mix vary by day of the week, the Friday (August 25th), Saturday (August 26th) and Sunday (August 27th) 2000 Houston on-road files were used to determine the Friday (September 17th), Saturday (September 18th) and Sunday (September 19th) 1999 on-road inputs, respectively. Ron Thomas of TCEQ recommended using Wednesday, August 30, 2000 as a typical weekday (September 13th through 16th and 20th) for purposes of the 1999 episode.

The August 2000 vehicle emission rates were adjusted to reflect the correct month and year. This was accomplished using the MOBILE6 model. Two runs were conducted for Houston

[34] Available: ftp://ftp.tceq.state.tx.us (April 4, 2003)
[35] Available: ftp://ftp.tceq.state.tx.us (April 4, 2003)
[36] TCEQ, email: from Chris Kite received 12/10/02 (NNA areas) and 02/28/03 (Houston area).

using MOBILE6: one with appropriate settings (such as hourly temperature) for the August 2000 episode and one with appropriate settings for a September 1999 timeframe. The percent difference between the two was applied, in concert with a Vehicle Miles Traveled (VMT) adjustment to account for the difference between total VMT for the two runs, to the 2000 Houston link-based on-road emission file.

The 1999 MOBILE6 LBASE input files aggregate the 28 vehicle-types (EPA, 2001) into 9 (LDG, HDGV, LDD V and T1-4, HDDV2-7, HDDV8a-b, MC, HDGB, HDDBT, and HDDBS) categories; the 13 roadway-types are aggregated into 3 (freeway, arterial, & local) categories.[37]

Other Urban Regions

The MOBILE5 on-road files for Corpus Christi, Tyler-Longview, and Victoria areas that were used in the development of the original September 1999 base case were replaced with the MOBILE6 files developed by the Texas Transportation Institute (TTI) and provided in model-ready format on TCEQ's ftp web site.[38] MOBILE6 ver.1 was used for Gregg, Smith, San Patricio, Nueces, and Victoria counties.

The on-road emissions files, photochemical model job scripts, counties they affect, and a brief description of what the job scripts/files accomplish are listed in Table D-6.

[37] TCEQ, email: from Chris Kite received 02/28/03, "MOBILE6 LBASE Input Files for Houston."
[38] Available ftp://ftp.tceq.state.tx.us (April 4, 2003)

Table D-6. Photochemical Model Jobs & Files for 1999 EI Development of On-Road Sources.

Counties/Regions	Job Scripts	Input Files	Description
Regional (outside of Texas)	mv.regional.net99	nei99ver2_mobile.ams	Process the regional on-road source file.[39]
Other Texas Counties (where MOBILE6 was not available)	pream.txnna.12km.HPMS chmspl.txnna.12km.HPMS grdem.txnna.12km.HPMS cntlem.daily.txnna.12km.mobile5.HPMS.job	AMS.mv.HPMS.hourly.xxx.yyyyyy.a0	Process MOBILE5 emissions, NIF (ENVIRON, 2002).
Bexar County	lbase.mobile6.4km.v2 chmspl.mobile6.4km.v2.job grdem.mobile6.4km.v2.job Cntlem.mobile6.4km.v2.job	m6.1999.bexar,.xxx.0920.lbase_in (Weekdays: Sep. 13-16 and 20th) m6.1999.$county,xxx.yyyyyy.lbase_in (Weekend days: Fri. Sep. 17, Sat. Sep. 18, & Sun. Sep. 19) cntlem.mobile6.4km.v2	Process on-road EI w/ MOBILE6 ver 2 for Bexar county.[40] Applied to MOBILE6 on-road emissions to adjust for each weekday based on day-specific temperature & humidity.[41]
CAPCO 3-county region		emiss.m6.limks.4km.Austin_3county.roadnox.yyyyyy	MOBILE6 ver. 2 w/MOPAC/IH35NOx decrease of 45% for HDDV[42]and day specific emissions.
CAPCO Counties: Bastrop Caldwell *AACOG Counties:* Comal Guadalupe Wilson	cntlem.daily.txnna.4km.mobile5.HPMS	mvfactors.aus.sa.yyyyyy	Converts MOBILE5 emissions estimates to MOBILE6 ver. 2 values with day-specific, pollutant-specific factors.[43]
Houston 8-county Region	lbase.mobile6.12km.houston chmspl.mobile6.12km.houston grdem.mobile6.12km.houston	mobile6.2000.HGA_8county.0830.lbase_in mobile6.2000.HGA_8county.0825.lbase_in mobile6.2000.HGA_8county.0826.lbase_in mobile6.2000.HGA_8county.0827.lbase_in	Process MOBILE6 EI for Houston counties.

[39] TCEQ, Modeling EI based on EPA's NIF version 2.0.
[40] UT; email: from Gary McGaughey received 08/27/03, "1999 M6 files for SA/AUS."
[41] UT; email from Alba Webb received 03/11/04, "RE: Gifs attached." [TTI, June 2003: Appendix C].
[42] UT; email: from Alba Webb received 01/16/04, "Revised Mobile Files," [TTI, June 2003: Appendix C].
[43] UT; email: from Alba Webb received 09/05/03; "RE: Victoria area/nonroad/point 1999 EI data"

	cntlem.mobile6.12km.houston	ctl.onroad.LINKS.daily.yyyyyy	Backcast Houston emissions from Aug. 2000 to Sep. 1999.[44]
Gregg & Smith counties*	lbase.mobile6.12km.LINKS chmspl.mobile6.12km.LINKS grdem.mobile6.12km.LINKS	m6.1999.Tyler_2county.weekday.0816.lbase_in m6.1999.Tyler_2county.weekday.0813.lbase_in m6.1999.Tyler_2county.weekday.0814.lbase_in m6.1999.Tyler_2county.weekday.0815.lbase_in	Process MOBILE6 EI for Gregg & Smith counties.[45]
	cntlem.mobile6.12km.LINKS	ctl.onroad.Links.daily.yyyyyy	Project emissions from Aug. 1999 to Sept. 1999.[46]
Houston 8-county Region	mrguam.mobile6.12km.mv	emiss.mv.mobile6.12km.houston.xxx.yyyyyy.a0	Running of MRGUAM module for the Mobile EI 12km level in 1999.
Gregg County		emiss.mv.mobile6.12km.gregg.xxx.yyyyyy.a0	
Other counties		emiss.mv.mobile5.HPMS.$hpms_.xxx.yyyyyy.a0	
Nueces San Patricio	lbase.mobile6.4km.corpus chmspl.mobile6.4km.v2.job grdem.mobile6.4km.v2.job	m6.1999.corpus.xxx.yyyyyy.lbase_in	Process MOBILE6 Emissions.[47]
Victoria 7-county region		emiss.m6.links.4km.vic.yyyyyy	Day specific 7-county emissions[48] with MOBILE6 for Victoria County and MOBILE5 for other 6 counties.
Bexar Austin 3-county region** Nueces San Patricio Victoria Fort Bend Harris Waller Other	mrguam.txnna.4km.mobile6.v2	emiss.mv.mobile6.v2.4km.bexar.xxx.yyyyyy.a0 emiss.m6.links.4km.Austin_3county.roadnox.yyyyyy emiss.mv.mobile6.4km.nueces.weekday.yyyyyy.a0 emiss.mv.mobile6.4km.sanpatricio.weekday.yyyyyy.a0 emiss.mv.mobile6.4km.victoria.weekday.yyyyyy.a0 emiss.mv.mobile6.4km.fortbend.weekday.yyyyyy.a0 emiss.mv.mobile6.4km.harris.weekday.yyyyyy.a0 emiss.mv.mobile6.4km.waller.weekday.yyyyyy.a0 emiss.mobile5.HPMS.$hpms_day.yyyyyy.ao	MRGUAM module for the Mobile EI (4km) weekdays Mon. Sep 13 –Thurs. Sep. 16 and Mon. Sep 20.

[44] TCEQ, email: from Chris Kite received 02/28/03, "MOBILE6 LBASE Input Files for Houston."
[45] TCEQ; email: from Chris Kite received 08/29/03, "1999 Gridded Onroad Mobile CAMx Files for NNA Subdomain."
[46] TCEQ; email: from Chris Kite received 08/29/03, "1999 Gridded Onroad Mobile CAMx Files for NNA Subdomain."
[47] TCEQ; email: from Chris Kite received 08/29/03, "1999 Gridded Onroad Mobile CAMx Files for NNA Subdomain."
[48] UT; email from Alba Webb received 03/11/04, "RE: Gifs attached." [TTI, June 2003: Appendix C].

Bexar Austin 3-county region** Nueces San Patricio Victoria Fort Bend Harris Waller Other	mrguam.txnna.4km.mobile6.v2	emiss.mv.mobile6.v2.4km.bexar.xxx.yyyyyy.a0 emiss.m6.links.4km.Austin_3county.roadnox.yyyyyy emiss.mv.mobile6.4km.nueces.xxx.yyyyyy.a0 emiss.mv.mobile6.4km.sanpatricio.xxx.yyyyyy.a0 emiss.mv.mobile6.4km.victoria.xxx.yyyyyy.a0 emiss.mv.mobile6.4km.fortbend.xxx.yyyyyy.a0 emiss.mv.mobile6.4km.harris.xxx.yyyyyy.a0 emiss.mv.mobile6.4km.waller.xxx.yyyyyy.a0 e3miss.mobile5.HPMS.$hpms_day.yyyyyy.ao	MRGUAM module for the Mobile EI (4km) to allocate for weekdays and weekend days.
Regional	mrguam.mv.all_reg.mobile6.0999	emiss.mv.all_counties.12km.yyyyyy.a0 emiss.mv.reg.net99.xxx	Merges Mobile emissions for the Regional Grid, 1999.

*Input days used are Aug. 13th for Friday, Aug. 14th for Saturday, Aug. 15th for Sunday, and Aug. 16 for a "representative" weekday. Each day was backcast to Sept. 1999 using day-specific temperatures in MOBILE6 to produce a Gregg and Smith county on-road EI for modeling episode Sept. 13-20, 1999. This is similar to the methodology used for Houston on-road emissions and approved by TCEQ. It was also found to be more accurate than "default" non-gridded on-road emissions.

**Austin emission files were provided by UT and were based on TTI emissions data. These files contain the I35/MOPAC adjustment in Travis County.

SUMMARY OF THE 1999 BASE CASE DEVELOPMENT

Development and refinement of the September 1999 photochemical modeling episode was an extensive project that required the assistance of consultants and the cooperation of several agencies. In addition, it required review and analysis of data from a variety of sources. Meteorological refinements were developed by consultants from ENVIRON International Corporation and the University of Texas at Austin. Their efforts produced three meteorological schemes (labeled 5d, 5g, and 6f) that replicated climatic and atmospheric conditions during the September 1999 episode. The new meteorological schemes were run through the photochemical model to determine their affect on the formation, transport, and deposition of ozone.

Another major step in the development and refinement process entailed developing/obtaining improved emission data for model input and, when necessary, adjusting the rates to the correct time period and converting the data to model-readable files. Sources of refined emissions data included EPA's National Emissions Trend database and State Implementation Plan data developed for other urban areas of Texas. Emissions databases were also reviewed for accuracy as recommended by the EPA in their draft modeling guidance (EPA, 1999a). During this quality assurance/quality control process, several problems were identified that required corrections, such as adjustments to the temporal and spatial allocation of emission rates

The most significant refinement to the emission inputs for the San Antonio region was development of gridded MOBILE6 and MOBILE6 version 2 based on-road emission estimations. The Texas Transportation Institute created average weekday on-road emissions for Bexar County and spatially allocated the emissions to the 4-km grid system. AACOG staff modified the average weekday on-road data to account for variances in temperatures during the modeling episode weekdays

The revised 1999 emissions rates used for input to the photochemical model for Bexar County are summarized in figures D-1 and D-2. These figures provide NOx and VOC emission totals by source category. Prior to incorporating these values in the model, all emission rates were spatially allocated to the 4-km grid using EPA-approved methodologies.

Table D-7. 1999 Emissions by Source Category for Texas for Sept. 13 (Monday)

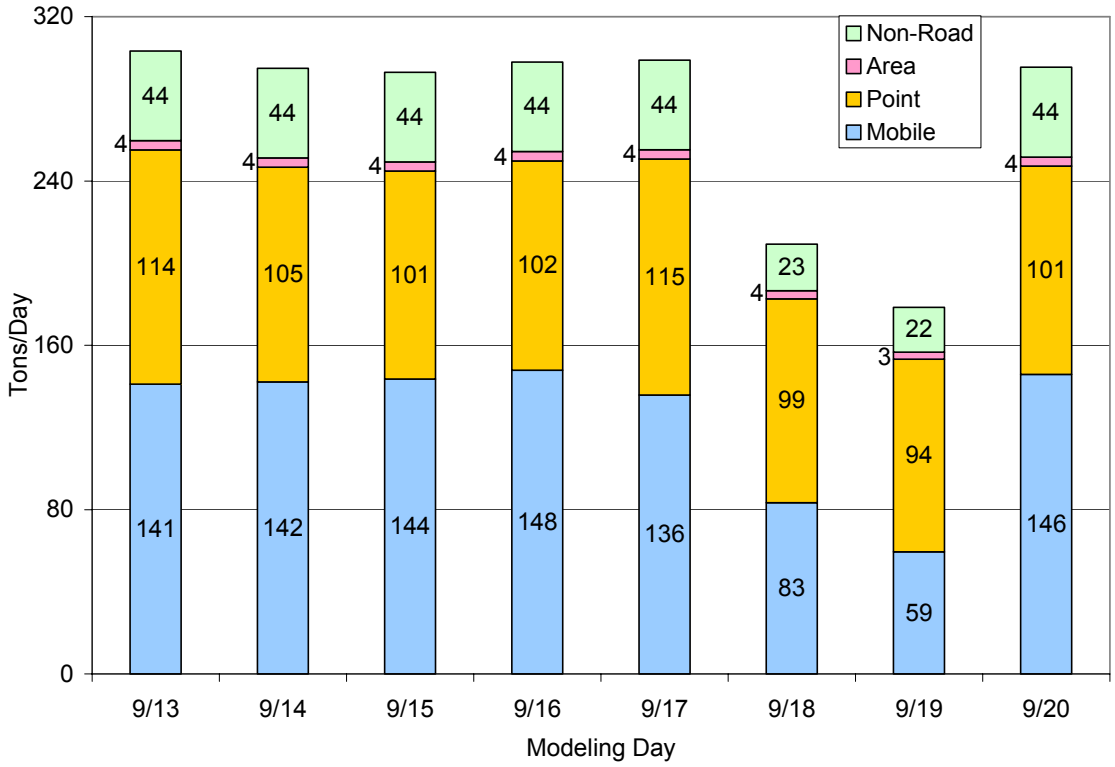
County FIPS Code	Non-Road Emissions		Area Emissions		Mobile Emissions		Point Emissions	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
48001	3.8	0.5	0.5	6.3	2.0	1.5	2.4	1.3
48005	1.9	2.3	0.3	6.5	4.8	2.3	6.1	10.5
48007	0.8	4.9	0.3	1.5	0.7	0.4	1.1	0.8
48009	0.5	0.4	0.2	15.9	0.7	0.5	0.0	0.0
48011	0.4	0.0	0.0	0.1	0.2	0.1	0.0	0.0
48015	5.9	0.7	1.1	3.5	3.3	1.0	0.1	1.2
48023	0.7	0.5	0.3	2.2	0.4	0.2	0.0	0.0
48025	0.7	0.2	1.3	8.6	1.2	0.6	1.4	0.0
48027	10.5	3.2	0.7	16.0	11.6	6.1	0.4	2.8
48033	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
48035	4.8	1.2	0.1	1.8	0.7	0.5	5.7	0.2
48037	6.8	1.6	0.3	7.9	8.6	3.5	0.6	1.9
48039	6.9	4.7	5.0	15.1	6.2	3.4	33.3	23.4
48041	3.5	2.2	1.0	11.7	6.5	3.2	4.0	0.2
48045	0.1	0.0	0.0	0.5	0.1	0.0	0.0	0.0
48047	0.2	0.7	1.5	2.4	0.8	0.6	2.0	1.0
48049	1.6	1.1	2.7	10.2	1.8	1.2	0.5	1.7
48051	4.4	0.5	0.7	6.5	1.1	0.5	2.0	0.9
48059	3.2	0.2	0.5	5.5	3.2	0.9	0.6	0.1
48061	7.0	10.7	0.8	18.5	8.8	7.7	2.5	2.3
48063	1.8	0.8	0.0	1.2	0.6	0.3	0.0	0.0
48065	2.3	0.1	0.7	2.7	0.5	0.2	1.4	0.3
48067	5.7	1.1	0.3	3.8	2.1	1.2	6.4	8.7
48071	0.9	2.9	6.2	5.2	3.8	1.8	8.2	11.0
48073	3.6	0.6	0.6	5.7	2.1	1.5	7.4	0.7
48075	2.3	0.2	0.1	1.4	0.9	0.4	0.0	0.0
48077	2.2	0.5	0.3	6.4	1.7	1.1	0.6	0.2
48081	0.1	0.4	0.2	1.7	0.3	0.2	3.1	0.5
48083	1.3	0.3	1.7	5.9	0.7	0.5	0.3	0.0
48085	20.3	6.2	2.3	15.8	16.0	8.8	3.1	1.4
48087	0.5	0.1	1.5	2.7	0.2	0.1	0.0	0.0
48089	1.9	1.0	1.1	3.5	4.5	1.2	2.3	1.4
48093	0.8	0.3	0.7	2.8	0.9	0.6	0.0	0.0
48095	0.5	0.4	0.2	2.0	0.4	0.3	0.1	0.0
48097	3.1	1.3	0.3	11.0	3.1	1.7	0.0	0.2
48099	1.0	0.3	0.2	3.6	1.4	1.2	0.0	0.3
48101	0.3	0.1	0.2	0.9	0.2	0.1	0.0	0.0
48105	0.1	0.4	16.9	23.0	1.6	0.5	0.6	0.0
48107	0.2	0.0	0.0	1.0	0.1	0.1	0.0	0.0
48113	62.9	29.3	17.8	73.6	89.4	44.9	14.3	13.2
48119	0.2	0.0	0.0	0.7	0.4	0.2	0.0	0.0
48121	9.6	5.1	2.5	19.0	14.8	7.8	2.0	1.9
48125	0.3	0.1	0.0	1.2	0.3	0.1	0.0	0.0
48127	0.1	0.1	0.6	3.1	0.5	0.3	0.6	0.1
48129	2.5	0.8	0.0	0.8	1.3	0.5	0.0	0.0
48131	0.9	0.1	2.1	6.3	0.7	0.5	1.1	1.7

48133	3.3	0.4	3.9	8.7	4.1	1.1	1.2	0.6
48137	0.0	0.0	1.5	2.2	0.1	0.1	5.1	1.9
48139	11.2	2.2	0.3	10.3	6.3	3.0	39.1	5.7
48143	0.8	0.6	1.1	4.7	1.7	1.0	0.6	0.3
48145	3.7	0.3	0.1	2.4	1.0	0.6	0.0	0.0
48147	1.1	0.4	0.3	3.9	1.5	0.9	16.5	0.4
48151	2.0	0.2	0.1	3.0	0.3	0.2	0.4	0.1
48153	0.3	0.0	0.0	0.5	0.1	0.1	0.0	0.0
48155	0.3	0.1	0.3	1.2	0.2	0.1	0.0	0.0
48157	6.5	2.9	1.7	14.6	9.4	4.8	16.0	3.5
48159	0.4	0.5	0.2	1.7	1.1	0.5	0.5	0.2
48161	2.3	0.3	3.8	7.6	3.2	1.1	45.0	5.1
48167	4.3	9.2	4.3	12.1	5.7	3.3	24.4	37.3
48169	0.4	0.0	0.0	1.9	0.2	0.1	0.0	0.0
48177	2.2	0.8	0.1	2.8	2.8	0.9	0.0	0.4
48179	3.3	0.4	4.4	15.4	2.1	1.0	18.5	8.8
48181	7.3	2.9	0.7	13.4	7.3	3.8	1.5	0.2
48183	5.0	1.3	2.5	18.8	6.3	3.3	9.8	4.3
48185	7.5	0.7	1.1	3.1	1.5	0.7	24.9	1.5
48191	1.5	0.2	0.0	1.2	0.5	0.2	0.0	0.0
48193	0.4	0.1	0.1	1.3	0.4	0.3	0.0	0.0
48195	0.4	0.1	1.1	1.9	0.1	0.1	2.0	0.2
48197	2.7	0.2	0.2	2.1	0.8	0.4	0.4	0.1
48199	2.7	0.4	0.5	4.8	2.2	1.3	1.3	1.9
48201	51.7	26.6	20.6	115.7	96.9	57.5	84.3	142.6
48203	5.1	1.3	2.7	10.9	9.6	2.8	34.0	20.1
48207	1.2	0.3	0.2	3.3	0.5	0.3	3.2	0.1
48211	3.5	0.2	5.2	5.9	0.4	0.2	7.7	2.0
48213	3.6	2.1	1.1	8.0	2.9	2.0	6.5	0.7
48215	13.9	12.7	6.1	32.8	16.0	14.3	8.5	2.8
48217	5.8	1.4	0.2	4.6	4.4	1.8	0.0	0.2
48221	0.7	0.4	1.1	3.1	1.4	0.8	20.5	0.7
48223	1.9	0.7	0.1	4.2	3.6	1.6	1.0	0.1
48225	2.2	0.9	0.2	2.8	1.3	0.6	0.0	1.9
48227	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48231	2.5	2.0	0.3	9.6	5.8	2.8	0.3	0.1
48233	0.1	0.0	0.8	3.7	0.2	0.1	0.0	0.0
48235	0.1	0.0	0.8	5.4	0.2	0.1	1.2	0.3
48237	0.1	0.1	4.6	11.4	0.5	0.3	2.9	1.5
48241	5.3	1.2	0.3	3.0	1.9	1.2	7.3	3.0
48245	7.3	4.9	8.4	18.0	13.4	6.6	65.5	66.9
48247	0.1	0.3	0.7	1.5	0.2	0.2	0.7	0.1
48249	1.8	0.4	1.4	5.0	2.3	1.2	5.0	1.5
48251	7.5	1.0	0.3	8.7	4.6	2.5	5.7	0.8
48253	1.2	0.3	0.1	5.0	1.3	0.7	3.0	0.1
48257	3.9	1.0	0.2	10.7	4.9	2.6	10.5	2.3
48261	1.7	5.4	0.4	1.3	0.7	0.5	1.5	0.7
48263	0.1	0.0	0.0	1.7	0.1	0.1	2.6	0.2
48267	0.1	1.0	0.0	0.8	1.8	0.5	0.1	0.0

48269	0.1	0.0	0.2	1.9	0.2	0.1	0.0	0.0
48271	2.6	0.1	0.0	0.3	0.3	0.2	0.0	0.0
48273	1.4	2.9	1.1	4.1	1.5	0.9	9.2	2.4
48275	0.9	0.2	0.3	2.6	0.3	0.2	0.0	0.0
48277	6.0	1.1	0.2	6.7	2.4	1.5	6.3	1.2
48281	1.1	0.2	0.0	1.4	1.0	0.6	0.0	0.0
48283	1.1	0.5	0.9	2.4	1.4	0.6	0.0	0.0
48289	3.8	0.3	1.1	3.8	2.8	1.0	0.8	0.3
48291	3.1	1.0	0.5	5.5	2.8	1.6	4.3	2.4
48293	3.0	0.6	1.3	4.6	0.8	0.6	34.4	0.9
48295	1.6	0.1	3.8	5.5	0.2	0.1	1.1	0.1
48297	3.9	1.4	1.3	3.4	1.8	0.9	2.8	3.5
48307	1.0	0.2	0.2	2.0	0.6	0.4	0.0	0.0
48309	8.7	4.0	0.6	16.7	11.8	6.0	35.7	0.7
48311	1.0	0.4	2.4	4.6	0.1	0.1	0.5	0.3
48313	0.4	0.1	0.2	1.6	1.8	0.6	0.4	0.0
48315	1.6	0.6	0.3	1.7	0.6	0.4	7.0	0.9
48319	0.1	0.3	0.0	0.6	0.2	0.2	0.0	0.0
48321	7.7	6.4	1.2	6.2	1.8	0.9	8.5	1.3
48323	0.4	0.6	0.4	3.6	1.4	0.9	0.1	0.0
48327	0.1	0.0	0.0	0.7	0.3	0.2	0.0	0.0
48331	6.8	0.5	0.1	7.8	1.5	0.8	13.2	0.2
48333	0.9	0.1	0.0	0.9	0.5	0.3	0.0	0.0
48335	0.9	0.2	0.0	8.3	1.9	0.5	22.9	0.4
48337	3.7	0.7	0.3	9.4	1.3	0.9	0.3	0.9
48339	4.3	3.4	1.8	12.8	11.8	6.0	4.6	3.4
48343	1.4	0.5	0.0	1.8	1.2	0.5	0.5	0.4
48345	0.3	0.0	0.0	0.8	0.2	0.1	0.0	0.0
48347	1.3	1.2	0.9	7.2	3.8	1.8	2.8	5.6
48349	4.9	1.3	0.2	8.5	3.0	1.5	5.4	2.6
48351	0.5	0.5	0.2	1.8	0.7	0.5	4.2	3.1
48353	2.8	0.3	0.3	4.6	2.9	0.9	7.5	0.4
48355	54.5	22.7	0.9	49.8	14.0	8.3	78.1	29.7
48357	1.8	0.3	3.8	7.9	0.6	0.3	3.2	0.3
48361	4.1	1.5	0.5	3.9	5.9	2.5	42.5	16.7
48363	3.6	1.6	5.7	9.6	1.6	0.9	6.1	0.6
48365	1.7	1.1	8.0	13.3	2.0	1.1	13.0	4.1
48367	4.3	1.1	3.9	8.9	4.5	2.3	6.9	1.1
48373	0.8	2.1	0.5	3.8	3.4	1.6	2.5	6.2
48379	0.2	0.7	0.1	0.7	0.6	0.3	0.2	0.0
48383	0.1	0.6	0.0	0.4	0.2	0.1	0.0	0.0
48385	0.6	0.2	0.0	2.0	0.8	0.5	2.2	0.0
48387	3.1	1.1	1.6	5.2	1.2	0.6	5.0	2.9
48393	2.1	0.1	2.4	3.2	0.2	0.1	0.6	0.0
48395	6.9	0.5	0.4	2.5	1.3	0.6	6.9	0.8
48397	1.3	0.7	0.1	2.5	2.2	1.1	0.0	0.0
48399	1.2	0.3	0.2	4.7	0.6	0.4	0.2	0.1
48401	4.9	1.1	4.7	8.4	2.2	1.5	62.9	3.4
48403	1.5	2.1	0.0	1.0	0.7	0.3	0.2	1.0

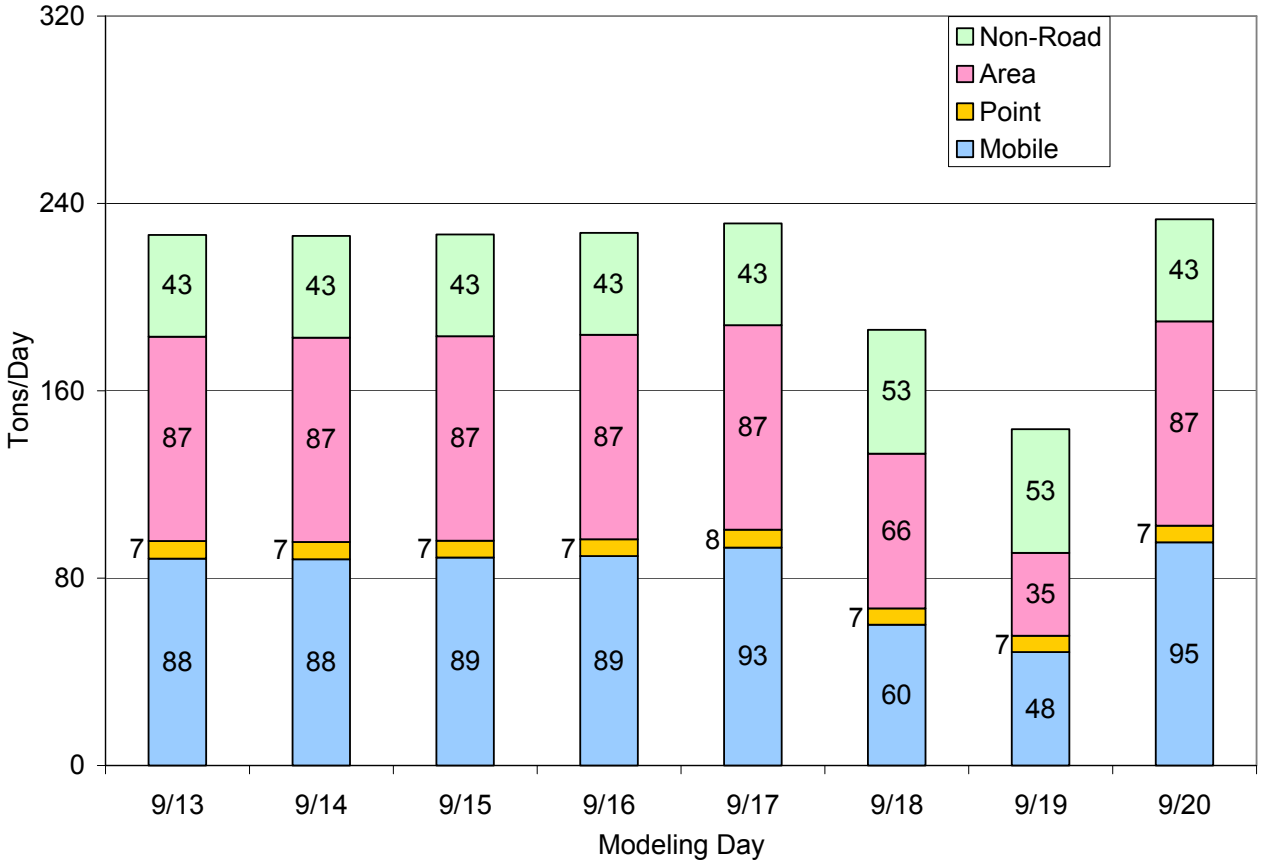
48405	1.2	0.9	0.0	0.8	0.6	0.3	0.0	0.0
48407	0.2	0.8	0.2	1.5	1.6	0.7	0.0	0.0
48409	21.7	16.0	0.2	16.2	3.5	2.0	12.2	1.4
48411	0.3	0.4	0.0	0.9	0.3	0.2	0.0	0.0
48413	0.2	0.0	2.5	3.8	0.2	0.1	0.9	0.2
48415	3.8	0.4	0.1	10.5	1.3	0.7	4.5	1.8
48417	0.3	0.1	0.9	8.8	0.4	0.2	1.1	0.2
48419	2.1	0.7	0.9	3.7	1.7	0.7	0.5	0.0
48423	6.5	2.5	1.0	13.7	10.8	6.2	4.1	9.3
48425	0.2	1.0	0.0	0.5	0.4	0.2	0.0	0.0
48427	1.0	0.3	4.2	7.3	1.5	1.3	4.8	0.5
48429	0.7	0.5	2.9	8.0	0.5	0.3	0.2	0.1
48431	0.1	0.0	2.4	6.5	0.3	0.2	0.0	0.0
48433	0.3	0.1	0.0	2.9	0.2	0.1	0.0	0.0
48435	0.1	0.1	13.1	12.8	1.8	0.5	5.3	1.1
48439	52.3	18.0	9.0	58.1	63.2	31.4	9.9	10.0
48441	6.0	2.9	0.5	14.9	9.7	4.3	0.1	1.4
48447	0.4	0.1	0.3	4.5	0.1	0.1	0.0	0.0
48449	1.7	0.8	0.1	3.1	3.1	1.2	73.6	1.5
48451	2.6	1.9	0.6	11.6	5.1	2.6	2.0	0.1
48455	1.2	1.9	0.0	1.1	0.7	0.3	0.7	0.4
48457	0.2	0.8	0.1	2.0	0.8	0.5	0.0	0.0
48459	3.6	0.4	3.2	9.5	1.6	1.0	0.8	0.6
48463	4.5	2.2	0.1	2.6	1.1	0.9	0.0	0.0
48465	2.0	2.0	0.7	3.3	1.4	0.8	0.0	0.0
48467	3.1	0.5	0.3	5.3	4.5	2.3	0.9	0.9
48471	2.0	1.1	0.2	3.4	4.5	1.7	0.1	1.2
48473	2.2	1.2	0.4	2.0	1.1	1.2	2.6	0.7
48477	2.3	1.6	0.7	4.4	2.1	1.0	0.0	0.0
48479	4.2	2.3	12.7	22.6	6.9	4.4	2.7	0.2
48481	2.6	0.8	2.0	7.9	2.9	1.4	3.6	1.8
48483	0.6	0.1	3.3	5.6	2.6	0.6	0.9	0.0
48485	3.4	1.3	0.7	33.3	6.6	4.3	20.7	6.8
48487	2.9	0.4	0.5	6.1	1.4	0.9	17.7	0.2
48489	2.0	2.3	0.2	3.0	0.7	0.6	0.3	0.1
48497	5.6	1.0	13.0	18.4	3.1	1.9	8.3	2.2
48499	2.8	2.4	0.4	5.3	1.3	1.0	0.0	0.0
48503	0.8	0.6	1.3	14.0	0.8	0.5	13.1	1.5
48505	0.3	1.8	8.3	8.4	0.6	0.5	0.8	0.2
48507	0.3	0.1	0.5	2.7	0.6	0.4	0.0	0.0

Figure D-1. 1999 Estimated NOx Emissions in Tons/Day for the San Antonio EAC Region during the September 1999 episode.



Modeling Day	Mobile	Point	Area	Non-Road	Total
Day 1	141.1	114.0	4.5	43.6	303.3
Day 2	142.2	104.6	4.5	43.6	294.9
Day 3	143.6	101.3	4.5	43.6	293.0
Day 4	147.9	101.9	4.5	43.6	297.9
Day 5	135.8	114.9	4.5	43.6	298.9
Day 6	83.4	99.2	3.9	22.7	209.2
Day 7	59.5	93.7	3.4	21.9	178.5
Day 8	145.8	101.4	4.5	43.6	295.3

Figure D-2. 1999 Estimated VOC Emissions in Tons/Day for the San Antonio EAC Region during the September 1999 episode.



Modeling Day	Mobile	Point	Area	Non-Road	Total
Day 1	88.4	7.5	87.3	43.4	226.0
Day 2	88.1	7.3	87.3	43.4	225.8
Day 3	88.8	7.2	87.3	43.4	226.2
Day 4	89.4	7.2	87.3	43.4	226.8
Day 5	93.1	7.6	87.3	43.4	230.9
Day 6	60.2	6.9	66.1	52.9	185.6
Day 7	48.5	6.9	35.4	52.7	143.1
Day 8	95.3	7.1	87.3	43.4	233.6

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