APPENDIX G

2007 FUTURE BASE CASE AND SENSITIVITY ANALYSES

Appendix G

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INTRODUCTION
To create a 2007 future case on which to model attainment, certain adjustments were made to the 1999 base case. Meteorological fields, boundary/initial conditions, dry deposition algorithms, chemical mechanisms and other model configurations remained identical between the September 1999 and 2007 simulations. However, VOC, NOx, and CO emission estimations from anthropogenic sources were adjusted to account for such factors as anticipated growth/decline in population and employment and the impact of federal, state and regional emission reduction measures. The biogenic emissions inventory (EI) for the 2007 base was the same as that used for the 1999 base case, in accordance with EPA guidelines.

Tables G-1 and G-2 provide comparisons between the 1999 anthropogenic modeling EI developed for the four-county San Antonio Early Action Compact Region (SAER) and the 2007 anthropogenic modeling EI. Despite projections in population growth in all four SAER counties between 1999 and 2007, most emissions categories are expected to decrease between the base year and attainment year. Overall, anthropogenic VOC emissions for the SAER were projected to decrease by 20.88% between 1999 and 2007; likewise, anthropogenic NOx emissions were projected to decrease by 30.11% during the same timeframe.

Table G-1. Comparison of 1999 and 2007 Anthropogenic VOC Emissions in the Four-county SAER for a Typical Weekday (Wednesday).

County	On-Road (tpd)	Area / Non-road (tpd)	Point (tpd)	Total (tpd)
1999				
Bexar	75.52	111.98	6.30	193.80
Comal	6.15	6.70	0.34	13.20
Guadalupe	5.57	7.77	0.45	13.78
Wilson	1.57	3.73	0.07	5.37
Total (tpd)	88.81	130.18	7.17	226.15
2007				
Bexar	42.42	98.55	11.82	152.79
Comal	3.85	5.53	0.52	9.90
Guadalupe	3.42	6.98	1.10	11.50
Wilson	0.98	3.68	0.07	4.74
Total (tpd)	50.67	114.75	13.50	178.93
% Difference between 1999 and 2007				
Bexar	-43.83%	-11.99%	87.47%	-21.16%
Comal	-37.42%	-17.45%	50.94%	-24.98%
Guadalupe	-38.63%	-10.08%	145.00%	-16.58%
Wilson	-37.42%	-1.31%	0.00%	-11.82%
Total	-42.95%	-11.85%	88.44%	-20.88%

Table G-2. Comparison of 1999 and 2007 Anthropogenic NOx Emissions in the Four-county SAER for a Typical Weekday (Wednesday).

County	On-Road (tpd)	Area / Non-road (tpd)	Point (tpd)	Total (tpd)
1999				
Bexar	119.57	39.39	88.59	247.55
Comal	11.64	3.57	12.16	27.38
Guadalupe	10.47	4.24	0.51	15.21
Wilson	1.89	0.93	0.00	2.82
Total (tpd)	143.58	48.12	101.26	292.96
2007				
Bexar	67.45	39.18	53.24	159.86
Comal	7.07	3.70	13.77	24.53
Guadalupe	6.47	3.40	8.07	17.95
Wilson	1.34	1.04	0.00	2.39
Total (tpd)	82.34	47.32	75.08	204.74
% Difference between 1999 and 2007				
Bexar	-43.59%	-0.53%	-39.90%	-35.42%
Comal	-39.30%	3.46%	13.22%	-10.39%
Guadalupe	-38.15%	-19.65%	1492.19%	17.99%
Wilson	-29.00%	12.17%	0.00%	-15.44%
Total	-42.65%	-1.67%	-25.85%	-30.11%

Figures G-1 through G-3 provide graphical comparisons of the anthropogenic NOx EIs for 1999 and 2007 by source category, both in terms of magnitude of concentrations and spatial allocation of plumes. Similarly, figures G-4 through G-6 provide graphical comparisons between estimated 1999 and 2007 anthropogenic VOC emissions inventories. As indicated by these pictures, on-road precursor emissions are concentrated in urban areas. By comparison, area/non-road and point source emissions are more dispersed. It is also evident that, overall, most anthropogenic emission categories are expected to decrease between 1999 and 2007.

Figure G-1. Comparison of 1999 and 2007 Anthropogenic NOx Precursor Emissions from On-road Sources within the 4-km Subdomain on Wednesday, September 15th.

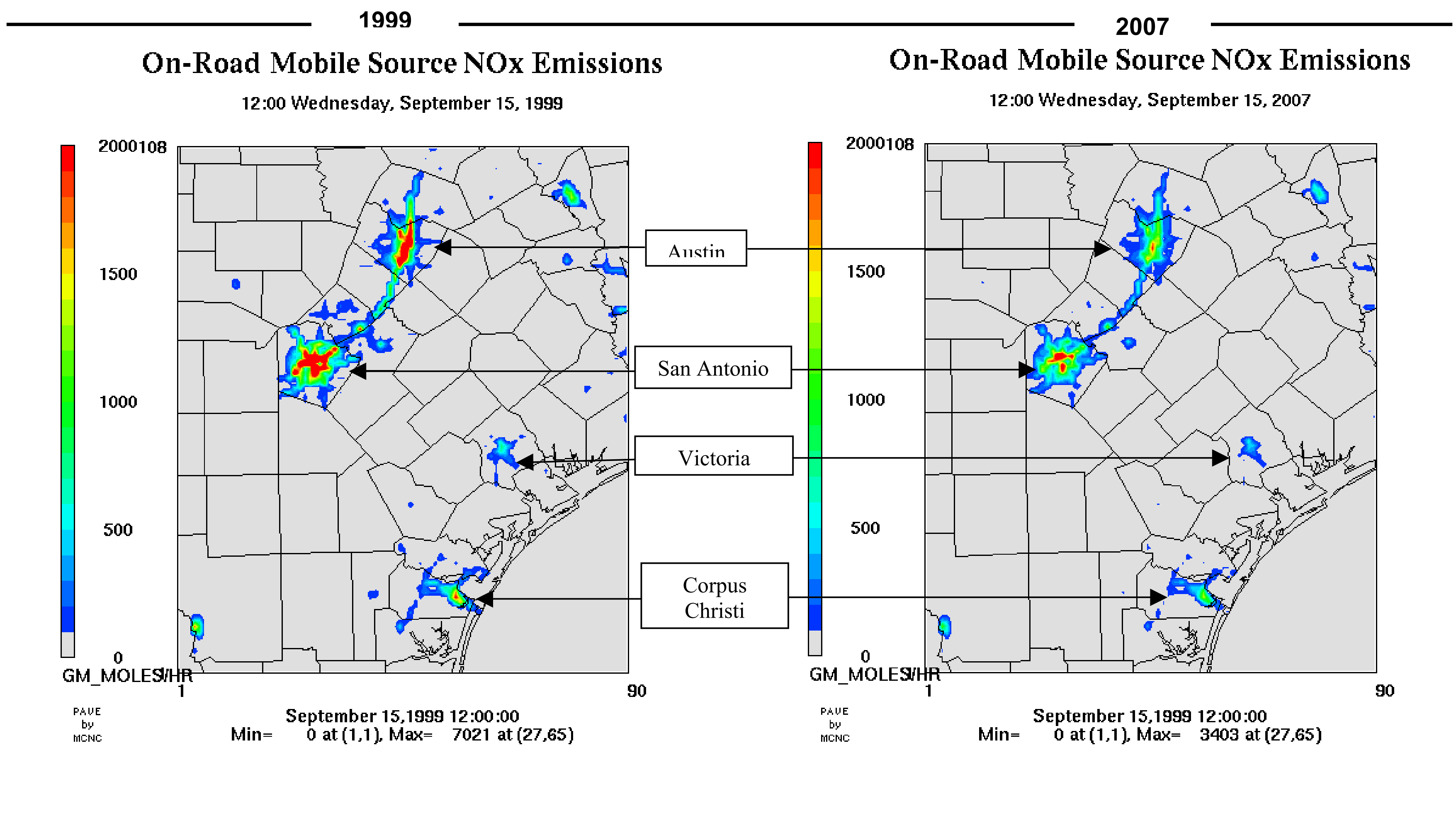
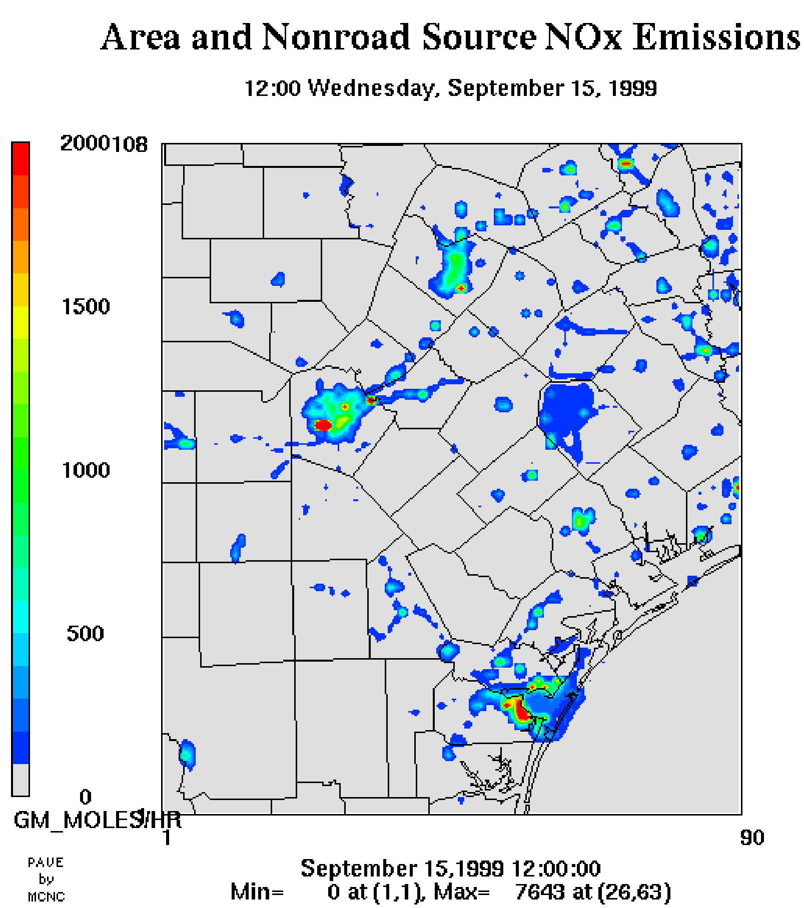


Figure G-2. Comparison of 1999 and 2007 Anthropogenic NOx Precursor Emissions from Area/non-road Sources within the 4-km Subdomain on Wednesday, September 15th.

1999



2007

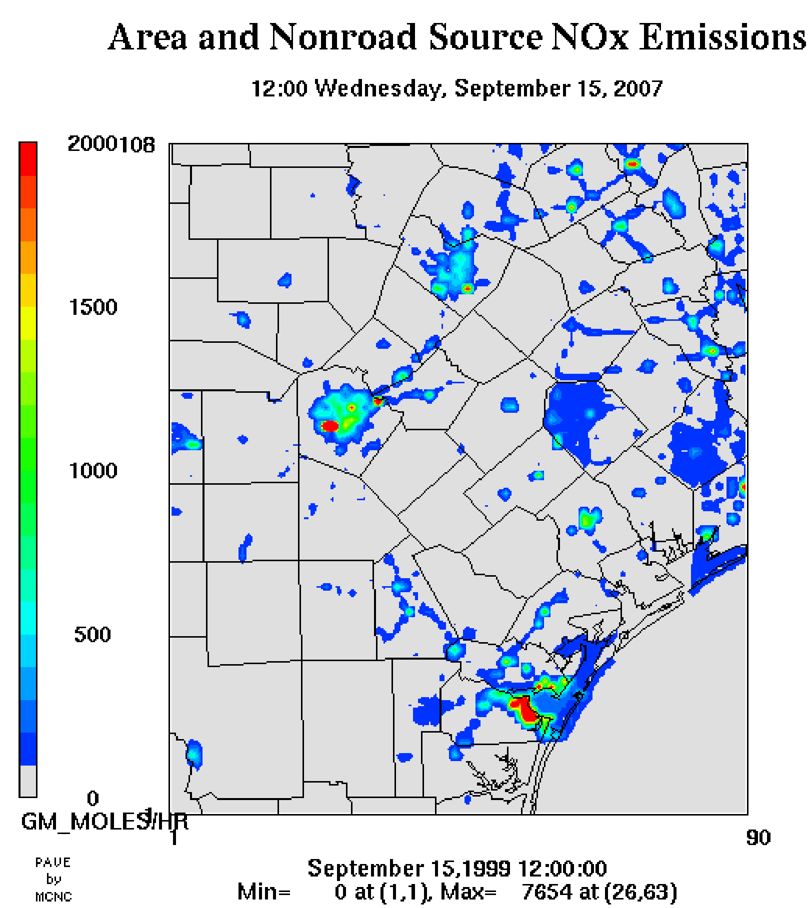
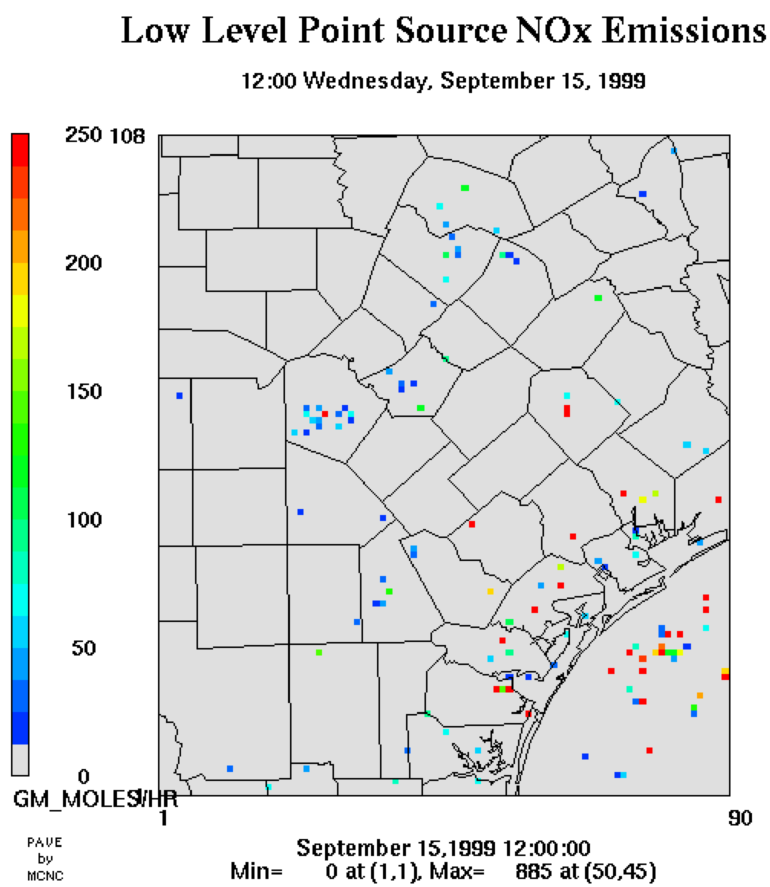


Figure G-3. Comparison of 1999 and 2007 Anthropogenic NOx Precursor Emissions from Low-level Point Sources within the 4-km Subdomain on Wednesday, September 15th.

1999



2007

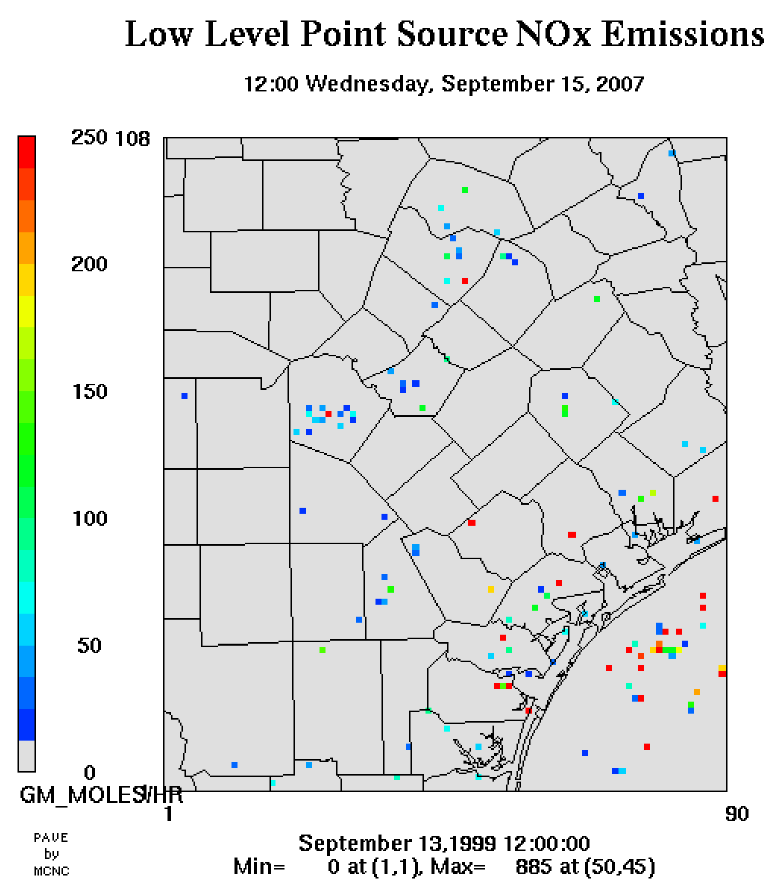
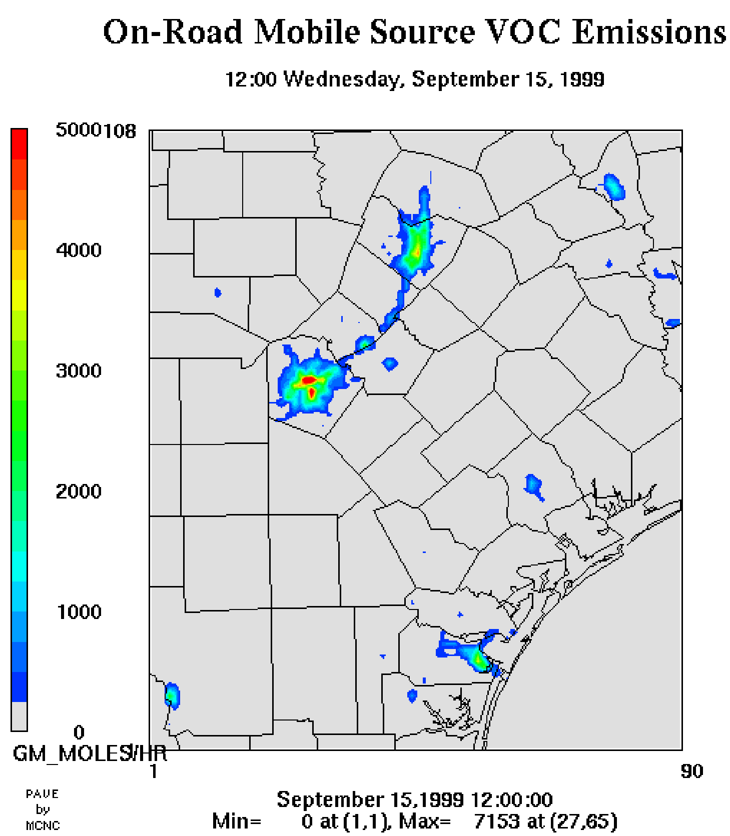


Figure G-4. Comparison of 1999 and 2007 Anthropogenic VOC Precursor Emissions from On-road Sources within the 4-km Subdomain on Wednesday, September 15th.

1999



2007

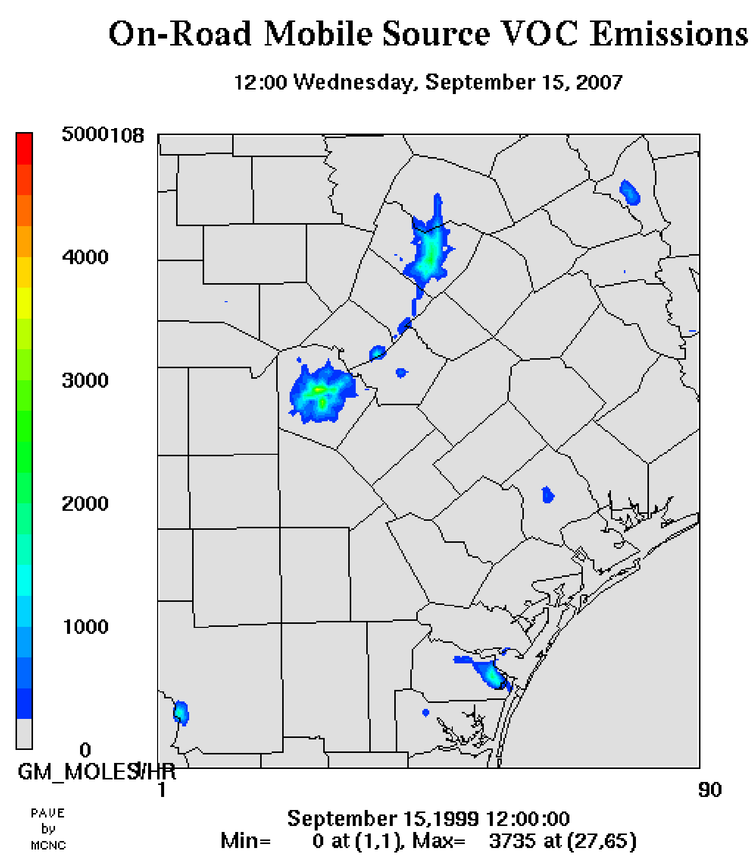


Figure G-5. Comparison of 1999 and 2007 Anthropogenic VOC Precursor Emissions from Area/non-road Sources within the 4-km Subdomain on Wednesday, September 15th.

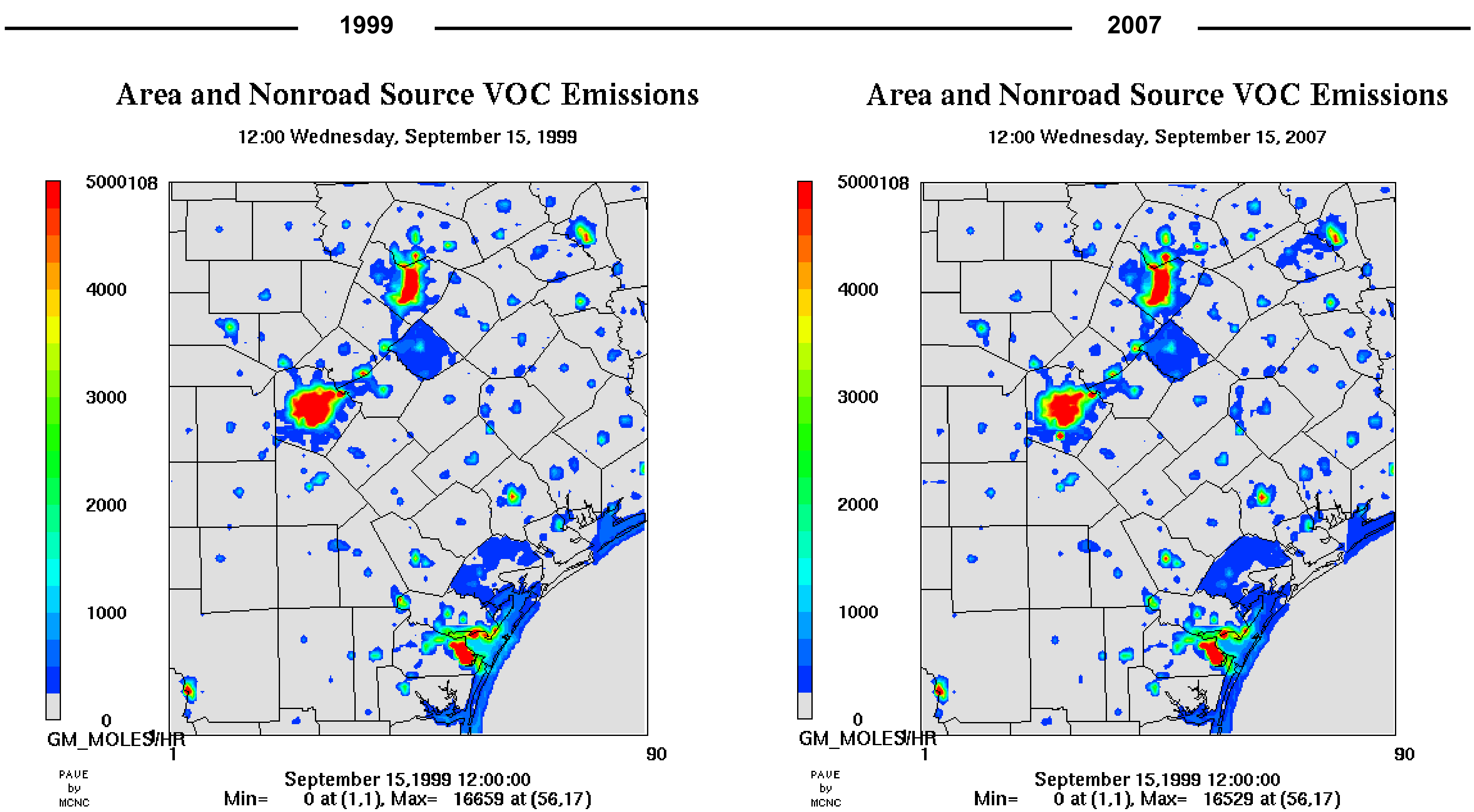
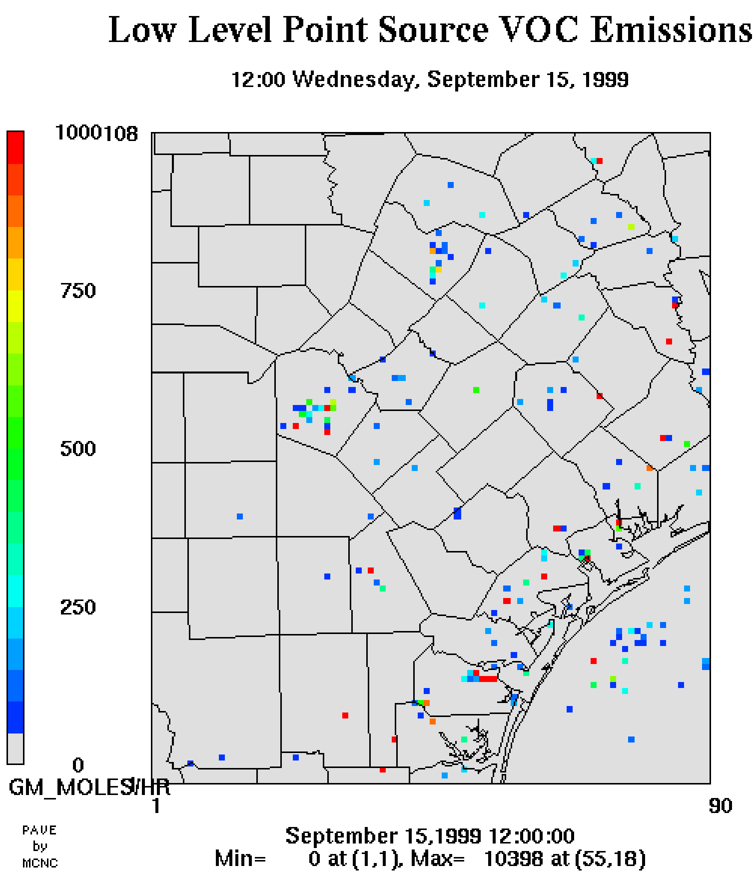
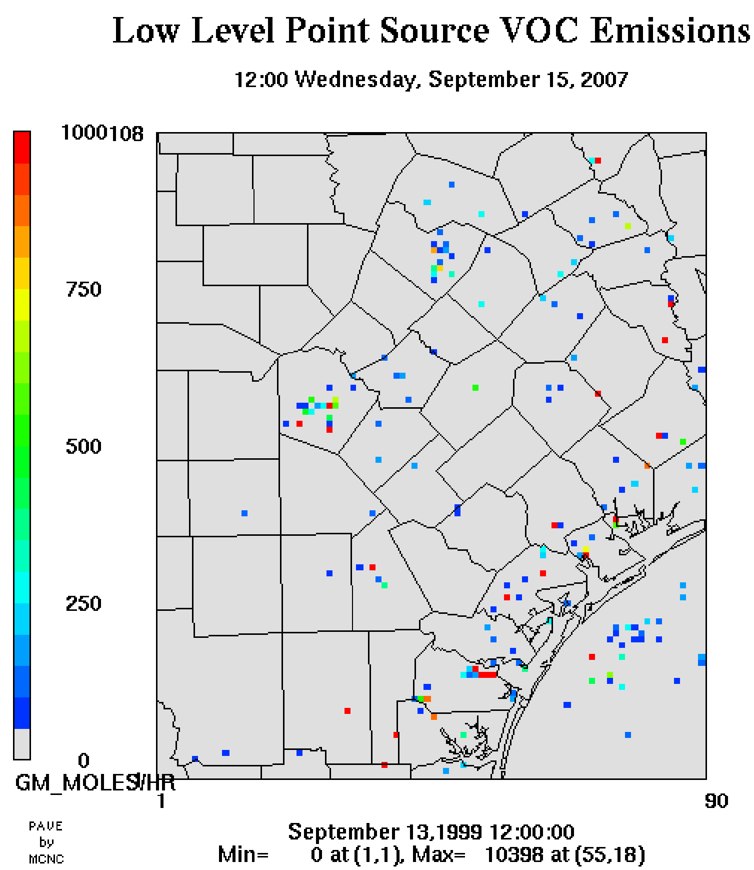


Figure G-6. Comparison of 1999 and 2007 Anthropogenic VOC Precursor Emissions from Low-level Point Sources within the 4-km Subdomain on Wednesday, September 15th.

1999 **2007**





2007 BASE CASE

Once the 1999 base case was modified by replacing the photochemical model's emissions inputs (i.e., replacing the 1999 local, state, and regional anthropogenic EI with a 2007 local, state, and regional EI), the model was rerun. The resulting episode projection represents the 2007 future case for the SAER.

The impact of modifying the anthropogenic local and regional emissions inventories between the 1999 base and 2007 future cases is demonstrated in table G-3. As shown, the 2007 projection predicts a decrease in ozone concentration at each San Antonio monitoring station (7x7 array of cells near monitor) compared to the 1999 base case predictions.

Table G-3. Comparison of 1999 and 2007 Predicted Maximum 8-hour Average Ozone Concentrations by Monitor, September 15th - 20th.

CAMS Station	1999 Predicted 8-hr Max. Ozone	2007 Predicted 8-hr Max. Ozone	1999-2007 Percent Change
CAMS 23	89.0 ppb	84.5 ppb	-5.0%
CAMS 58	87.8 ppb	82.8 ppb	-5.6%
CAMS 59	78.1 ppb	73.6 ppb	-5.7%
CAMS 678	80.1 ppb	77.4 ppb	-3.3%

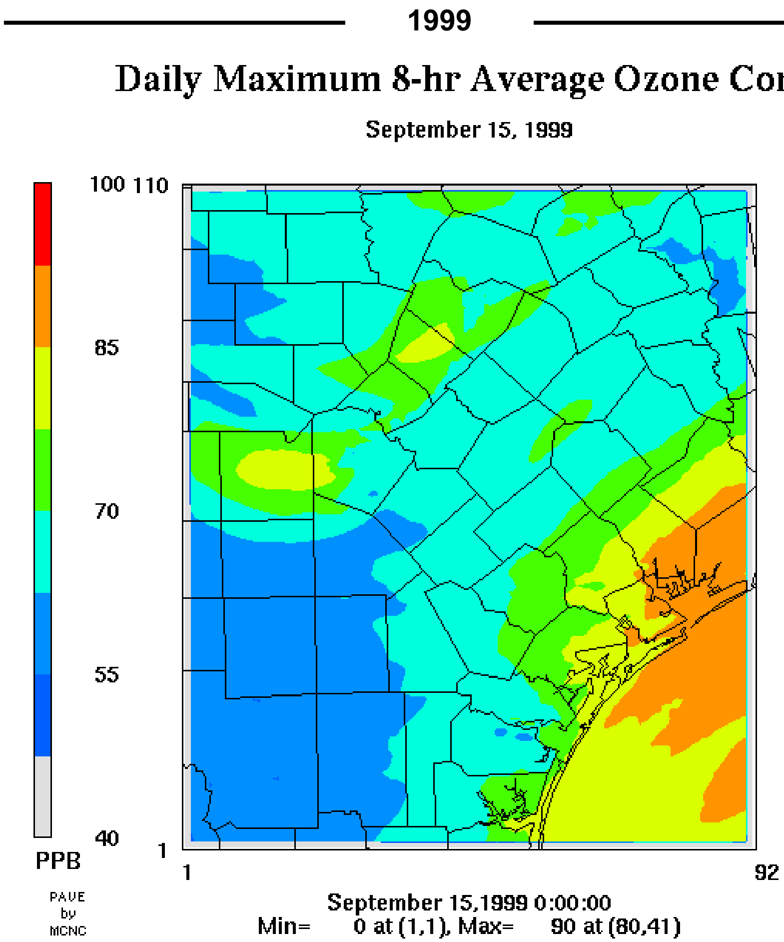
2007 BASE CASE PERFORMANCE EVALUATION

Appendix E describes a variety of tests that were conducted on the 1999 base case in order to evaluate model performance. For a future case, such as the 2007 projection, methods of analyzing model performance are more limited. Ozone metrics and several other types of analyses that compare the model's predictions with actual measurements cannot be performed prior to compilation of those actual future measurements. As a consequence, performance analyses conducted on the 2007 future case were restricted to tile plots, comparisons between model refinements, and sensitivity runs.

Tile Plots

Tile plots provide an indication of where the model is or isn't performing correctly given known changes to modeling input in the future case. These plots are visual representations of the model's predictions and provide such information as when and where the model predicts urban plumes. The following tile plots (figures G-7 through G-12) represent comparisons between the 1999 and 2007 8-hour daily maximum ozone concentrations within the modeling domain for each day of the primary episode.

Figure G-7. Comparison of 1999 and 2007 Predicted Daily Maximum 8-hour Ozone Concentrations in the 4-km Subdomain on Wednesday, September 15th.



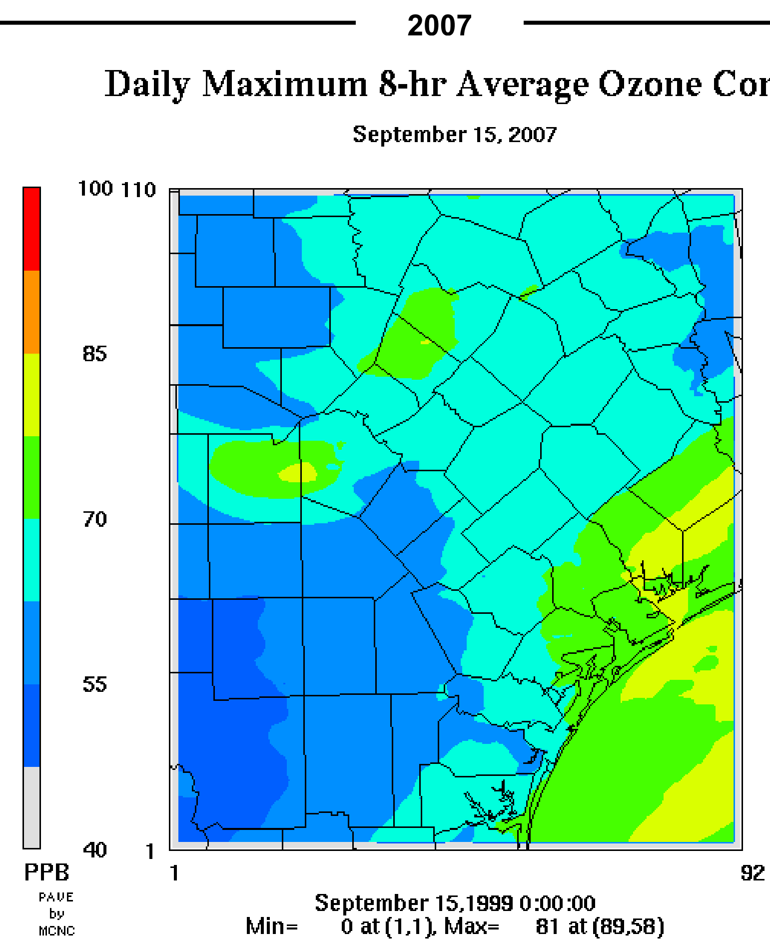
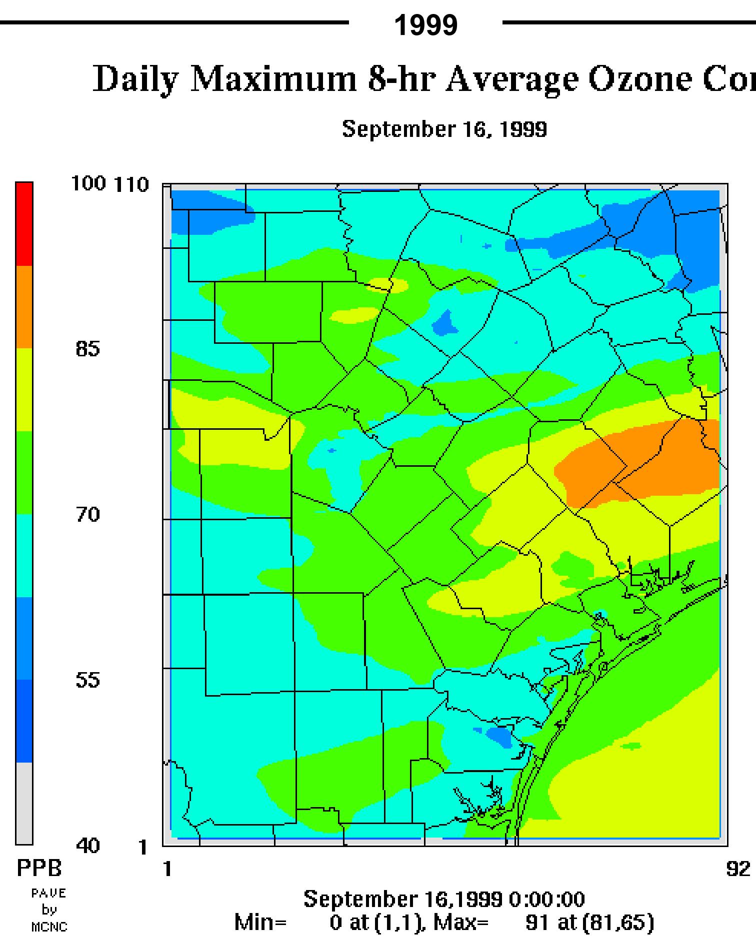


Figure G-8. Comparison of 1999 and 2007 Predicted Daily Maximum 8-hour Ozone Concentrations in the 4-km Subdomain on Thursday, September 16th.



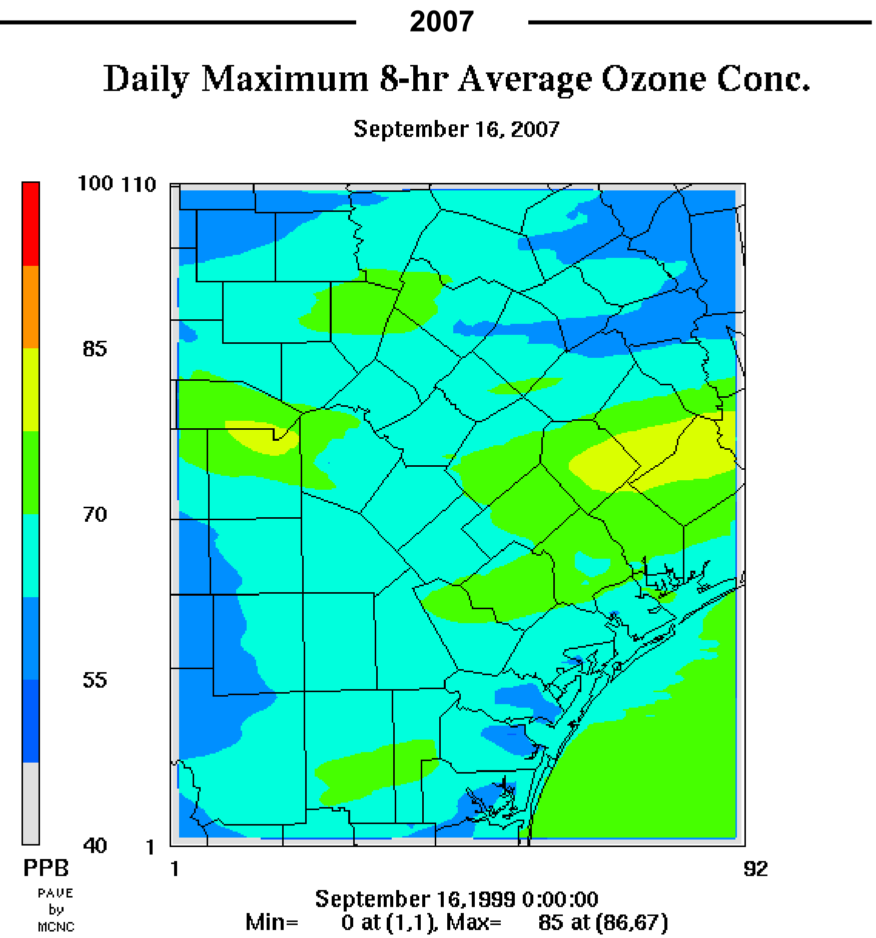
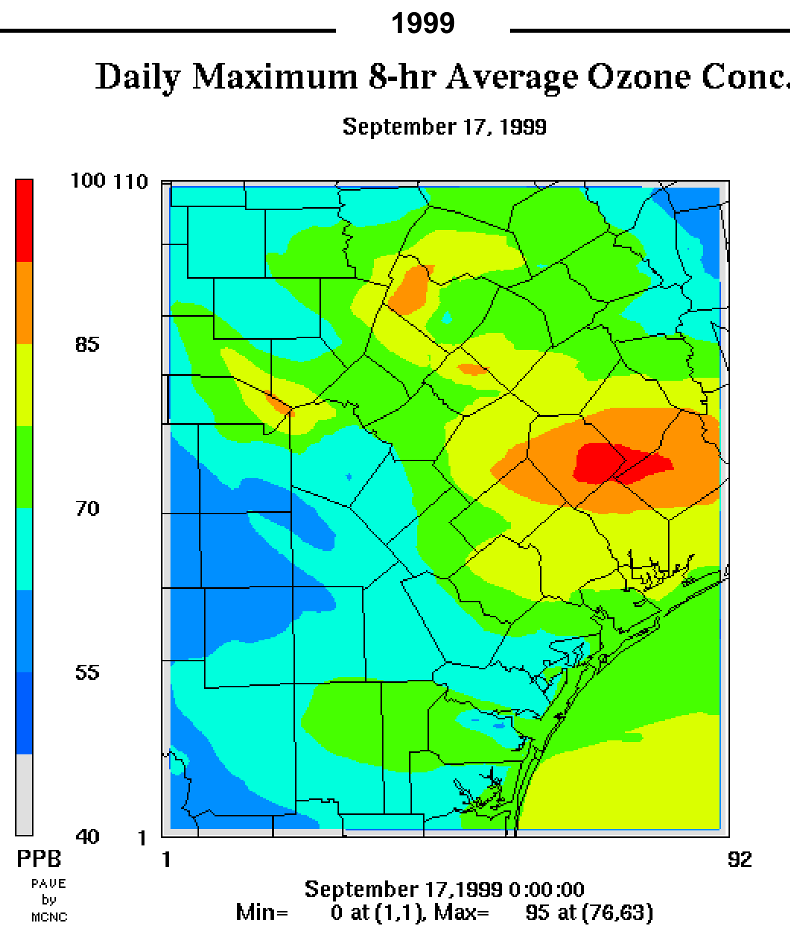


Figure G-9. Comparison of 1999 and 2007 Predicted Daily Maximum 8-hour Ozone Concentrations in the 4-km Subdomain on Friday, September 17th.



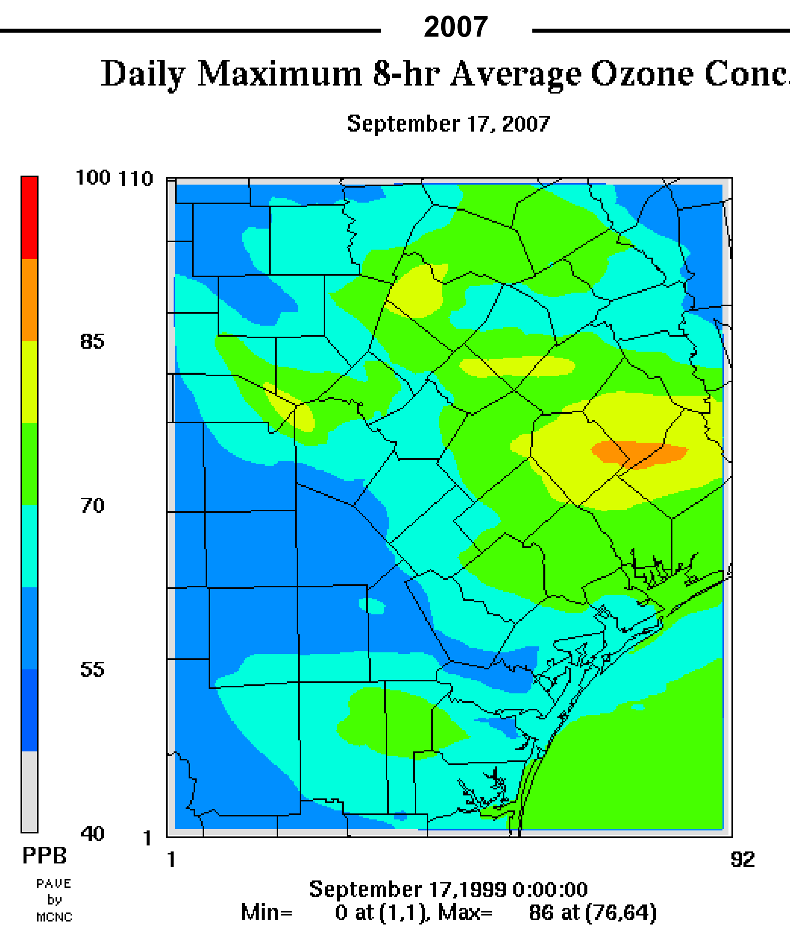
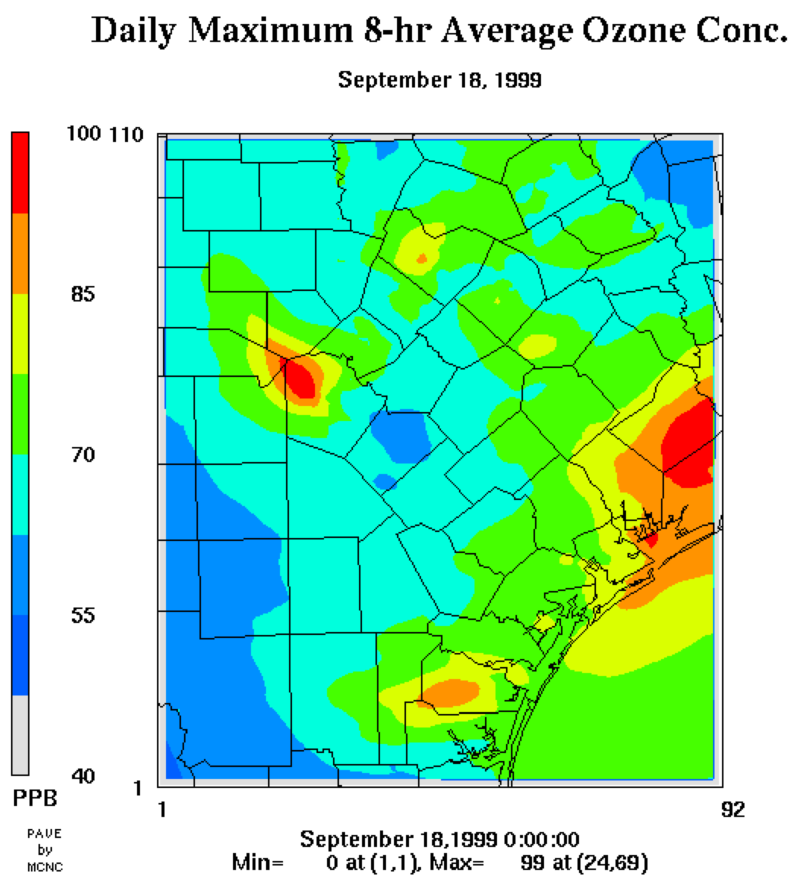


Figure G-10. Comparison of 1999 and 2007 Predicted Daily Maximum 8-hour Ozone Concentrations in the 4-km Subdomain on Saturday, September 18th.

1999



2007

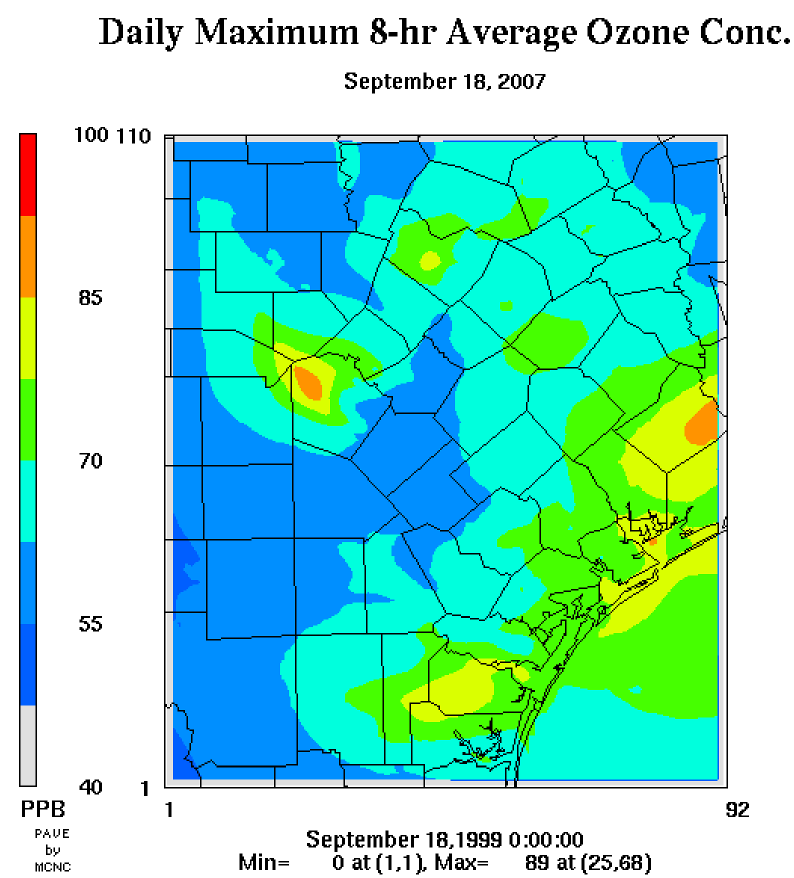


Figure G-11. Comparison of 1999 and 2007 Predicted Daily Maximum 8-hour Ozone Concentrations in the 4-km Subdomain on Sunday, September 19th.

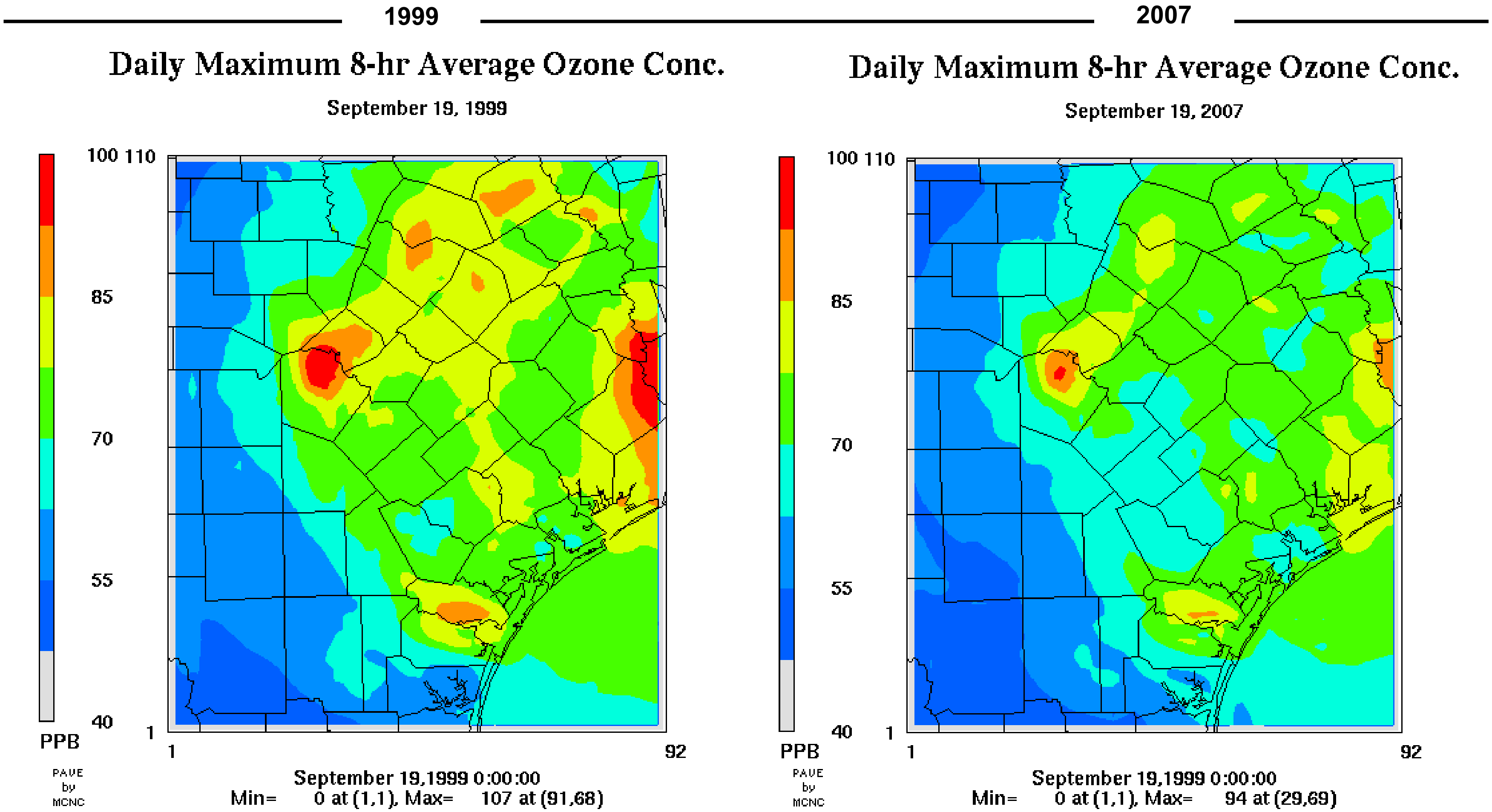
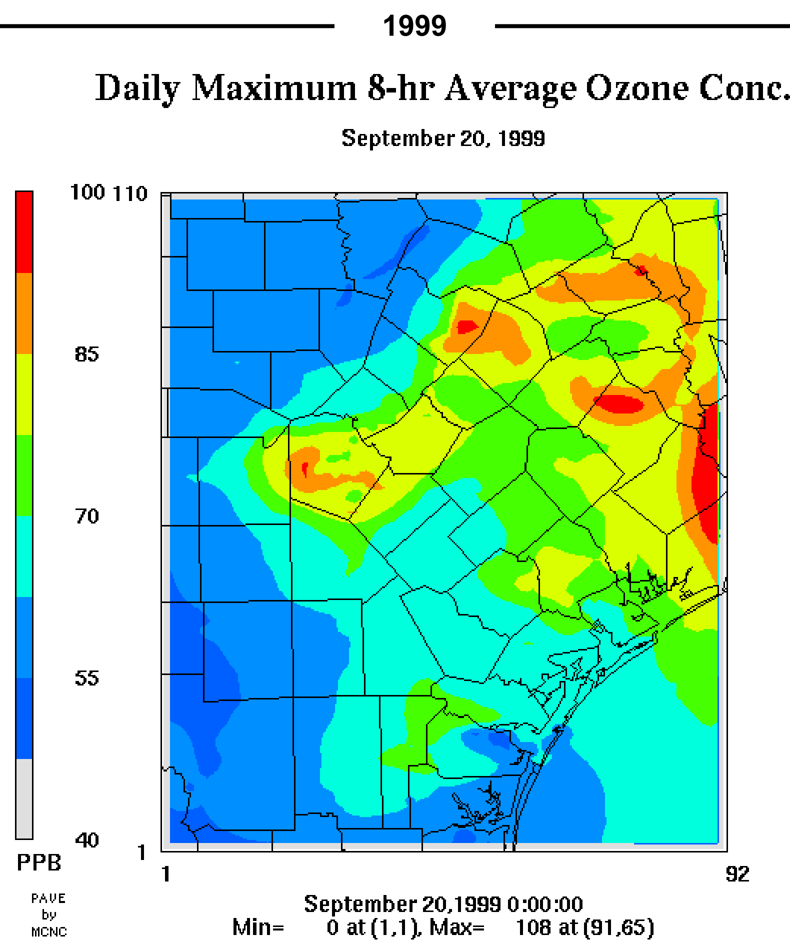
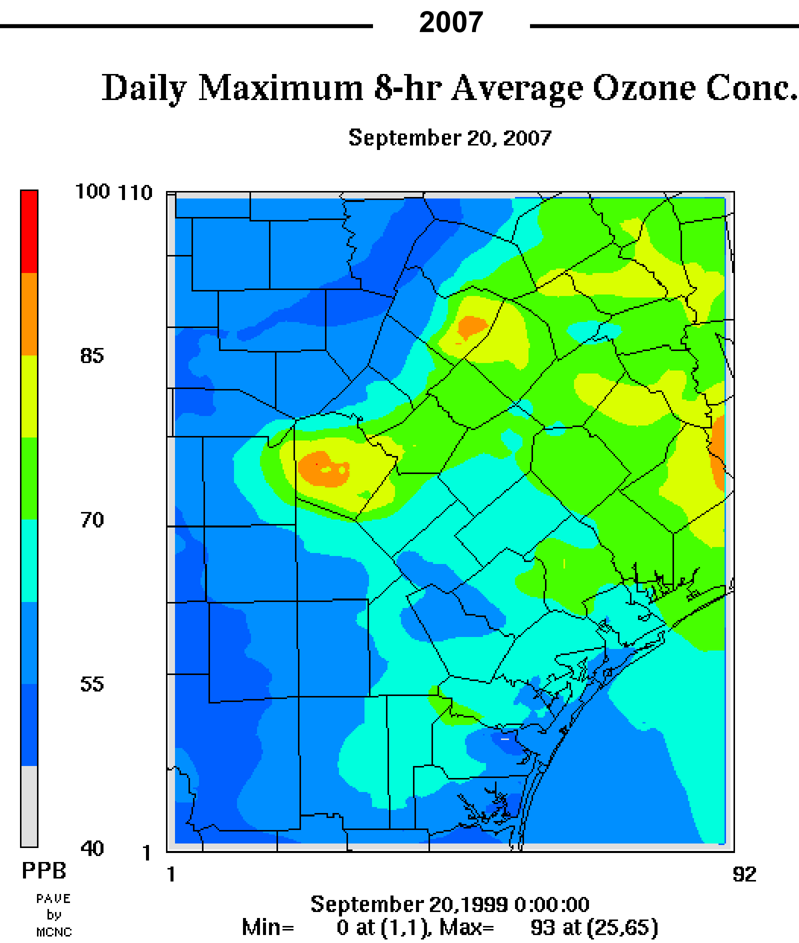


Figure G-12. Comparison of 1999 and 2007 Predicted Daily Maximum 8-hour Ozone Concentrations in the 4-km Subdomain on Monday, September 20th.





As demonstrated by these plots, urban plumes are replicated predictably, both in terms of intensity and spatial allocation. Peak ozone concentrations are predicted downwind of city centers and major point sources in these tile plots. In addition, the overall reduction in NOx, VOC, and CO emissions (local and regional) between 1999 and 2007 reduced the magnitude of the ozone plumes in each of the daily 1999-2007 comparisons.

Comparisons Between Model Refinements

As described in appendix E, the original September 1999 model was developed by ENVIRON and refined through a collaboration between ENVIRON, UT Austin[1], and AACOG (meteorological model and air quality input refinements). Subsequently, the model was provided to the Texas Near Nonattainment (NNA) partners[2], or their contractors, for further modifications. These modifications included refinement of the emissions inventory inputs, development of the future case, and clean air strategy analyses. Because the model was modified by more than one agency during this process, there was a concern that the various agencies' models would become dissimilar and provide different predictions for the base case, future case, and control strategy runs.

A great amount of effort was spent ensuring that the Austin and San Antonio base and future cases contained identical input. Often this involved discussions between the two agencies, as well as TCEQ, regarding the most appropriate EI data for local and regional areas. Discrepancies in emissions inputs were corrected prior to the final AACOG and UT runs.

An analysis was conducted by AACOG staff to determine any differences between the final 1999 base case refined by UT Austin and the final base case refined by AACOG, based on predicted concentrations at two Austin monitors. The 2007 future cases developed by UT and AACOG were similarly analyzed. The results of these analyses are provided in table G-4. The table provides daily peak 8-hour predictions within the 7x7 array of cells near the Murchison and Audubon monitors for the 1999 and 2007 base cases.

As shown, the differences between predictions by AACOG's final run (labeled 1999_sos.f) and UT's final run (labeled 1999_v3) are insignificant. With regards to the Murchison monitor, the average difference (six episode days) in ozone concentrations between the two 1999 base cases was 0.00 ppb, while the average difference at the Audubon monitor was 0.05 ppb. For the 2007 future cases, the average differences in peak ozone concentrations for the six-day episode was -0.06 ppb (Murchison) and –0.04 ppb (Audubon). These results provide additional, independent verification of the performance of the 1999 base case and 2007 future case.

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[1] UT Austin acted on behalf of Austin modeling.

[2] Development of the September 1999 photochemical model simulation was a collaboration between TCEQ and four Texas NNAs: Austin, Corpus Christi, San Antonio, and Victoria.

Table G-4. Comparison of Predicted Peak 8-hour Concentrations for Final UT and AACOG Base and Future Case Runs.

Monitor	UT **1999_v3**	AACOG **1999_sos.f**	Average Difference	UT **2007_v3**	AACOG **2007.f**	Average Difference	UT **RRF**	AACOG **RRF**	Average Difference	**Days**	Date
MURC	84.6	84.6	0.00	80.2	80.3	-0.06	0.948	0.949	-0.001	6	9/15 – 9/20
AUDU	81	80.9	0.05	76.7	76.7	-0.04	0.948	0.948	0.000	6	9/15 – 9/20
Monitor	UT **1999_v3**	AACOG **1999_sos.f**	Daily Difference	UT **2007_v3**	AACOG **2007.f**	Daily Difference	UT **RRF**	AACOG **RRF**	Daily Difference	**Days**	**Date**
MURC	77.8	77.8	0.0	75.1	75.1	0.0	0.964	0.965	-0.001	1	9/15
MURC	75.5	75.4	0.1	72.8	72.8	0.0	0.964	0.966	-0.002	1	9/16
MURC	86.8	86.7	0.1	82.2	82.2	0.0	0.947	0.948	-0.001	1	9/17
MURC	84.5	84.4	0.1	79.8	79.8	0.0	0.945	0.946	-0.001	1	9/18
MURC	89.6	89.7	-0.1	83.4	83.4	0.0	0.932	0.930	0.002	1	9/19
MURC	93.6	93.6	0.0	88.2	88.3	-0.1	0.942	0.942	0.000	1	9/20
AUDU	76.2	76.1	0.1	73.7	73.7	0.0	0.968	0.969	-0.001	1	9/15
AUDU	78.2	78.2	0.0	74.6	74.7	-0.1	0.954	0.955	-0.001	1	9/16
AUDU	87.4	87.4	0.0	82.2	82.2	0.0	0.94	0.941	-0.001	1	9/17
AUDU	84.5	84.4	0.1	78.8	78.8	0.0	0.933	0.934	-0.001	1	9/18
AUDU	89.4	89.5	-0.1	82.9	82.9	0.0	0.928	0.927	0.001	1	9/19
AUDU	70.1	70.2	-0.1	68.1	68.2	-0.1	0.972	0.971	0.001	1	9/20

Sensitivity Tests
Sensitivity tests are used throughout model development as diagnostic tools. These tests are conducted by perturbing model input. Results of sensitivity tests are analyzed in terms of whether the model responded to changes in input and, further, whether the model responded in a manner judged to be appropriate to input modifications.

In addition to providing an indication of model performance, sensitivity tests are useful for providing key information. For example, when applied to a projection year base case, sensitivity runs may be used to analyze the impact of emissions sources in the future. Furthermore, these evaluations may be used to predict the impact of control strategies and assist with determining what types of precursor reductions are likely to be the most effective for reducing ozone concentrations.

The 2007 future case sensitivity tests were conducted by modifying model input in one of two ways: 1) removing the precursor emissions for specific point sources/urban areas, or 2) reducing the local anthropogenic NOx and VOC emissions inventories in incremental amounts. The results of modifying model input to the 2007 future case are provided in the following sections.

Zero-Out Runs: Urban Areas
Appendix E describes sensitivity tests conducted on the 1999 base case in which the anthropogenic NOx and VOC EIs for Austin, Corpus Christi, and Houston were removed from, or “zeroed out” of, the model. These tests were also conducted on the 2007 future case, i.e., the 2007 NOx and VOC EIs for Austin, Corpus Christi, and Houston were removed from the future case in three separate tests. Figures G-13 and G-14 provide the predicted changes in ozone concentrations at CAMS 23 and CAMS 58, respectively, after removing the anthropogenic EIs for each of the three urban areas and compares those values to the 1999 sensitivity runs.

As shown by the graphs in figures G-13 and G-14, removing the anthropogenic EI for the 11-county Houston area had the greatest predicted impact on 2007 ozone concentrations in the San Antonio area, followed by the 2-county Corpus Christi area and 5-county Austin area. Moreover, this trend is the same whether referring to the 1999 base or 2007 future case sensitivity runs. During the 1999 episode, the predominate wind direction was such that Houston emissions were more likely to impact San Antonio than Austin or Corpus Christi. Since the meteorological inputs remain identical between base and future cases, it stands to reason that Houston emissions would continue to demonstrate the greatest influence on San Antonio ozone concentrations during the September episode.

Figure G-13. Predicted Reductions in Ozone Concentrations at CAMS 23 after Zeroing Out Anthropogenic Precursor Emissions for the 11-county Houston Area, 2-county Corpus Christi Area, and 5-county Austin Area from the 1999 Base Case (orange) and 2007 Future Case (blue).

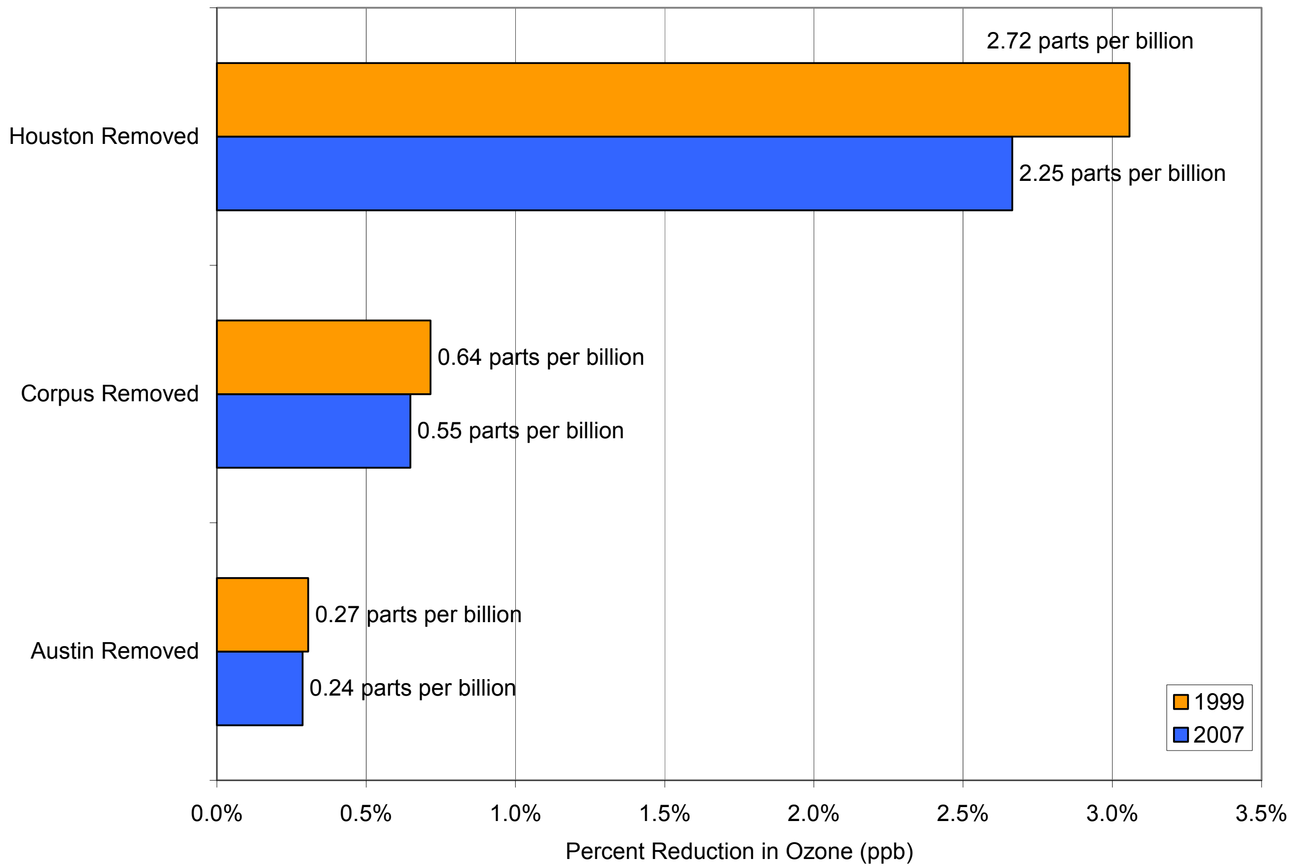
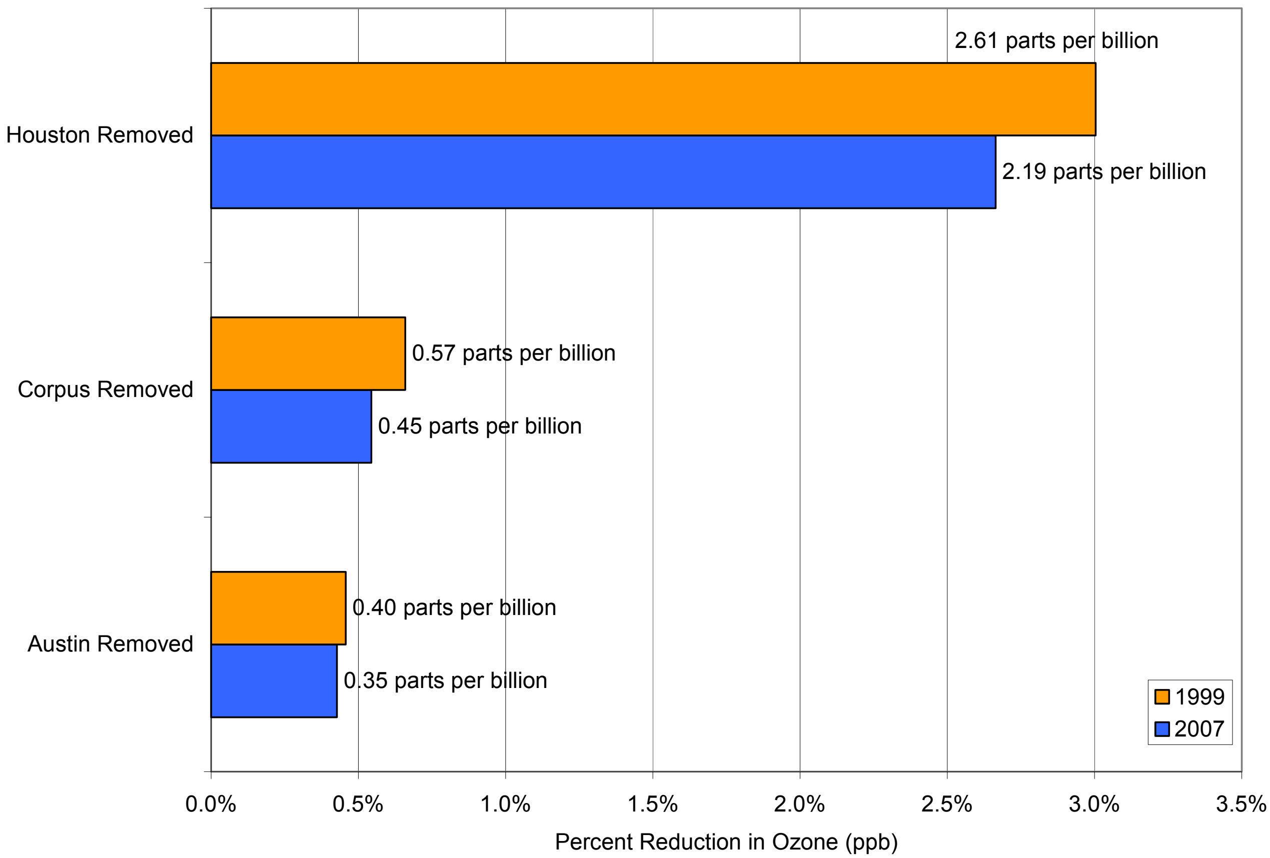


Figure G-14. Predicted Reductions in Ozone Concentrations at CAMS 58 after Zeroing Out Anthropogenic Precursor Emissions for the 11-county Houston Area, 2-county Corpus Christi Area, and 5-county Austin Area from the 1999 Base Case (orange) and 2007 Future Case (blue).

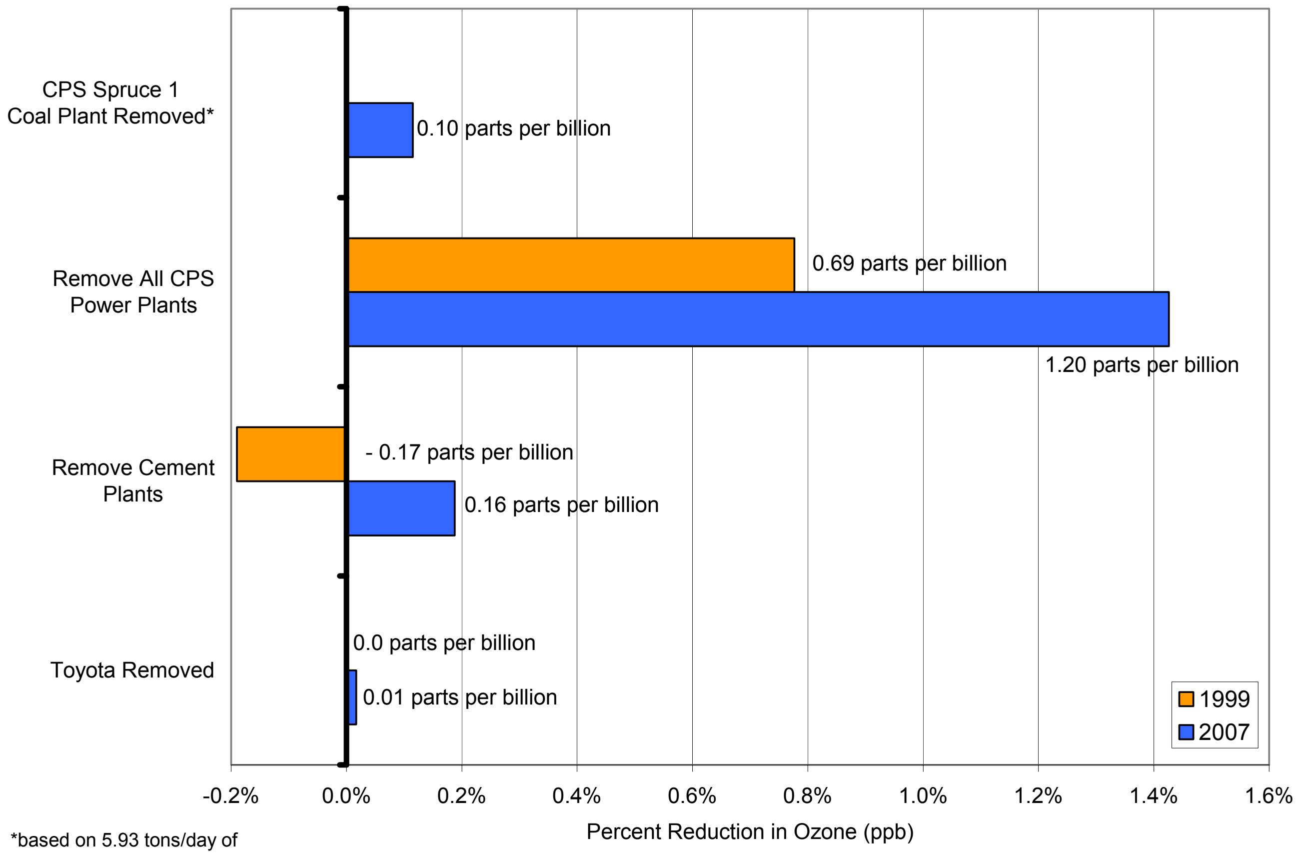


Zero-Out Runs: Point Sources

Analyses were also conducted in which specific point source emissions were removed from the model in separate sensitivity runs. These tests were run at the request of local elected officials and the TCEQ to identify likely strategies (VOC versus NOx) for ambient ozone reductions in the SAER.

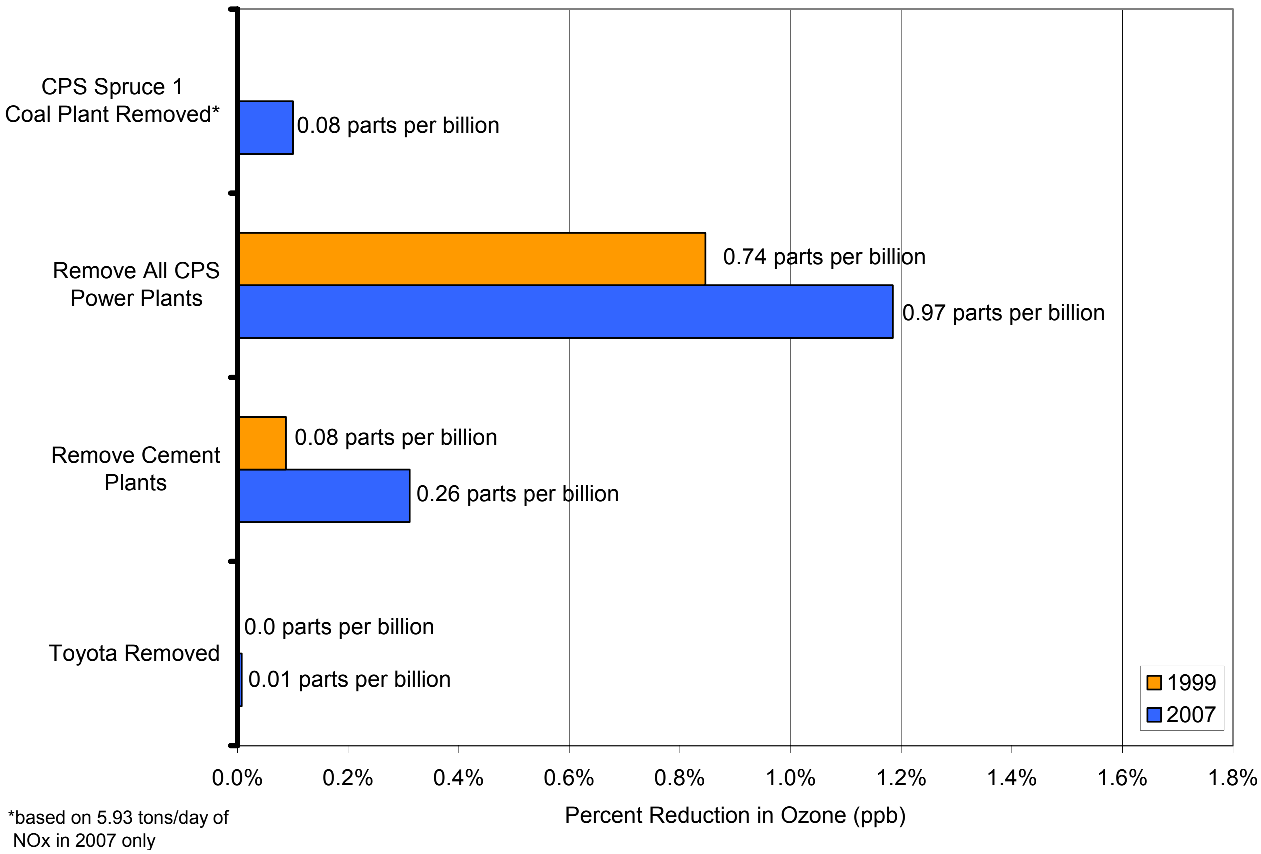
Figures G-15 and G-16 provide the predicted changes in ozone concentrations at CAMS 23 and 58, as the result of conducting these zero out runs for 1999 and 2007. One run, labeled “CPS Spruce 1 Coal Plant Removed,” simulates the impact of removing a currently-existing 750-megawatt power plant from the 2007 future case in the San Antonio area. A second run, “Remove All CPS Power Plants,” simulates the impact of removing the nine power plants in the San Antonio region in 1999 from the 1999 base case and removing seven power plants (due to anticipated closures of two plants) from the 2007 future case. A third run “Remove Cement Plants” represents the removal of emissions from all cement kilns in the 4-county SAER. The last run, “Toyota Removed,” simulates the impact of removing the EI for a major manufacturing plant from the 2007

Figure G15. Predicted Reductions in Ozone Concentrations at CAMS 23 after Removing Various Point Source Emissions within the SAER– Comparison between 1999 (orange) and 2007 (blue).



*based on 5.93 tons/day of NOx in 2007 only

Figure G-16. Predicted Reductions in Ozone Concentrations at CAMS 58 after Removing Various Point Source Emissions within the SAER– Comparison between 1999 (orange) and 2007(blue).



future case. Since the plant is not scheduled to be in operation until 2006, removing these emissions have no impact on the 1999 base case.

As shown in these graphs, removing all power plant emissions had the greatest impact on both the 1999 and 2007 simulations. Since the combined power plants were the largest source of precursors (NOx) of all sources tested, this type of result is expected. Conversely, the Toyota plant, which has the lowest emission rates (primarily VOC), impacts San Antonio ozone concentrations the least.

With the exception of the results of removing the cement kiln emissions from the 1999 base case at CAMS 23, each sensitivity run demonstrates a decrease in predicted 1999 or 2007 ozone concentrations. The predicted increase in ozone concentration at CAMS 23 is most likely a reversal of the model's ozone scavenging process. During much of the 1999 episode, the model predicts conditions in which decreases in NOx cause ozone concentrations to increase (NOx reduction disbenefit). Thus, removing the NOx emissions from kilns near the monitor causes the model to predict increased ozone concentrations at that location in the 1999 base case.

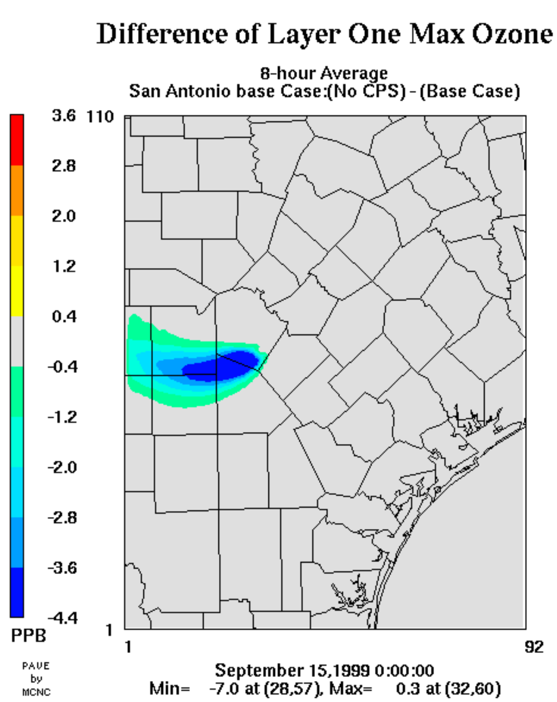
This NOx reduction disbenfit is much less evident in the 2007 future case. Consequently, removing the NOx emissions associated with the San Antonio area power plants causes larger ozone reductions in the 2007 future case than in the 1999 base case. Since there are no power plants in the vicinity of CAMS 23, removing the 1999 power plant emissions from the model did not cause an increase in predicted ozone levels in the 1999 base case, as was demonstrated by the cement kiln sensitivity run.

At the request of EPA Region 6, the output from each point source "zero out" simulation was run through a graphics program, PAVE, to obtain a visual depiction of the impact of removing these sources in the SAER. The plots for zeroing out point sources were created for all primary episode weekdays, when applicable,[3] as shown in figures G-17 through G-22. An advantage these plots have compared to the graphs for CAMS 23 and 58, shown previously, is that they provide an indication of the impact of modifying emissions in terms of spatial distribution.

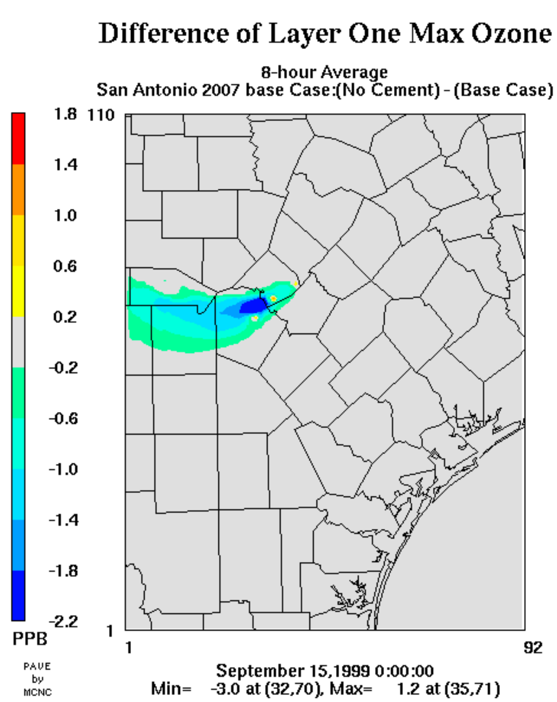
As shown by these graphs, the impact of removing point source emissions was, to a large extent, influenced by the model's meteorological processes, particularly wind direction. The September 15th – 17th plots, for example, indicate that these emissions primarily affect counties to the west and northwest of Bexar County. In addition, the cement kiln zero out runs tended to show the widest area of influence. This is an expected outcome since the cement kiln emission sources are spread throughout the San Antonio area, whereas all seven CPS power plants are located in southeast Bexar County. Similarly, the Toyota manufacturing plant is represented by a single point in south Bexar County on the plots.

[3] Weekends were not included for the Toyota set of sensitivity runs because the plant is not scheduled to be operational on Saturday and Sunday.

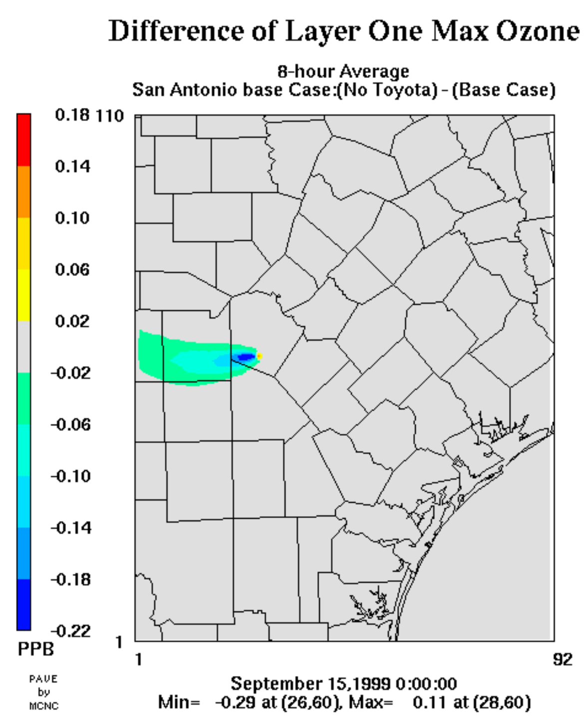
Figure G-17. Comparison of Zero Out Runs Conducted for CPS Power Plants, Cement Kilns, and Toyota Manufacturing Plant on the 2007 Future Case, Wednesday, September 15th.



Removal of CPS Power Plant Emissions

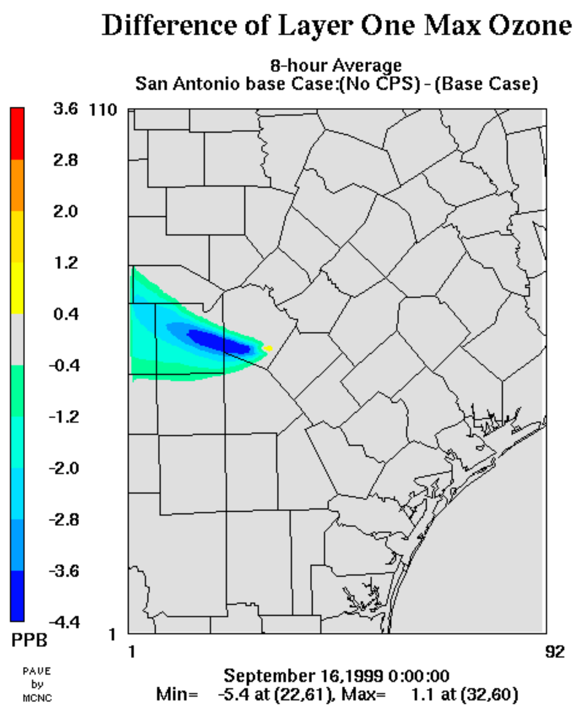


Removal of San Antonio area Cement Kiln Emissions

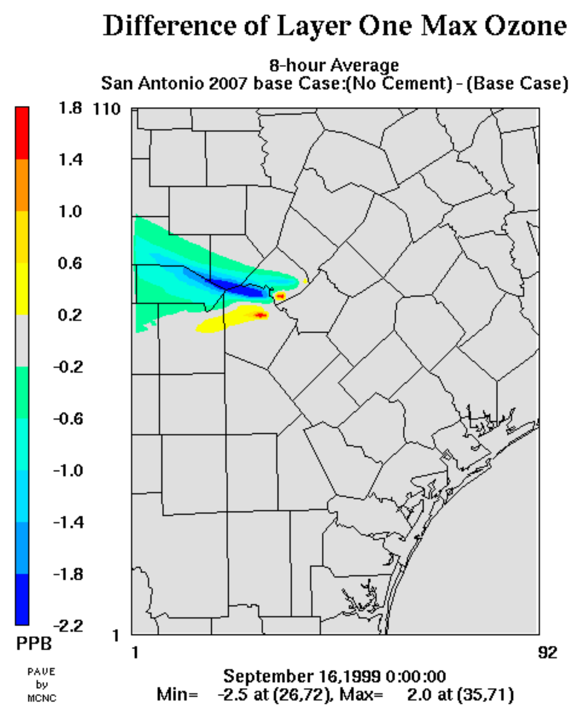


Removal of Toyota Manufacturing Plant Emissions

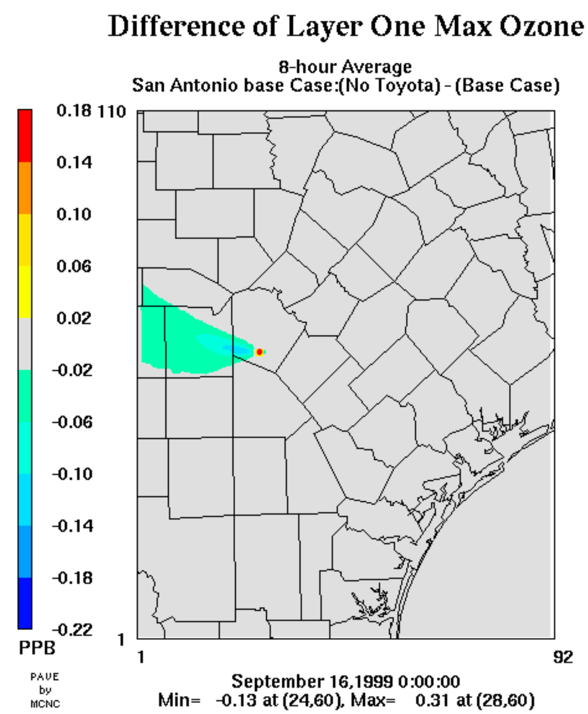
Figure G-18. Comparison of Zero Out Runs Conducted for CPS Power Plants, Cement Kilns, and Toyota Manufacturing Plant on the 2007 Future Case, Thursday, September 16th.



Removal of CPS Power Plant Emissions

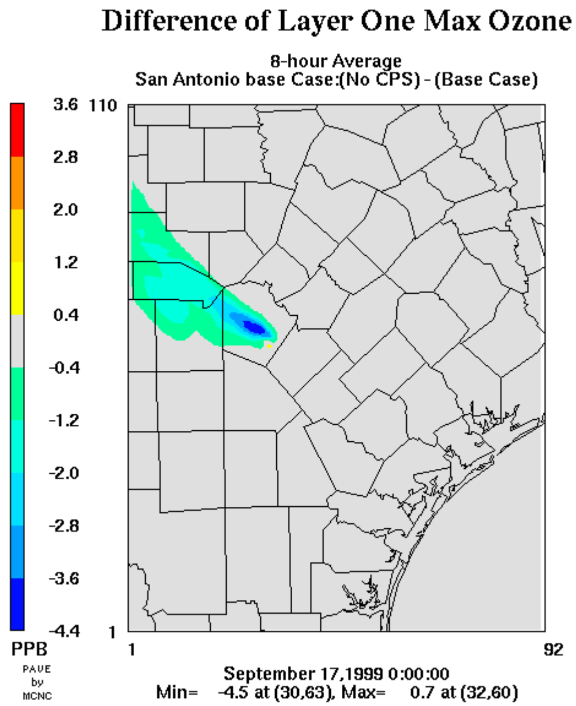


Removal of San Antonio Area Cement Kiln Emissions



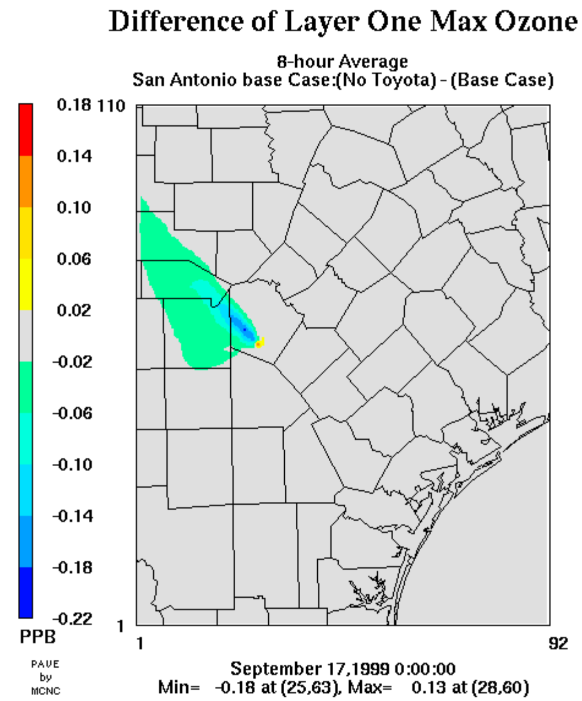
Removal of Toyota Manufacturing Plant Emissions

Figure G-19. Comparison of Zero Out Runs Conducted for CPS Power Plants, Cement Kilns, and Toyota Manufacturing Plant on the 2007 Future Case, Friday, September 17th.



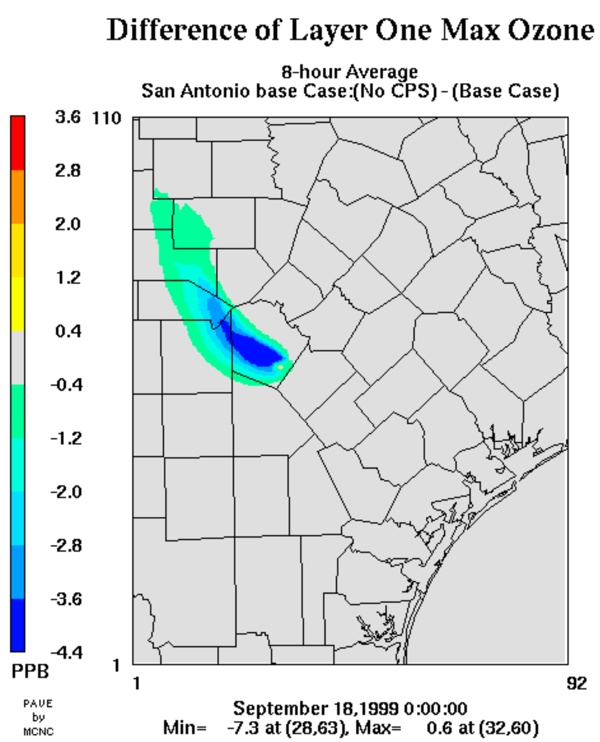
Removal of CPS Power Plant Emissions

Problems with the graphics software prevented the completion of a tile plot for the September 17th cement kiln sensitivity run

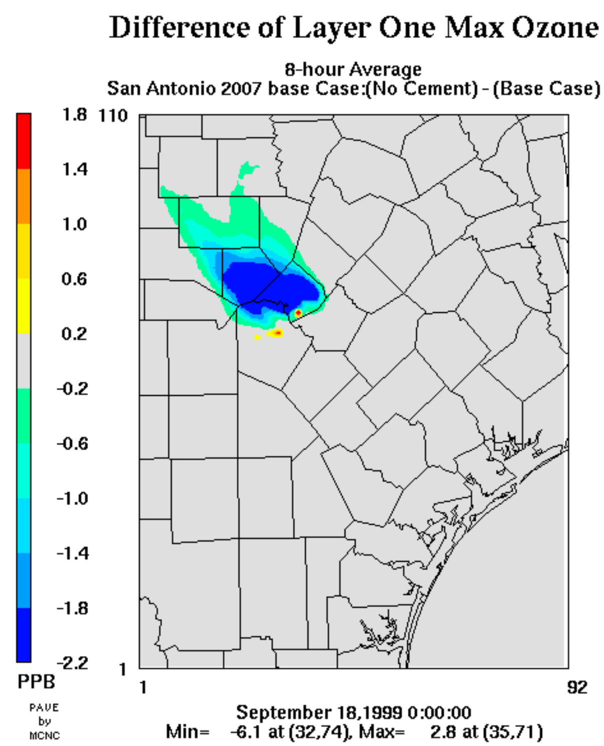


Removal of Toyota Manufacturing Plant Emissions

Figure G-20. Comparison of Zero Out Runs Conducted for CPS Power Plants, Cement Kilns, and Toyota Manufacturing Plant on the 2007 Future Case, Saturday, September 18th.



Removal of CPS Power Plant Emissions

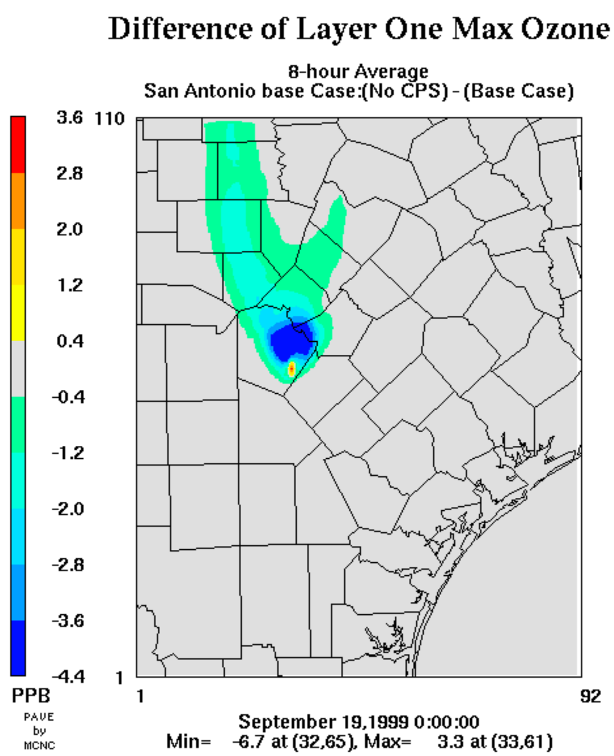


Removal of San Antonio Area Cement Kiln Emissions

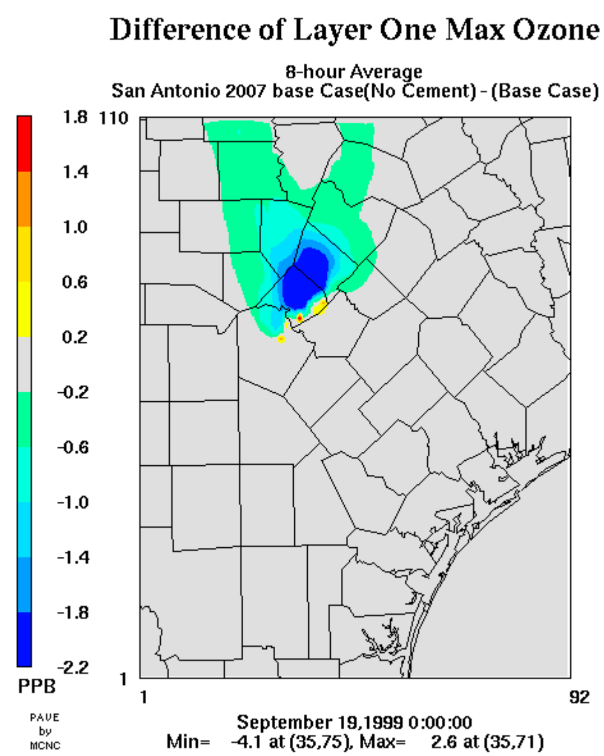
Not Applicable

Toyota Manufacturing Plant is not scheduled to be operational on Saturdays

Figure G-21. Comparison of Zero Out Runs Conducted for CPS Power Plants, Cement Kilns, and Toyota Manufacturing Plant on the 2007 Future Case, Sunday, September 19th.



Removal of CPS Power Plant Emissions

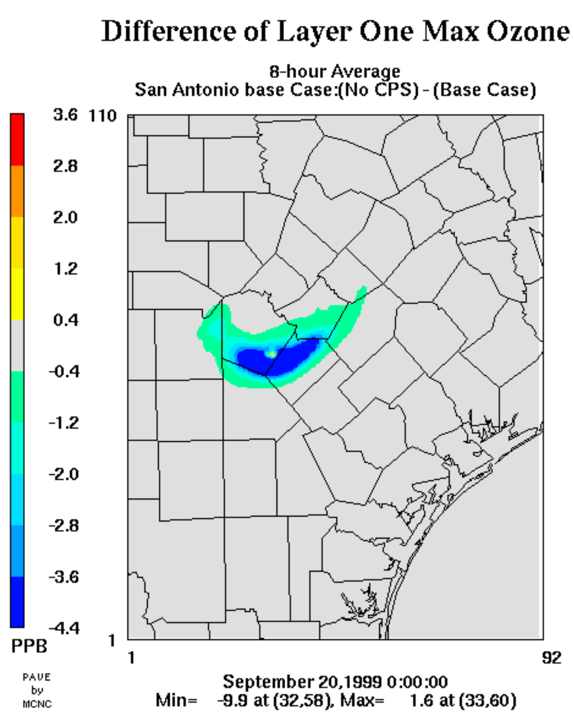


Removal of San Antonio Area Cement Kiln Emissions

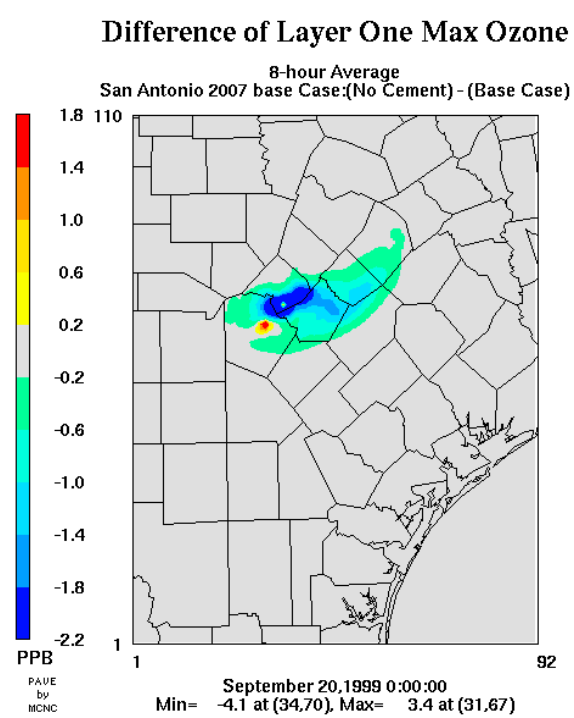
Not Applicable

Toyota Manufacturing Plant is not Scheduled to be Operational on Sundays

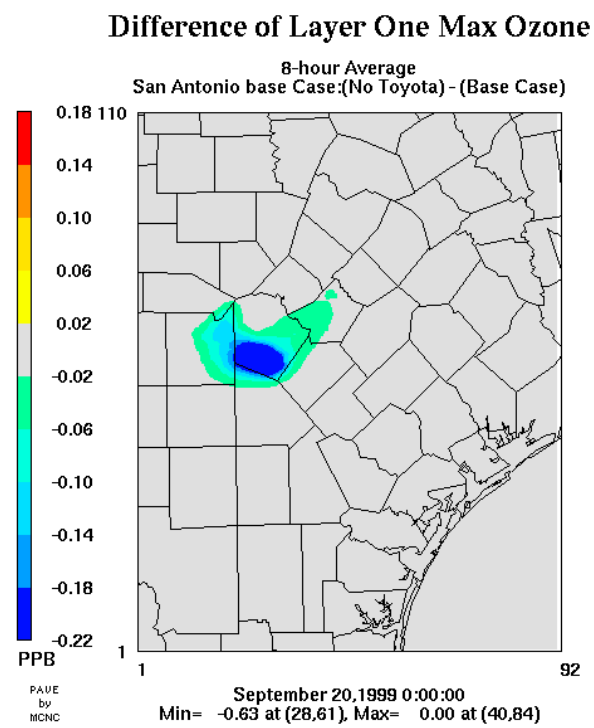
Figure G-22. Comparison of Zero Out Runs Conducted for CPS Power Plants, Cement Kilns, and Toyota Manufacturing Plant on the 2007 Future Case, Monday, September 20th.



Removal of CPS Power Plant Emissions



Removal of San Antonio Area Cement Kiln Emissions



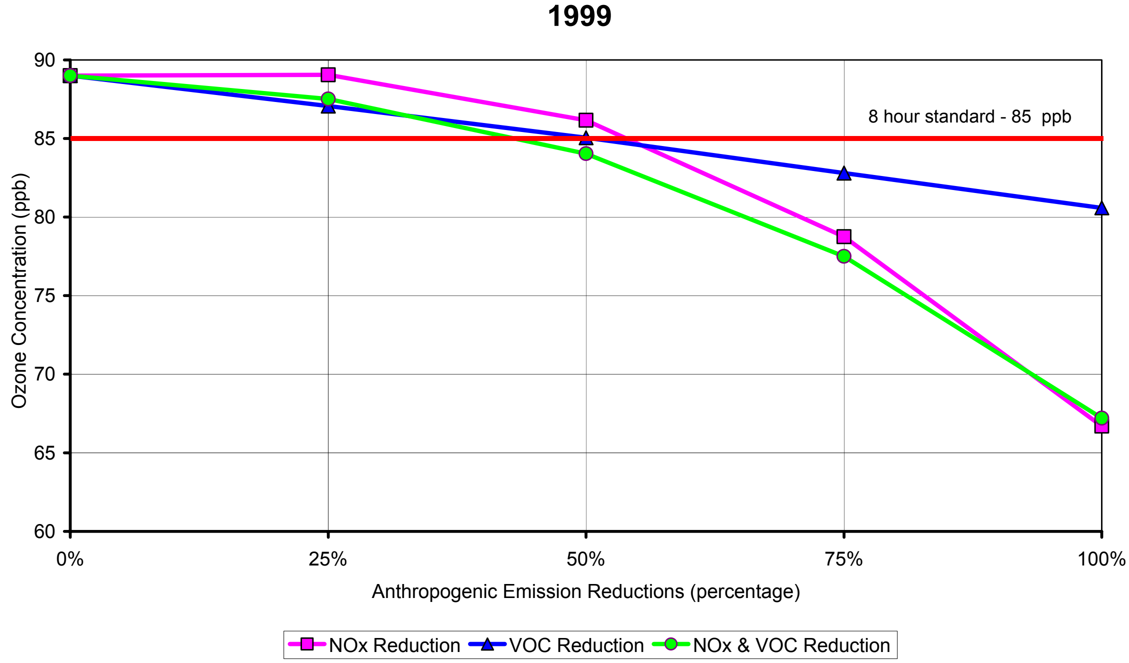
Removal of Toyota Manufacturing Plant Emissions

For the most part, removing point source emissions caused the model to predict decreases in ozone concentrations along the area of impact. However, the model also predicts some areas of increased ozone concentrations, the most prominent of which is the Thursday, September 16th plot depicting the impact of zeroing out cement kiln emissions. Likewise some of the Toyota sensitivity runs exhibit small increases in ozone concentrations near the plant, despite the very low NOx emissions the plant represents (0.34 tons/day). This NOx reduction disbenefit is less pronounced in the power plant sensitivity runs. However, these tile plots depict ozone concentrations in the lowest atmospheric grid layer, whereas power plants pollutants are emitted, by computer simulation, into higher grid layers.

Incremental Removal of VOC and NOx Precursor Emissions
Across-the-board sensitivity runs were conducted by removing 25%, 50%, 75%, and 100% of the local (4-county SAER) NOx emissions, VOC emissions, and combinations of the two, from the 2007 future case. Figures G-23 and G-24 provide the results of the across-the-board reduction runs for CAMS 23 and CAMS 58 (San Antonio downwind monitors), averaged over the six day modeling period conducted on the 1999 base and 2007 future cases.

At the 25% reduction level (CAMS 23), VOC reductions were slightly more effective than NOx reductions at lowering ozone concentrations. At CAMS 58, 25% NOx and 25% VOC reductions are equally effective. These results are somewhat different than those predicted for the 1999 base case in that, at the 25% level, VOC reductions were more effective than NOx for reducing ozone concentrations in the SAER. These results tend to support the evaluation of both VOC and NOx control strategies as possible means of reducing ambient ozone concentrations in the San Antonio region.

Figure G-23. Predicted Ozone Concentrations at CAMS 23 after Removing Local NOx and VOC Emissions from CAMx Run 18, Averages for September 15 -20, 1999 and 2007.



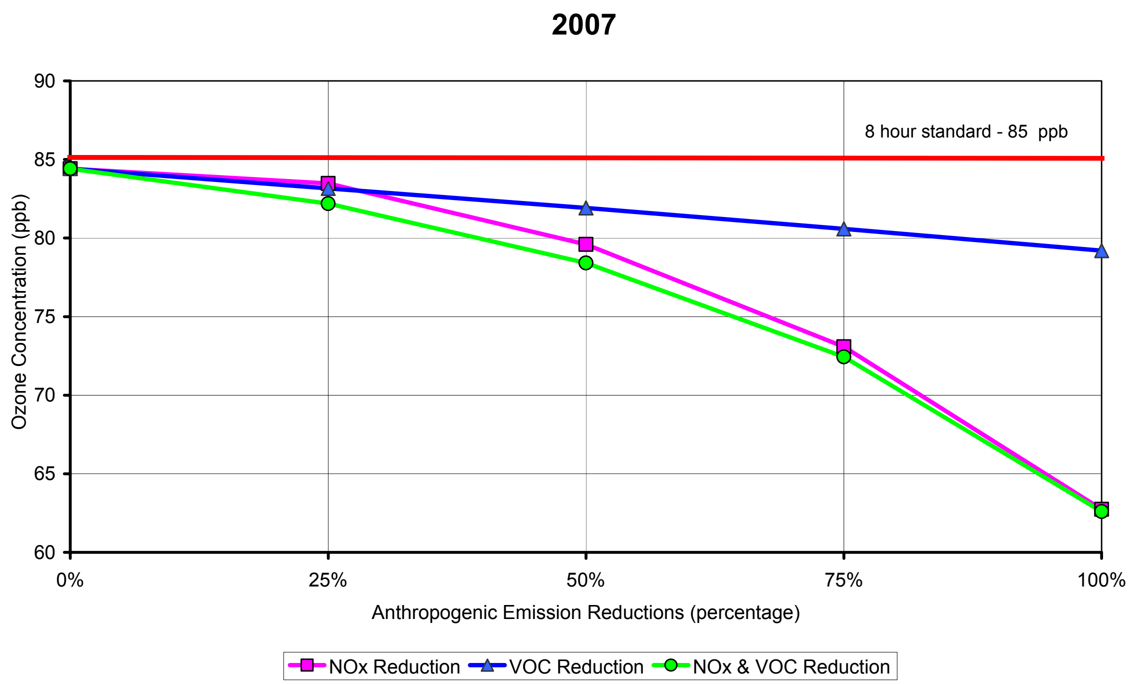
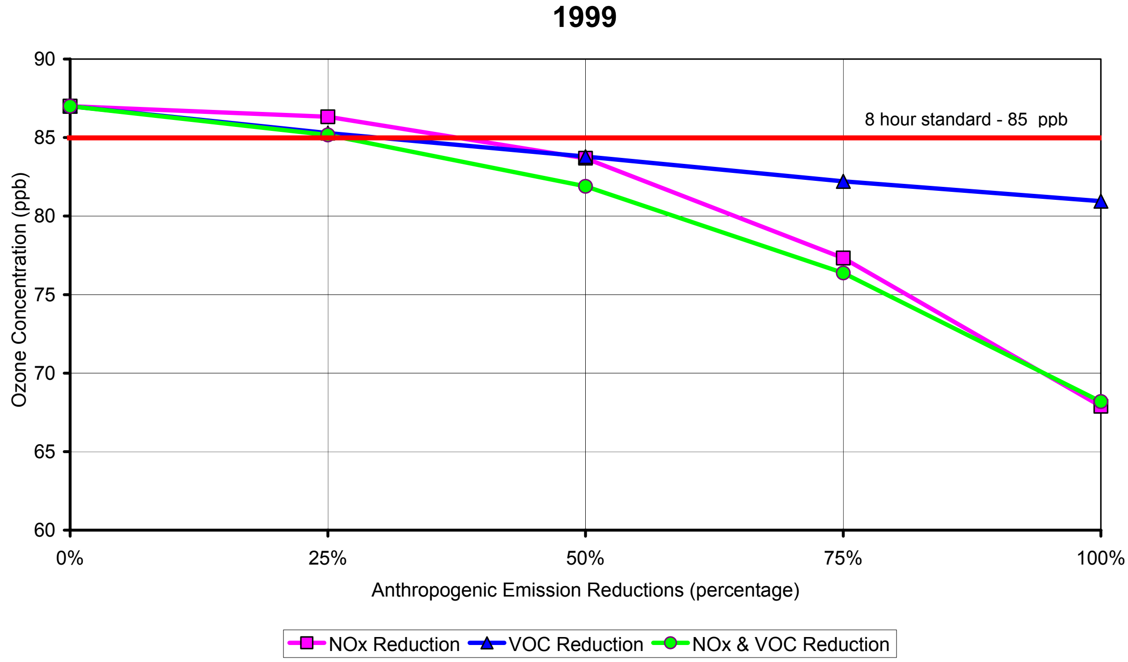
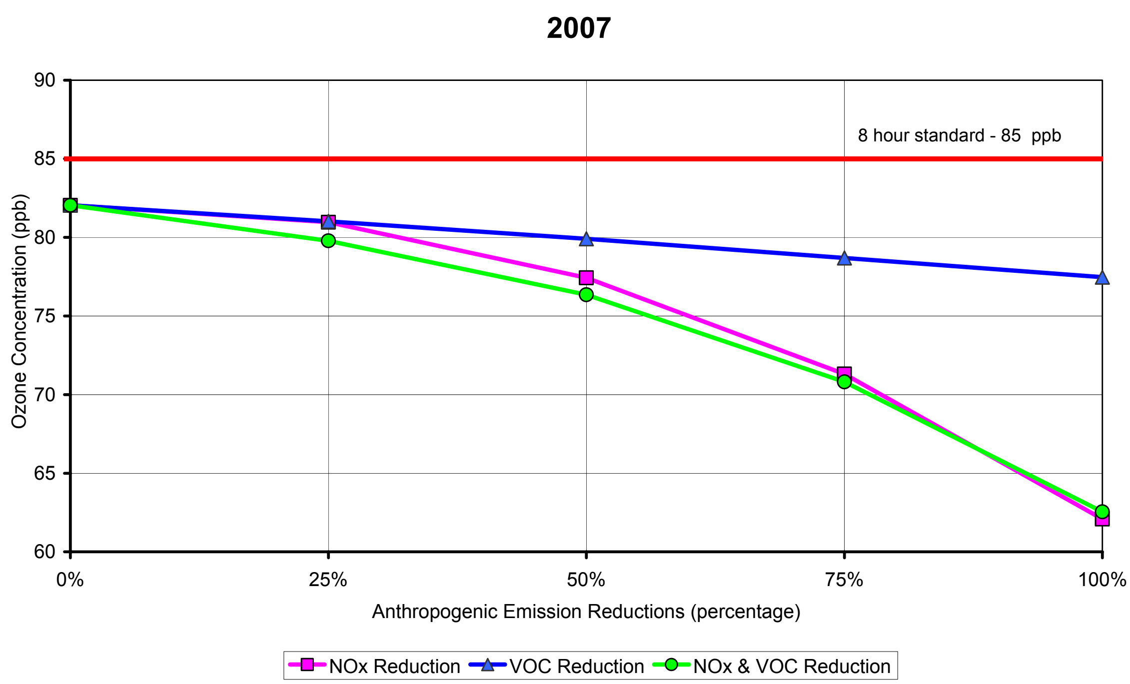


Figure G-24. Predicted Ozone Concentrations at CAMS 58 after Removing Local NOx and VOC Emissions from CAMx Run 18, Average for September 15 -20, 1999 and 2007.





SUMMARY OF MODIFICATIONS TO THE 1999 BASE AND 2007 FUTURE CASES AND RESULTING DESIGN VALUES

As described previously, a great amount of time and effort were spent ensuring the 2007 future cases developed by UT Austin and AACOG were consistent. As part of that effort, UT and AACOG staff, in consultation with the TCEQ, evaluated local and regional 2007 EI files used as input to the two future cases. Whenever inconsistencies in emissions or procedures were identified, staff from UT, AACOG, and the TCEQ determined the most appropriate data to incorporate into the models. Both the UT and AACOG future cases were modified to reflect these decisions.

Tables G-5 through G-8 summarize the impact of making these modifications to AACOG's 2007 future case. The future case runs, labeled A through G, represent the first future case (A) developed by AACOG, projected from the 1999 base case labeled CAMx Run 18 (see appendix E for more information), through the final 2007 future case run (G). The far right column lists changes that were made to the model for each run.

Results of making the modifications to the future case model simulation are provided for each monitor in the San Antonio region (CAMS 23, 58, 59, and 678). Based on analyses between the AACOG and UT final future cases (see section on "Comparisons Between Model Refinements"), it is evident that the extra effort required to analyze all model inputs resulted in consistent, well-performing future case simulations on which to model control strategy effectiveness and base attainment demonstrations.

Table G-5. Modifications to the1999 Base Case and 2007 Future Case as Part of the QA/QC Process and Resulting Peak 8-hour Predictions at CAMS 23 Associated with Each Run.

CAMS 23		Peak Predicted 8-hour Ozone Concentrations								
Run Label	Year	15th	16th	17th	18th	19th	20th	Average	Design Value	Modifications to Model
Base Case.A	1999	81.63	78.25	81.39	98.68	102.54	93.73	89.37	89.00	
Base Case.B	1999	81.62	78.25	81.36	98.67	102.46	93.68	89.34	89.00	▪ Updated quarry and construction equipment emissions
Base Case.D	1999	81.62	78.25	81.36	98.67	102.46	93.67	89.34	89.00	▪ Incorporated new wastewater estimates from San Antonio Water System
Base Case.E	1999	81.73	78.16	81.36	98.72	101.59	93.49	89.18	89.00	▪ Updated 1999 area and non-road source temporal profiles for regional Texas to match 2007 temporal profiles ▪ Updated point source cut off point from 20m to 50m for the 4km grid
Base Case F	1999	81.35	78.22	81.52	98.67	101.49	93.42	89.11	89.00	▪ Updated Victoria's mobile EI with latest data from UT ▪ Updated chemical and temporal profiles for Texas area and non-road emissions ▪ Updated Victoria's point sources ▪ Updated Texas NEGU and EGU sources outside of Houston ▪ Updated Louisiana point source emissions ▪ Updated Austin's area & non-road sources
Base Case G	1999	81.14	78.08	81.36	98.57	101.40	93.20	88.96	89.00	▪ Updated San Antonio asphalt emissions ▪ Updated tanker truck unloading emissions ▪ Updated tanker trucks in transit emissions ▪ Updated emissions for other gasoline distribution activities
Base Case.A	2007								84.56	
Base Case.B	2007	80.00	76.21	80.05	89.45	93.92	92.67	85.38	85.06	▪ Updated regional EI HDD non-road EI (provided by TCEQ) ▪ Updated Austin Point Source Control EI (Alcoa) ▪ Updated San Antonio construction and quarry equipment emissions

CAMS 23 (continued) Base Case.D	2007	80.09	76.19	80.01	89.45	93.93	92.67	85.39	85.07	▪ Incorporated new wastewater estimates ▪ Revised Austin Point Source Control EI (Alcoa)
Base Case.E	2007	79.70	75.20	79.57	88.73	92.48	91.45	84.52	84.35	▪ Revised Austin Point Source Control EI ▪ Incorporated new regional temporal profile for point sources ▪ Added CO for Austin on-road EI (3 County) ▪ Included stage1 (125k) for the 4-county San Antonio MSA ▪ Removed tank truck unloading on Sunday to match EPA guidance ▪ Updated other area source temporal profiles to match EPA guidance ▪ Updated Texas regional area and non-road emissions ▪ Updated Texas point sources (besides CPS) ▪ Updated Lehigh cement Kiln controls ▪ Updated point source cut off point from 20m to 50m on the 4-km grid to match the 12-km grid cut off ▪ Updated Victoria's EI
Base Case F	2007	79.70	75.20	79.57	88.73	92.49	91.46	84.53	84.42	▪ Updated Victoria's mobile EI ▪ Updated chemical and temporal profiles for Texas area and non-road emissions
Base Case G	2007	79.57	75.07	79.50	88.69	92.50	91.57	84.48	84.52	▪ Updated San Antonio asphalt emissions ▪ Updated tanker truck unloading emissions ▪ Updated tanker trucks in transit emissions ▪ Updated emissions from other gasoline distribution activities ▪ Updated emissions for ROP controls

Table G-6. Modifications to the1999 Base Case and 2007 Future Case as Part of the QA/QC Process and Resulting Peak 8-hour Predictions at CAMS 58 Associated with Each Run.

CAMS 58		Peak Predicted 8-hour Ozone Concentrations								
Run Label	Year	15th	16th	17th	18th	19th	20th	Average	Base Case Design Value	Modifications to Model
Base Case.A	1999	75.95	77.44	81.93	98.68	102.75	91.66	88.07	87.00	
Base Case.B	1999	75.95	77.44	81.93	98.67	102.68	91.64	88.05	87.00	▪ Updated quarry and construction equipment emissions
Base Case.D	1999	75.95	77.44	81.92	98.67	102.68	91.63	88.05	87.00	▪ Incorporated new wastewater estimates from San Antonio Water System
Base Case.E	1999	76.00	77.41	81.87	98.72	101.92	91.50	87.90	87.00	▪ Updated 1999 area and non-road source temporal profiles for regional Texas to match 2007 temporal profiles ▪ Updated point source cut off point from 20m to 50m for the 4km grid
Base Case F	1999	75.74	77.44	82.16	98.67	101.90	91.51	87.90	87.00	▪ Updated Victoria's mobile EI with latest data from UT ▪ Updated chemical and temporal profiles for Texas area and non-road emissions ▪ Updated Victoria's point sources ▪ Updated Texas NEGU and EGU sources outside of Houston ▪ Updated Louisiana point source emissions ▪ Updated Austin's area & non-road sources
Base Case G	1999	75.59	77.26	82.01	98.57	101.83	91.30	87.76	87.00	▪ Updated San Antonio asphalt emissions ▪ Updated tanker truck unloading emissions ▪ Updated tanker trucks in transit emissions ▪ Updated emissions for other gasoline distribution activities
Base Case.A	2007								82.19	
Base Case.B	2007	74.11	75.41	79.07	89.45	93.92	90.17	83.69	82.69	▪ Updated regional EI HDD non-road EI (provided by TCEQ) ▪ Updated Austin Point Source Control EI (Alcoa) ▪ Updated San Antonio construction and quarry equipment emissions

CAMS 58 (continued)										
Base Case.D	2007	74.28	75.40	79.02	89.45	93.93	90.18	83.71	82.71	▪ Incorporated new wastewater estimates ▪ Revised Austin Point Source Control EI (Alcoa)
Base Case.E	2007	73.91	74.46	78.57	88.73	92.48	89.17	82.89	82.03	▪ Revised Austin Point Source Control EI ▪ Incorporated new regional temporal profile for point sources ▪ Added CO for Austin on-road EI (3 County) ▪ Included stage1 (125k) for the 4-county San Antonio MSA ▪ Removed tank truck unloading on Sunday to match EPA guidance ▪ Updated other area source temporal profiles to match EPA guidance ▪ Updated Texas regional area and non-road emissions ▪ Updated Texas point sources (besides CPS) ▪ Updated Lehigh cement Kiln controls ▪ Updated point source cut off point from 20m to 50m on the 4-km grid to match the 12-km grid cut off ▪ Updated Victoria EI
Base Case F	2007	73.90	74.46	78.57	88.73	92.49	89.18	82.89	82.04	▪ Updated Victoria's mobile EI ▪ Updated chemical and temporal profiles for Texas area and non-road emissions
Base Case G	2007	73.80	74.28	78.50	88.69	92.50	89.25	82.84	82.12	▪ Updated San Antonio asphalt emissions ▪ Updated tanker truck unloading emissions ▪ Updated tanker trucks in transit emissions ▪ Updated emissions from other gasoline distribution activities ▪ Updated emissions for ROP controls

Table G-7. Modifications to the1999 Base Case and 2007 Future Case as Part of the QA/QC Process and Resulting Peak 8-hour Predictions at CAMS 59 Associated with Each Run.

Gray strike-through numbers are values that fall below the EPA requirement (EPA 1999, p. 41) of 70 ppb to be included in the RRF

CAMS 59		Peak Predicted 8-hour Ozone Concentrations								
Run Label	Year	15th	16th	17th	18th	19th	20th	Average	Base Case Design Value	Modifications to Model
Base Case.A	1999	~~66.95~~	72.04	~~69.83~~	72.53	83.04	86.65	76.82	79.00	
Base Case.B	1999	~~66.95~~	72.04	~~69.83~~	72.53	82.90	86.61	76.78	79.00	▪ Updated quarry and construction equipment emissions
Base Case.D	1999	~~66.95~~	72.04	~~69.83~~	72.53	82.90	86.60	76.78	79.00	▪ Incorporated new wastewater estimates from San Antonio Water System
Base Case.E	1999	~~67.33~~	72.30	~~69.86~~	72.58	82.24	86.25	76.65	79.00	▪ Updated 1999 area and non-road source temporal profiles for regional Texas to match 2007 temporal profiles ▪ Updated point source cut off point from 20m to 50m for the 4km grid
Base Case F	1999	~~67.12~~	72.33	70.09	72.38	81.90	86.46	76.63	79.00	▪ Updated Victoria's mobile EI with latest data from UT ▪ Updated chemical and temporal profiles for Texas area and non-road emissions ▪ Updated Victoria's point sources ▪ Updated Texas NEGU and EGU sources outside of Houston ▪ Updated Louisiana point source emissions ▪ Updated Austin's area & non-road sources
Base Case G	1999	~~66.89~~	72.38	~~69.90~~	72.12	81.75	86.26	78.13	79.00	▪ Updated San Antonio asphalt emissions ▪ Updated tanker truck unloading emissions ▪ Updated tanker trucks in transit emissions ▪ Updated emissions for other gasoline distribution activities
Base Case.A	2007								74.96	
Base Case.B	2007	~~64.65~~	67.40	~~67.68~~	68.97	78.73	84.15	73.38	75.51	▪ Updated regional EI HDD non-road EI (provided by TCEQ) ▪ Updated Austin Point Source Control EI (Alcoa)

CAMS 59 (continued)										
Base Case.D	2007	~~64.70~~	67.40	~~67.66~~	68.97	78.73	84.15	73.38	75.51	▪ Updated San Antonio construction and quarry equipment emissions ▪ Incorporated new wastewater estimates ▪ Revised Austin Point Source Control EI (Alcoa)
Base Case.E	2007	~~64.25~~	65.90	~~68.05~~	69.21	76.99	83.03	72.64	74.87	▪ Revised Austin Point Source Control EI ▪ Incorporated new regional temporal profile for point sources ▪ Added CO for Austin on-road EI (3 County) ▪ Included stage1 (125k) for the 4-county San Antonio MSA ▪ Removed tank truck unloading on Sunday to match EPA guidance ▪ Updated other area source temporal profiles to match EPA guidance ▪ Updated Texas regional area and non-road emissions ▪ Updated Texas point sources (besides CPS) ▪ Updated Lehigh cement Kiln controls ▪ Updated point source cut off point from 20m to 50m on the 4-km grid to match the 12-km grid cut off ▪ Updated Victoria EI
Base Case F	2007	~~64.25~~	65.90	68.05	69.21	77.01	83.05	72.64	74.89	▪ Updated Victoria's mobile EI ▪ Updated chemical and temporal profiles for Texas area and non-road emissions
Base Case G	2007	~~63.98~~	65.93	~~67.82~~	68.92	76.84	82.96	73.66	74.48	▪ Updated San Antonio asphalt emissions ▪ Updated tanker truck unloading emissions ▪ Updated tanker trucks in transit emissions ▪ Updated emissions from other gasoline distribution activities ▪ Updated emissions for ROP controls

Table G-8. Modifications to the1999 Base Case and 2007 Future Case as Part of the QA/QC Process and Resulting Peak 8-hour Predictions at CAMS 678 Associated with Each Run.

Gray strike-through numbers are values that fall below the EPA requirement (EPA 1999 , p. 41) of 70 ppb to be included in the RRF

CAMS 678		Peak Predicted 8-hour Ozone Concentrations								
Run Label	Year	15th	16th	17th	18th	19th	20th	Average	Base Case Design Value	Modifications to Model
Base Case A	1999	70.34	71.19	~~69.83~~	80.03	92.94	88.47	78.80	77.00	
Base Case B	1999	70.33	71.19	~~69.83~~	80.01	92.81	88.33	78.75	77.00	▪ Updated quarry and construction equipment emissions
Base Case D	1999	70.33	71.19	~~69.83~~	80.01	92.80	88.32	78.75	77.00	▪ Incorporated new wastewater estimates from San Antonio Water System
Base Case E	1999	70.57	71.45	~~69.86~~	80.06	91.99	87.92	78.64	77.00	▪ Updated 1999 area and non-road source temporal profiles for regional Texas to match 2007 temporal profiles ▪ Updated point source cut off point from 20m to 50m for the 4km grid
Base Case F	1999	70.39	71.50	70.09	79.81	91.60	87.84	78.54	77.00	▪ Updated Victoria's mobile EI with latest data from UT ▪ Updated chemical and temporal profiles for Texas area and non-road emissions ▪ Updated Victoria's point sources ▪ Updated Texas NEGU and EGU sources outside of Houston ▪ Updated Louisiana point source emissions ▪ Updated Austin's area & non-road sources
Base Case G	1999	70.16	71.51	~~69.90~~	79.63	91.49	87.65	80.09	77.00	▪ Updated San Antonio asphalt emissions ▪ Updated tanker truck unloading emissions ▪ Updated tanker trucks in transit emissions ▪ Updated emissions for other gasoline distribution activities
Base Case A	2007								74.71	
Base Case B	2007	70.43	69.14	~~68.99~~	76.78	87.03	89.14	76.92	75.21	▪ Updated regional EI HDD non-road EI (provided by TCEQ) ▪ Updated Austin Point Source Control EI (Alcoa)

CAMS 678 (continued)										
Base Case D	2007	70.56	69.14	~~68.94~~	76.77	87.04	89.14	76.93	75.22	▪ Updated San Antonio construction and quarry equipment emissions ▪ Incorporated new wastewater estimates ▪ Revised Austin Point Source Control EI (Alcoa)
Base Case E	2007	70.08	68.00	~~68.89~~	76.26	85.53	87.83	76.10	74.51	▪ Revised Austin Point Source Control EI ▪ Incorporated new regional temporal profile for point sources ▪ Added CO for Austin on-road EI (3 County) ▪ Included stage1 (125k) for the 4-county San Antonio MSA ▪ Removed tank truck unloading on Sunday to match EPA guidance ▪ Updated other area source temporal profiles to match EPA guidance ▪ Updated Texas regional area and non-road emissions ▪ Updated Texas point sources (besides CPS) ▪ Updated Lehigh cement Kiln controls ▪ Updated point source cut off point from 20m to 50m on the 4-km grid to match the 12-km grid cut off ▪ Updated Victoria EI
Base Case F	2007	70.08	68.00	68.89	76.26	85.55	87.84	76.10	74.61	▪ Updated Victoria's mobile EI ▪ Updated chemical and temporal profiles for Texas area and non-road emissions
Base Case G	2007	69.89	67.86	~~68.75~~	76.11	85.50	87.87	77.45	74.46	▪ Updated San Antonio asphalt emissions ▪ Updated tanker truck unloading emissions ▪ Updated tanker trucks in transit emissions ▪ Updated emissions from other gasoline distribution activities ▪ Updated emissions for ROP controls

REFERENCES

U.S. Environmental Protection Agency (May 1999). Draft Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS. Research Triangle Park, NC: Office of Air Quality Planning and Standards.