Phase II, Task 3.2 - CAPCOG Emissions Inventory Review for Phase III

July 17, 2012

Selected Projects for Phase III

After a review of existing emissions estimates and research on a variety of emissions sources, CAPCOG recommends the following emissions inventory projects be undertaken by CAPCOG or TCEQ during the Phase III grant period:

- On-Road Emissions Inventory Improvements:
  - Develop a 2015 On-Road Link-Based Inventory for the 5-County MSA (CAPCOG, with CAMPO & TTI);
  - Develop local-specific vehicle populations for 2006 On-Road inventory for buses and refuse trucks (CAPCOG);
  - Develop an inventory of public fleets within the 5-County MSA for 2006, 2011, and 2015 (CAPCOG);
  - Develop local-specific compliance rate for I/M program (CAPCOG or TCEQ);
  - Develop improved local-specific fuel properties and allocations for 2006, 2008, 2011, and 2015 (CAPCOG or TCEQ);
  - Develop more detailed inventories for heavy-duty vehicles (CAPCOG or TCEQ);
- Area Source Improvements:
  - Develop 2006, 2008, 2011, and 2015 Oil and Gas Exploration and Production Equipment inventory within the Program Area (CAPCOG or TCEQ); and
  - Develop 2006, 2008, 2011, and 2015 inventory of stationary generators (CAPCOG);
- Non-Road Improvements:
  - Develop 2006, 2008, 2011, and 2015 inventory of mobile generators (CAPCOG);
  - Develop estimates for construction and mining equipment subsectors not completed in Phase II (CAPCOG);
  - Develop 2006 and 2011 inventories of Austin-Bergstrom International Airport;
- Point Source Improvements:
  - Develop point source inventories for four facilities believed to have a potential to emit over 25 tpy that do not have emissions reported in the point source inventory (TCEQ);
  - Develop day-specific or hourly-specific inventories for non-EGU facilities (CAPCOG or TCEQ).

Inventory Years of Interest

There are a number of emissions inventory years that would be of interest to CAPCOG. The key years for which CAPCOG would be interested in developing emissions inventories include 2006, 2008, 2011, 2015, and 2019. Since 2006 is the current base case and the current baseline used for photochemical modeling, emissions inventories for this year would improve the accuracy of any ozone projections made from 2006 forward. 2008 and 2011 are periodic emissions inventory years and could be useful for developing a baseline modeling scenario more recent than 2006. 2015 and 2019 would be useful future years to develop emissions estimates for: 2015 is the year EPA is likely to use monitoring data for to base nonattainment designations upon, and 2019 would be the attainment year for any area classified as Marginal under a new ozone standard if designations were completed in 2016.

Pollutants of Interest

CAPCOG is primarily interested in improving estimates of local NO_X emissions. Modeling conducted by the University of Texas at Austin for CAPCOG's current Rider 8 grant has shown that changes in local anthropogenic NO_X emissions estimates have a much larger impact on modeled ozone levels than changes in anthropogenic VOC emissions. Preliminary modeling results indicate that changes in local anthropogenic NO_X emissions have about 14-21 times the impact of changes in anthropogenic VOC emissions. CAPCOG is most interested in improving NOX estimates to ensure more accurate ozone modeling results. If and when CAPCOG needs to improve the accuracy of VOC emissions for SIP requirements, it will consider doing so. For any category CAPCOG conducts an emissions inventory for, it will provide estimates for NOX, VOC, and CO.

Geographies of Interest

There are several geographies CAPCOG is interested in improving emissions estimates for. The broadest geography is CAPCOG's Rider 8 Program Area, which includes the 10 CAPCOG Counties (Bastrop, Blanco, Burnet, Caldwell, Fayette, Hays, Lee, Llano, Travis, and Williamson Counties) and Milam County.

Of those counties, the most important counties to improve emissions estimates for are Bastrop, Caldwell, Hays, Travis, and Williamson Counties, as these counties make up the Austin MSA and would be considered a default ozone nonattainment area if EPA ever looked at designating the area nonattainment for ozone. Current EPA guidance would also include Burnet County in a default Austin nonattainment area due to it being considered a "Micropolitan" area adjacent to the MSA. However, for the following reasons, Burnet County is not considered as high of a priority as the other five counties: 1) Burnet County was not identified as a potential upwind source area in the area's most recent ozone conceptual model, 2) Burnet County is not part of the current local air quality plan, and 3) a number of important emission control measures that apply to the five-county MSA do not apply to Burnet County, including TxLED and TERP.

Criteria for Selecting Emissions Inventory Projects

CAPCOG used two main criteria to evaluate whether to undertake potential emissions inventory projects: 1) the potential impact on modeled ozone levels, and 2) the capacity of CAPCOG or a subcontractor to develop substantially better estimates. In looking at the potential impact on modeled ozone levels, CAPCOG considered the magnitude of existing emissions estimates, the magnitude of expected changes in expected emissions over time, and the availability of well-defined control measures. In looking at the capacity of CAPCOG or a subcontractor to develop substantially better estimates, CAPCOG considered the availability of more detailed data than what current estimates were based on, the expected difficulty in collecting more detailed data, and whether or not other research projects produced by others could be used to improve estimates if CAPCOG is unable to obtain sufficient bottom-up data to base an inventory on.

Emissions Overview

Figure 1: Ozone Season Day Emissions by Source Category for Program Area, 2008 (tons per day)

Source Type	NOX	VOC
On-Road	78.77	31.01
Non-Road	38.45	24.76
Point	62.50	4.79
Area	13.29	111.34
TOTAL	193.01	171.89
3% Total	5.79	5.16
15% Total	28.95	25.78

Figure 2: Ozone Season Day Emissions by Source Category for Austin MSA, 2008 (tons per day)

Source Type	NOX	VOC
On-Road	63.91	27.10
Non-Road	27.61	16.83
Point	23.89	2.46
Area	8.69	79.79
TOTAL	124.10	126.18
3% Total	3.72	3.79
15% Total	18.61	18.93

Figure 3: Ozone Season Day Emissions by Source Category for Travis County, 2008 (tons per day)

Source Type	NOX	VOC
On-Road	35.99	15.88
Non-Road	14.10	10.40
Point	9.74	1.18
Area	3.47	44.16
TOTAL	63.30	71.62
3% Total	1.90	2.15
15% Total	9.50	10.74

Emissions Inventory Projects Currently Underway

CAPCOG has a number of emissions inventory projects currently underway, which should be complete by fall 2012. These include:

- Heavy Duty Vehicle Idling,
- Construction and Mining Equipment,
- Agricultural Equipment,
- Industrial Equipment,
- Lawn and Garden Equipment,
- Area Source Industrial Fuel Combustion, and
- Graphic Arts.

For Heavy Duty Idling, CAPCOG's current project involves producing emissions estimates for one specific type of idling – extended idling by Combination Long Haul Trucks – but not for other types of heavy-duty vehicle idling. For the non-road categories, CAPCOG does not plan to update every source classification

code (SCC) or and every diesel construction equipment (DCE) subsector. Instead, updates will be made to SCCs and DCEs CAPCOG was able to produce robust, reliable results for during the current project period. For Industrial Fuel Combustion, CAPCOG is focused on improving estimates of natural gas combustion, not other fuel types.

In addition to these projects, TCEQ has contracted with TTI to prepare 2006 and 2008 link-based on-road inventories for the five-county Austin-Round Rock-San Marcos Metropolitan Statistical Area (Austin MSA), which should also be completed by fall 2012.

On-Road Inventory Review

In 2008, On-Road emissions made up 41% of the NOX emissions for CAPCOG's program area, 51% of the NOX emissions for the MSA, and 57% of the NOX emissions for Travis County.

Existing Estimates

The most up-to-date estimates of on-road emissions for the region come from the statewide, non-link-based, on-road mobile source moves emissions inventories for 2006, 2008, 2012, and 2018 produced by the Texas Transportation Institute (TTI) in 2011[1]. The following are some key parameters from this study:

- Model version used: MOVES2010a,
- Used latest available Highway Performance Management System (HPMS) data from the Texas Department of Transportation (TxDOT) for each Texas County as basis for vehicle miles traveled estimates,
- Projected HPMS VMT for each county out to the designated future years based on expected growth trends in travel and human population,
- 2006 base case used hourly temperature, hourly humidity, and daily barometric pressure inputs provided by TCEQ based on weather station data averaged from June 1 – August 31, 2006,
- 2008 Baseline used hourly temperature, hourly humidity, and daily barometric pressure inputs provided by TCEQ based on weather station data averaged from June 1 – August 31, 2008,
- 2012 and 2018 future years used hourly temperature, hourly humidity, and daily barometric pressure inputs provided by TCEQ based on weather station data averaged from June 1 – August 31, 2006,
- Used July 2006 and July 2008 registration data queries from either the TxDOT or Texas Department of Motor Vehicles (TxDMV) as the basis for source use type (SUT) age distribution and fuel engine fractions compatible with moves,
- For future years of 2012 and 2018, used the latest available July queries of the vehicle registration database, which were from July 2010,
- For all counties for the 2006 base case and 2008 baseline years, mainly used fuel property inputs from surveys of retail gasoline and diesel fuel sold in Texas,
- Modeled I/M program in place in Travis and Williamson County.

For several source use types, TTI specifically identified opportunities for improvement with locally-specific data:

[1] Texas Transportation Institute Transportation Modeling Program. "Production of Statewide, Non-Link-Based, On-Road Emissions Inventories with the MOVES Model for the Eight-Hour Ozone Standard Attainment Demonstration Modeling-Final Report." July 2011. TTI Study No. 403421-14. ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/reports/mvs10a_att_tex_06_08_12_18_technical_report_final.pdf

- Refuse Trucks,
- Motor Homes,
- Buses, and
- Fuel Type Allocation.

Figure 4: On-Road NOX Emissions 2008-2018

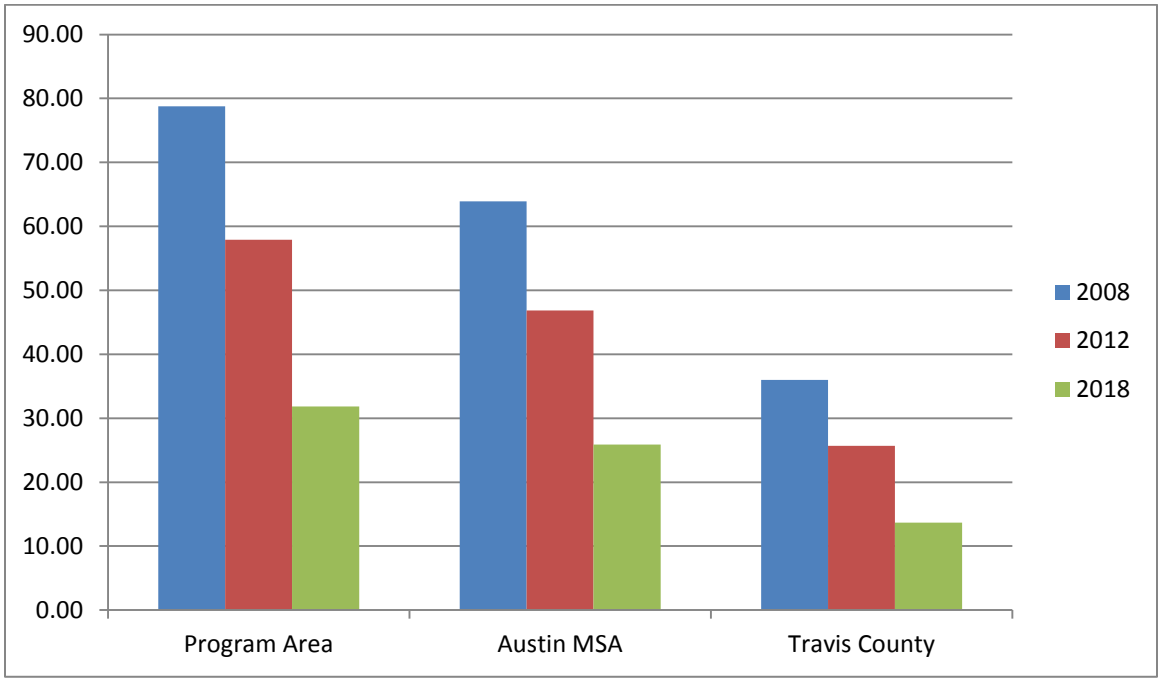


Figure 5: Percentage of On-Road NOX Emissions by MOVES Source Type, 2008

Source Type	Program Area	MSA	Travis County
Motorcycle (MC)	0.0%	0.0%	0.0%
Passenger Car (PC)	32.9%	36.7%	39.9%
Passenger Truck (PT)	16.0%	16.4%	16.0%
Light Commercial Truck (LCT)	6.1%	6.3%	6.2%
Intercity Bus (Ibus)	1.2%	1.2%	1.2%
Transit Bus (Tbus)	0.3%	0.3%	0.3%
School Bus (Sbus)	0.6%	0.6%	0.6%
Refuse Truck (RT)	0.4%	0.4%	0.4%
Single Unit Short Haul Truck (SUShT)	7.0%	6.8%	6.6%
Single Unit Long Haul Truck (SULhT)	0.7%	0.7%	0.6%
Motor Home (MH)	0.6%	0.5%	0.5%
Combination Short Haul Truck (CShT)	14.3%	12.7%	11.9%
Combination Long Haul Truck (CLhT)	19.9%	17.3%	15.7%

Figure 6: On-Road NOX Emissions by County and Fuel Type, 2008 (tons per day)

County	Gasoline	Diesel
Bastrop	2.22	1.70
Blanco	0.59	0.64
Burnet	1.47	1.39
Caldwell	1.03	0.84
Fayette	1.31	4.44
Hays	4.28	3.65
Lee	0.75	0.62
Llano	0.60	0.56
Milam	0.81	1.67
Travis	22.47	13.53
Williamson	8.32	5.87
Program Area	43.86	34.91
MSA	38.32	25.58

Potential Improvements for a Comprehensive Future Year Inventory

Improve Default Vehicle Populations and Activity

For five source use types, TTI used the MOVES defaults rather than local data due to lack of availability: intercity buses, transit buses, school buses, refuse trucks, and motor homes. Through targeted surveys, CAPCOG could collect data on these source use types to provide updated vehicle populations and activity.

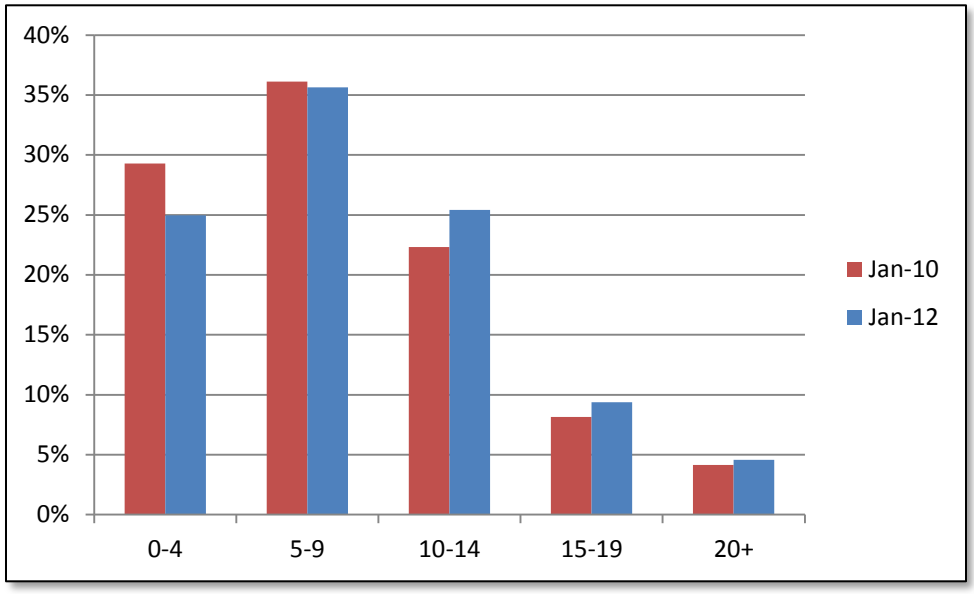
Incorporate Additional Off-Network Vehicle Activity

The "off network" category of emissions activity in the MOVES model does not capture all of the types of off-network vehicle activity that could generate emissions. These include short-term idling by trucks, use of power-take-off equipment when a vehicle is not on the road, and the use of pickup trucks in off-road applications on ranches and farms. CAPCOG could attempt to collect data sufficient to estimate these emissions.

Age Distribution

One significant assumption used for the projections that appears in need of being updated is the age distribution of vehicles. A comparison of the age distributions of vehicles registered in Travis County in January 2010 compared to the age distribution in January 2012 indicates that the existing estimates for the region's 2012 and 2018 emissions, which were based on 2010 age distributions, likely under-estimate the emissions in those years. Perhaps due to slower economic growth and higher unemployment than in previous years, it appears that people may be waiting longer to replace their vehicles.

Figure 7: Vehicle Age Distribution in Travis County, 2010 and 2012



Disaggregation of Emission Rates for Heavy-Duty Trucks by Weight Class and PTO Presence

One useful exercise might be to attempt to disaggregate the emission rates for combination trucks by weight class. The wide range of GVWRs that Combination Trucks can fall into, as well as the presence of significant power-take-off machinery on heavy duty trucks could enable more detailed MOVES runs to produce more accurate emissions rates that could be used to improve the inventory.

Updated HPMS Data

With extra HPMS data available for 2011 and possibly 2012, the future year emissions projections could be improved.

Meteorological Parameters

While at one point, TCEQ and near-nonattainment areas had assumed that the ozone standard would be lowered to a range of 60-70 ppb in 2011, possibly prompting the need for attainment demonstrations for what are now near-nonattainment areas, the decision by the current administration to delay any possible change to the ozone standard until the current review is complete rendered that concern moot. As such, there was no longer a need for a 2008 baseline and TCEQ has informed CAPCOG and other Rider 8 Grant recipients that it is not going to be providing a 2008 ozone baseline to use for modeling. That leaves the June 2006 ozone episode as the emissions inventory scenario most relevant for modeling. Therefore, it would be appropriate for any future year emissions inventory for current planning purposes to use the same meteorological parameters as were used for the 2006 scenario. The future year emissions scenarios could also use 2011 meteorological parameters in order to enable an August/September 2011 baseline to be used for future modeling efforts.

Improve Fuel Parameters

Fuel parameters are an important input to the MOVES model, and CAPCOG believes that there is likely enough information available to improve upon the existing estimates. For TTI's 2012 and 2018 inventories, they used sulfur content and ethanol content numbers that may be low. For sulfur, TTI assumed that the sulfur content for gasoline would be 22.91 ppm, but the summer 2011 summer fuel

study conducted by TCEQ showed Austin-area sulfur to be at 42.6 ppm. Using the data in the MOVES sensitivity report, CAPCOG estimates that this difference could result in a 2% difference in gasoline emissions. CAPCOG could use the 2011 summer fuel study in conjunction with other sources as the basis for revised projections.

The increasing biofuel requirements under the Renewable Fuels Standard could also lead to significantly different emissions in future years than the current fuel parameter assumptions - TTI's MOVES Sensitivity Report showed that increasing the ethanol content from 0% to 10% increased 2008 NOX emissions by 8%. A change of about that magnitude occurred in the Austin area from 2008 to 2011, according to the summer fuel studies conducted by TCEQ. In 2008, the ethanol content was only 0.024%, while in 2011, the ethanol content was 8.667%. The existing 2012 and 2018 inventories assume 10% ethanol content, but EPA's recent decision to allow for E15 blends to be used by gasoline-powered vehicles may increase the average ethanol content to increase above 10%.

An increasing number of vehicles in the region use E85, which is not accounted for in the inventory. For certain fleets within the region in particular, including the City of Austin, the City of San Marcos, and state vehicles, use significant amounts of E85 and B20. Recent guidance issued by TCEQ allows the B100 that gets blended into petroleum diesel to be exempt from TxLED requirements –which could result in about a 1% increase in NO_X emissions from any vehicle or equipment using B20 compared to petroleum diesel.

Investigate Added Emissions due to Power-Take-Off Equipment and Accessories

A number of vehicles have power-take-off equipment that enable the vehicle's engine to be used for the mechanical operation of other equipment, such as a cement mixers, cranes, pumps, compressors, dump trucks, aerial buckets, and others. In EPA's Report, Development of Emission Rates for Heavy-Duty Vehicles in the Motor Vehicle Emissions Simulator (EPA-420-P-09-005, August 2009, http://www.epa.gov/otaq/models/moves/techdocs/420p09005.pdf), EPA discusses the role of various types of accessories in adding load to the engine and how they can impact emission rates. However, it does not look like EPA specifically looked at how the added load due to the use of power-take-off equipment could affect an on-road engine's emissions. The 2002 Vehicle Inventory and Use Survey showed that in Texas, 31% of Class 7 & 8 trucks had a power-take-off system, and 21% of Class 6 trucks had such systems (http://www.census.gov/prod/ec02/ec02tv-tx.pdf, Table 4). In one technical report for the development of the MOVES Model (Draft MOVES2009 Highway Vehicle Temperature, Humidity, Air Conditioning, and Inspection and Maintenance Adjustments, http://www.epa.gov/otaq/models/moves/techdocs/420p09003.pdf), EPA details how it developed the impact of adding air conditioning to engine load. A similar approach could be used to estimate the impact of other accessory use on the engine.

CAPCOG has discussed the possibility of doing some research on this topic, but after some initial inquiries, it appears to be beyond the capabilities and resources available to CAPCOG to do much work on this. Such work would likely be more appropriate to be undertaken by TCEQ or EPA. During this grant period, CAPCOG may recommend some approaches that might be useful to conduct such work and could work with local companies to try to get some testing performed on trucks with power-take-off equipment.

Investigate Vehicle I/M Compliance Rate

From May 1, 2011 – April 30, 2012, 93.42% of all vehicles inspected as part of the region's vehicle inspection and maintenance program passed their initial emissions test, which is very close to the 93.12% default compliance rate in the MOVES Model. The pass rate is slightly higher for Williamson County than it is for Travis County, possibly because of differences in the age distributions. EPA recommends that emissions inventories use program-specific compliance rates where they are available, so it would be appropriate to do so for the Austin area rather than rely on the MOVES model. Despite the fact that the initial pass rate appears very close to the default I/M compliance rate, local law enforcement agencies in the Austin and Dallas areas that have undertaken enforcement efforts in support of the I/M program have found that there is at least some portion of the emissions certificates issued that fraudulent. CAPCOG could work with Travis and Williamson County law enforcement agencies to collect data on compliance rates, including so-called "clean-scans" that result in an actual emissions certificate that has been issued on a fraudulent basis by running the scan on a "clean" car rather than the car that received the sticker. TTI's MOVES Sensitivity Study released in July 2012 included an analysis of the difference in modeled NOX emissions if the I/M compliance rate were modified, which helps provide a sense of scale of how much it could impact the on-road inventory in the region. Passenger car NO_X emissions from increased by 2.5% when the I/M compliance rate dropped from 93.12% to 80%. If this same change applied to all gasoline vehicles in Travis and Williamson Counties, it would result in an increase in NOX emissions by 0.78 tons per day. Given the resources that would be required to assess a more program-specific compliance rate, CAPCOG believes that while such an investigation would be warranted for the development of a SIP, it may not be necessary during the next grant period.

Relevant Studies & Inventories

- *Production of Statewide Non-Link-Based, On-Road Emissions Inventories with the MOVES Model for the Eight-Hour Ozone Standard Attainment Demonstration Modeling Technical Report – Final.* Transportation Modeling Program, Texas Transportation Institute. TTI Study No. 403421-14. ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/reports/mvs10a_att_tex_06_08_12_18_technical_report_final.pdf
- MOVES Sensitivity Study Technical Report – Final. Transportation Modeling Program, Texas Transportation Institute. TTI Study No. 403421-16. July 2011. ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/MOVES/Sensitivity/MOVES_Sensitivity_Report_Final.pdf

Section 3: Non-Road Mobile Inventory Review

Based on the initial review criteria (at least 5.79 tpd NOX for the program area, 3.72 tpd NOX for the MSA, or 1.99 tpd NOX for Travis County, there are four categories of non-road mobile that would warrant further evaluation: agricultural equipment, aviation, construction and mining equipment, and industrial equipment. In addition to these categories, CAPCOG believes that commercial equipment – generator sets in particular – might be worthy of attention, due to the irregular nature in which the equipment can be categorized and the difficulty in distinguishing between stationary and mobile generator sets.

Figure 8: Non-Road NOX Emissions, 2008 (tons per day)

Category	Program Area	MSA	Travis County
Agricultural Equipment	12.44	6.41	0.90
Aviation	3.08	3.07	3.04
Commercial Equipment	1.42	1.31	0.99
Construction & Mining Equipment	14.01	10.76	5.40
Drilling Rigs	0.45	0.14	0.00
Industrial Equipment	4.00	3.70	2.82
Lawn and Garden Equipment	0.63	0.56	0.37
Locomotives	2.06	1.51	0.48
Railway Maintenance	0.05	0.02	0.00
Recreational Equipment	0.18	0.09	0.05
Recreational Marine	0.14	0.05	0.04
TOTAL	38.45	27.61	14.10

Agricultural Equipment

CAPCOG is currently conducting a study to improve estimates of emissions from agricultural equipment in the region based on equipment counts found in the 2007 Agricultural Census and activity data collected from local farmers. CAPCOG does not believe the further efforts on this category during the Phase III grant period other than possibly developing updated growth factors would be of much value. The 2012 Agricultural Census will provide new data that could be used to improve projections and estimate emissions in 2011, but it is not clear that the necessary data will be available during this grant period. It is more likely that it would be used for a future project after this grant period.

Aviation

While existing estimates for NOX emissions from TexAER indicate that at 3.04 tons per day, aviation made up over 3% of the NOX emissions in Travis County in 2008, a recent study completed by ERG indicated far less emissions – only 1.77 tons per day in 2008. At this level, aviation accounts for less than 3% of the region's NOX emissions. However, due to the airport's location directly upwind of the urban area of Austin during many high-ozone days, the sensitivity of these estimates to actual landing/takeoff activity for a given year, and some short-term possibilities for control strategies at the airport, it may still be worthwhile for CAPCOG staff to conduct some inventory improvements.

Table 1: Comparison of Aviation NOX Inventories, 2008 (tons per day)

Inventory	Program Area	MSA	Travis County
2011 ERG Study	1.85	1.82	1.77
TexAER A1 2008 Aviation Criteria Pollu	3.08	3.07	3.04

Estimates for aviation emissions in the region are highly dependent on the number of commercial flight landing/take-offs (LTOs), which account for 1.40 of the 1.77 tons per day of NOX from aviation in Travis County, while another 0.26 tons per day comes from ground support equipment and APUs.

Figure 9: Aviation NOX Emissions, 2008 - ERG (tons per day)

Category	Program Area	MSA	Travis County
Air Taxi, Piston	<0.01	<0.01	<0.01
Air Taxi, Turbine	0.01	0.01	0.01
APU	0.04	0.04	0.04
Commercial	1.40	1.40	1.40
General Aviation, Piston	0.03	0.02	<0.01
General Aviation, Turbine	0.14	0.12	0.09
GSE – CNG	<0.01	<0.01	<0.01
GSE – Diesel	0.18	0.18	0.18
GSE – Gasoline	<0.01	<0.01	<0.01
GSE – LPG	<0.01	<0.01	<0.01
Military	<0.01	<0.01	<0.01
TOTAL	1.85	1.82	1.77

There are some opportunities for improvement to aviation estimates. In particular, pulling historical LTO data for 2006 to improve the base case estimates, along with a comprehensive on-site inventory of non-road equipment and APUs could be beneficial, the latter especially so because of the City of Austin's Aviation Department's initiative to install charging stations for GSE equipment at the airport. CAPCOG could also develop LTO data for 2011, and update forecasts.

Construction and Mining Equipment

CAPCOG has a study on local construction and mining equipment underway, although not all diesel construction equipment subsectors will be included in the final study. CAPCOG could conduct additional improvements to particular DCE subsectors that it did not improve estimates for in the first round of improvements.

Since each DCE subsector requires separate data collection, it is worth evaluating the extent to which any individual DCE subsector has an impact on the overall class of construction and mining equipment. By far the largest DCE subsectors are mining and quarry equipment and heavy highway construction, but only heavy highway construction in Travis County exceeds 3% of the county's NOX emissions.

Figure 10: Construction Equipment NOX Emissions, 2008, by DCE Subsector (tons per day)

DCE Subsector	Program Area	MSA	Travis
Agricultural Activities	0.41	0.37	0.20
Boring/Drilling	0.06	0.06	0.04
Brick and Stone Operations	0.06	0.06	0.04
City and County Road Construction	0.14	0.14	0.06
Commercial Construction	0.67	0.61	0.31
Concrete Operations	0.07	0.06	0.04
County-Owned Equipment	0.06	0.06	0.04
Cranes	0.58	0.53	0.35
Heavy-Highway Construction	3.50	3.33	2.16
Landfill Operations	0.33	0.33	0.31
Landscaping Activities	0.18	0.17	0.11
Manufacturing Operations	0.13	0.13	0.11
Municipal-Owned Construction Equipment	0.20	0.18	0.11

Transportation/Sales/Services	0.74	0.70	0.55
Residential Construction	1.51	1.44	0.78
Rough Terrain Forklifts	1.37	1.29	0.61
Scrap/Recycling Operations	0.11	0.10	0.08
Skid Steer Loaders	1.00	0.83	0.55
Special Trades Contractors	0.00	0.00	0.00
Trenchers	0.89	0.78	0.49
TxDOT Equipment	0.07	0.05	0.04
Utility Construction	0.43	0.38	0.17
Mining and Quarry Operations	4.87	3.60	0.93
TOTAL	**24.07**	**15.48**	**6.50**

Industrial Equipment

CAPCOG currently is conducting a project to improve estimates of emissions from industrial equipment, the vast majority of which comes from forklifts. There may be some opportunities for further refinements or improvements after the current project is completed, but it seems unlikely that significant further work on the project beyond what CAPCOG is currently conducting would yield significant changes to this inventory.

Commercial Equipment

Current estimates do not indicate that as a category of nonroad equipment, commercial equipment only makes up 1.42 tons per day of NOX emissions across the program area, 1.42 tons per day of emissions within the MSA, and 0.99 tons per day in Travis County, short of the 3% threshold for each geography.

Figure 11: Commercial Equipment NOX Emissions, 2008 (tons per day)

Source Category	Program Area	Austin MSA	Travis County
AIR COMPRESSORS	0.28	0.26	0.20
GAS COMPRESSORS	0.01	0.01	0.01
GENERATOR SETS	0.68	0.63	0.48
HYDRO POWER UNITS	0.01	0.01	0.01
PUMPS	0.16	0.15	0.11
PRESSURE WASHERS	0.07	0.07	0.05
WELDERS	0.20	0.18	0.14
TOTAL	1.42	1.31	0.99

However, this is a category for which no emissions inventory improvements have been made for equipment populations and activity since the NONROAD model was first introduced, and based on EPA's assumptions about the use of commercial equipment – generator sets in particular, there may be some value in improving estimates from this source category in particular. One issue in the inventory is the irregular use of generator sets – often, special events such as football games, festivals, and other major events can make heavy use of generators, while during a "normal" day, these generators may not be used nearly as much. The NONROAD and TexN models assume that all "light commercial" equipment, including portable generators, are used 83% of the time during weekdays and 17% of the time during weekends. Given the extensive use of generators for special events in the area, which often occur on weekends, it is quite possible that the current inventory over-estimates average weekday emissions.

CAPCOG may consider developing a methodology for estimating generator usage at special events, which could in turn be used to help develop the overall estimate of the use of portable generators.

The other issue that arises in estimating emissions from portable generators is to make sure to distinguish between generators that are truly portable and generators that might be misclassified as portable but are actually stationary. Possibly the only way to understand the division between stationary and mobile generators would be to also inventory stationary generators as part of a commercial and institutional fuel combustion project, as described below.

Section 4: Area Source Inventory Review

Figure 12: Area Source NOX Emissions, 2008 (tons per day)

Category	Total	MSA	Travis
Industrial Fuel Combustion	2.97	2.74	1.94
Commercial/Institutional Fuel Combustion	1.82	1.74	1.13
Residential Fuel Combustion	0.54	0.52	0.38
Oil and Gas Exploration and Production	7.86	3.67	0.02
Agriculture	0.03	0.01	0.00
Other Combustion	0.03	0.01	0.00
Total	13.29	8.69	3.47

Based on the existing emissions estimates, only oil and gas production would meet the minimum threshold levels for further examination, and an extended discussion of that inventory is presented below. An analysis of the potential value of improving the commercial and institutional fuel combustion category is also included below since CAPCOG believes there are some well-defined methods that could be used to improve these estimates.

Oil and Gas Exploration and Production

For the purposes of this review, non-road drilling rigs for oil and gas exploration were combined with the area source category to form a consolidated oil and gas exploration category. CAPCOG believes that the oil and gas emissions inventory for the region should be improved. With this adjustment, oil and gas production and exploration in the program area makes up 8.31 tpd of NO_X emissions, 3.81 tpd of which occur within the MSA. This makes it more than 3% of both the program area's total NOX emissions and more than 3% of the MSA's NOX emissions.

Figure 13: Oil and Gas Production and Exploration NOX Emissions, 2008 (tons per day)

SCC Description	Bastrop	Caldwell	Fayette	Lee	Milam	Travis	Total
ARTIFICIAL LIFT	0.25	2.63	0.45	0.65	0.84	0.01	**4.83**
HEATER TREATER	0.06	0.62	0.11	0.16	0.20	0.00	**1.15**
COMPRESSOR ENGINES	0.02	0.01	1.00	0.71	0.03	0.00	**1.77**
GAS PRODUCTION HEATERS	0.02	0.00	0.06	0.02	0.00	0.00	**0.10**
DRILLING RIGS	0.11	0.03	0.15	0.13	0.03	0.00	**0.45**
TOTAL	**0.46**	**3.29**	**1.77**	**1.68**	**1.09**	**0.02**	**8.31**

CAPCOG's review of ERG's statewide 2008 oil and gas production inventory upon which the current estimates are based revealed several parts of the inventory that CAPCOG believes it could improve. One

key variable in the estimate of the emissions from artificial lift is the estimated percentage of pumpjacks that are run off of electric power. Discussions with local officials indicates that the 70% figure ERG used for a statewide basis is likely under-estimating the extent to which local pumpjacks use electricity.

This category is also one that is subject to significant changes over short periods of time. For instance, Bastrop County's oil production in 2011 was about 80% lower than what it was in 2008, and Caldwell County's 2011 oil production was more than 50% higher than it was in 2008. While the overall production for the whole program area only changed about 1% during that time, the distribution of production changed considerably.

There have also been fairly significant decreases in natural gas and condensate production over the last several years. It is not yet clear what future production may look like, but using more up-to-date data to prepare a 2011 base line emissions estimate would likely help provide more accurate projections of emissions from this category. The following figures show the changes in production levels of oil, gas, and condensate from 2006 to 2011, based on queries from Texas Railroad Commission's (RRC's) online data system.

Figure 14: Oil Production 2006 - 2011 (barrels)

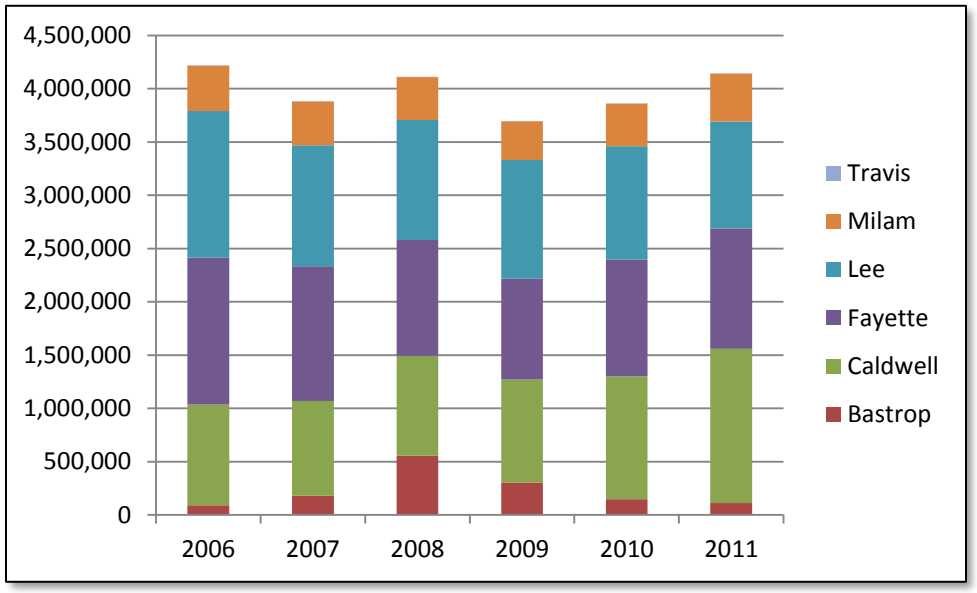


Figure 15: Casinghead Production (MCF)

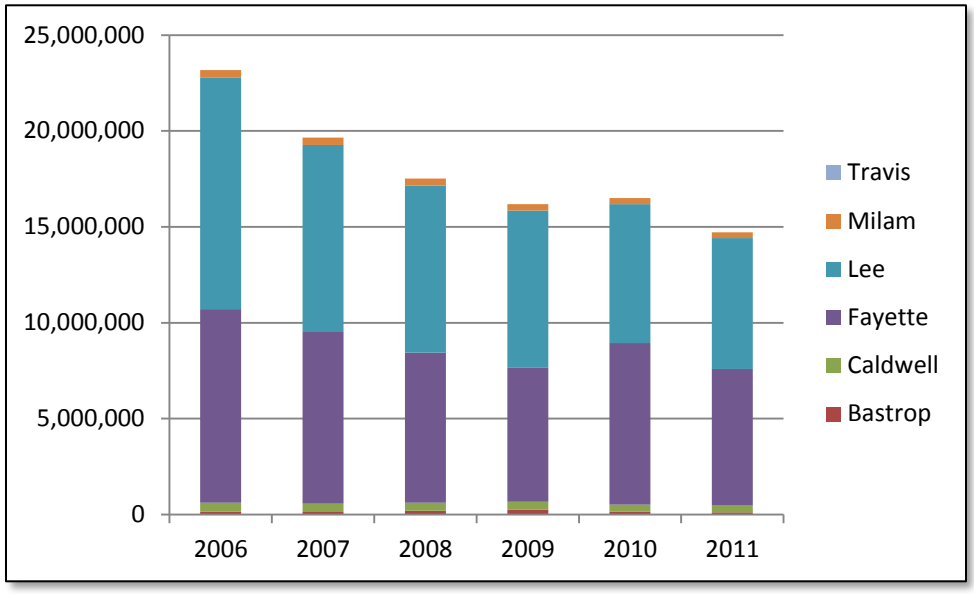


Figure 16: Gas Well Gas (MCF)

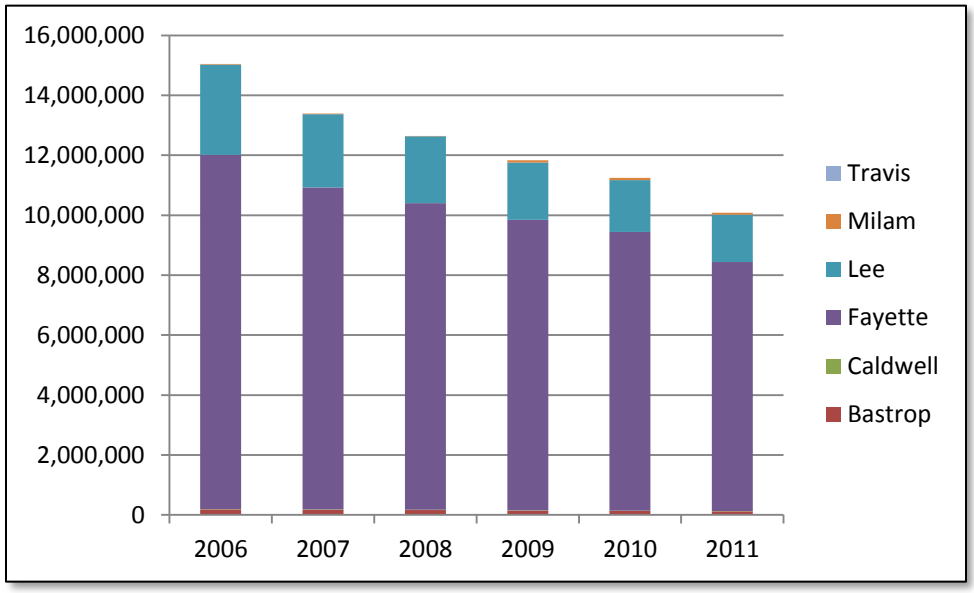
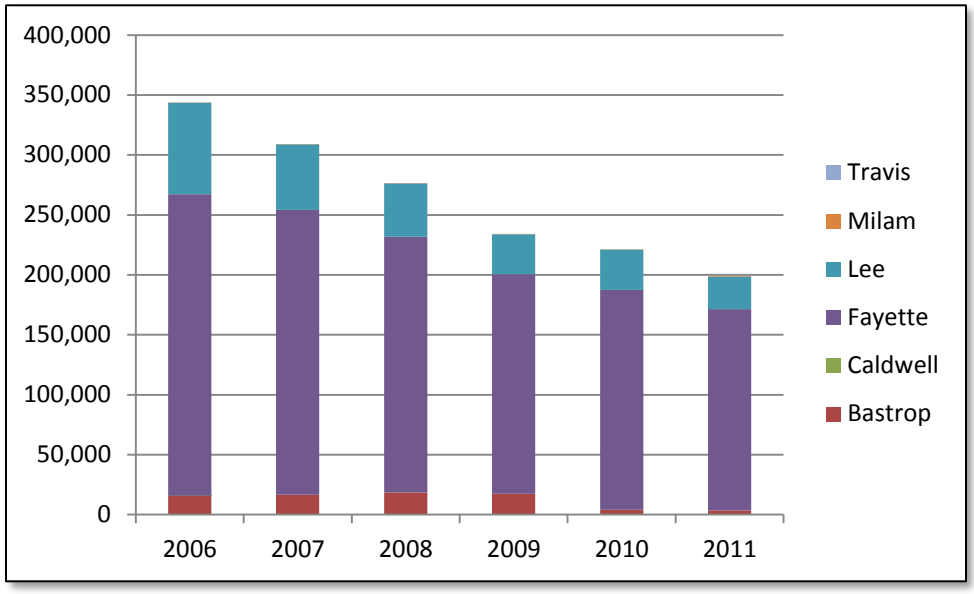


Figure 17: Condensate Production (barrels)



Another improvement that could be made is to develop improved spatial surrogates for this category based on the well-specific production, which can be queried from the RRC's data system as well. This project may also attempt to collect local data on the amount of truck traffic associated with the local wells.

Industrial, Commercial, and Institutional Fuel Combustion

While individually, area source industrial fuel combustion and commercial/institutional fuel combustion each fall below the minimum thresholds for NOX emissions, together they make up 4.48 tpd of NOX within the MSA and 4.48 tpd of NOX within Travis County. CAPCOG is currently working on a project to improve the estimates of emissions from the area source industrial fuel combustion category, and similar techniques could be used to improve the estimates and spatial allocation of the commercial and institutional fuel combustion categories. Data sources such as the Energy Information Agency, the state's Licensing and Regulation database of boilers, and Austin Energy's self-reported emissions for small-scale combined heat and power plants at the Domain and Mueller developments could be used to improve this inventory.

One potential more narrowly focused inventory could be conducted to estimate emissions from stationary backup generators. ERG conducted a study on diesel generators in the 9-County Dallas-Fort Worth 1997 Eight-Hour Ozone Nonattainment area[2], finding a total of 0.38 tons per day of emissions from these sources. This estimate assumes that the 137 tons per year of emissions were distributed evenly across every day of the year. However, much of these emissions likely come from regularly scheduled test-firing of the engines – often on Mondays in particular. It should be possible to use ERG's methodology to develop a similar local inventory of stationary generator emissions – a category that right now appears to be folded into the industrial, commercial, and institutional area source inventories.

[2]Eastern Research Group, Inc. Data Collection, Sampling and Emissions Inventory Preparation Plan for Selected Commercial and Industrial Equipment: Phase II, Final Report. August 31, 2005. http://www.tceq.texas.gov/assets/public/implementation/air/am/contracts/reports/ei/20050831-ergi-data_collection_plan_phase2.pdf. Last Accessed 7/11/2012.

This is a source that short-term emission reduction measures, such as avoiding test-firing the generators during predicted high ozone days, could be applied.

Section 5: Point Source Inventory Review

Natural Gas-Fired Boilers

CAPCOG has identified four facilities in the region that appear to have a potential to emit over 25 tons per year of NOX that are not reported to the point source database.

Figure 18: Calculated NOX Emissions from Facilities with Boilers at 100%, 75%, and 50% Capacity (tons per year)

Facility	County	Total Boiler Capacity	100%	75%	50%
Mueller CHP Plant	Travis	111 MMBTU/Hour	47 tpy	35 tpy	24 tpy
Griffin Industries	Bastrop	109 MMBTU/Hour	46 tpy	35 tpy	23 tpy
Hospira	Travis	100 MMBTU/Hour	43 tpy	32 tpy	21 tpy
JJ Pickle Research Campus	Travis	89 MMBTU/Hour	38 tpy	28 tpy	19 tpy
MD Anderson Cancer Center	Bastrop	78 MMBTU/Hour	33 tpy	25 tpy	17 tpy

Based on records from the Texas Department of Licensing and Registration's boiler safety database, these facilities have boilers of sufficient size such that under certain loads over 50% over the course of the year, they would emit at least 25 tpy of NO_X.

These estimates are based on the following equation:

*PTE = (1 ton/2000 lbs) * E * H * B * 1 day/24 hours * 1 year/365 days * Annual Load*

PTE = potential to emit, in tons

E = emissions rate, in pounds per MMCF of natural gas consumed (100 pounds NOX/MMCF)

H = heat content of natural gas (1,028 MMBtu/MMCF)

B = aggregate boiler capacity, in MMBTU/hour

Annual Load = % of boiler capacity used during a one-year time period

The emission factor was based on the emissions factor in AP-42, Fifth Edition, Volume I, Chapter 1.4: Natural Gas Combustion, small boilers (<100 MMBtu/hour heat input), which have an uncontrolled rate of 100 pounds of NOX per MMCF. For the Mueller plant, the larger boiler (86 MMBTU/hour) listed in the database has "steam" listed as its fuel, and the facility uses a turbine in its process, so it is not clear what exactly the emissions from this facility are, but it appears possible that it is emitting more than 25 tons per year. Similarly, a CHP plant operated by Austin Energy at the Domain is of a similar size and could be emitting over 25 tpy.

CAPCOG recommends that TCEQ initiate a formal written request to the owners and operators of these facilities to complete an EI for their facilities.

Bulk Fuel Terminals

A review of the IRS's listing of bulk fuel terminals indicates that while there is one bulk terminal in the region that reports to the point source database, there are two other terminals that do not. Based on the size of the tanks at the terminals (all of the images below are from approximately the same elevation) and the reported emissions in 2010 at the Austin terminal, it seems likely that the new Mustang Ridge terminal, which opened in late 2010, and the Cedar Creek terminal, which opened sometime between 2002 and 2005, have VOC emissions above the 10 tpy reporting threshold.

Details	Mustang Ridge Fuels Terminal. 1165 East Lone Star Dr., Buda, TX 76610	Flint Hills Resources, LP-Austin. 9011 Johnny Morris Rd, Austin, TX 78724	Flint Hills Resources, LP-Bastrop. 115 Mt. Olive Road, Cedar Creek, TX 78612
VOC	unknown emissions	65 tpy VOC (2010)	unknown
Picture			
Opened	Late 2010		Between 2002-2005

CAPCOG recommends that TCEQ initiate a formal written request to Flint Hills Resources, which owns all of these facilities, to complete an EI for their facilities.

Improved Temporal Allocation of Emissions

There may be some opportunities to improve the temporal allocation of point source emissions within the region for non-EGU facilities. Texas Lehigh, in particular, had made a commitment to using the maximum amount of urea in its SNCR system for predicted high-ozone days, and records from its continuous emissions monitoring systems could be used to develop hour-specific emissions estimates. CAPCOG could also reach out to other point sources to identify which ones have data that would enable the development of day-specific or hour-specific inventories that could be used for modeling. Key facilities CAPCOG could look at would be the Texas Lehigh facility, the Austin White Lime facility, and the Luling Gas Plant. CAPCOG could also work with the businesses that participate in the Clean Air Partners Program that have facilities that report to the point source inventory to obtain day-specific or hour-specific estimates where available.