

# Ozone Impact of Shale Gas Activities in Dallas-Fort Worth Metroplex

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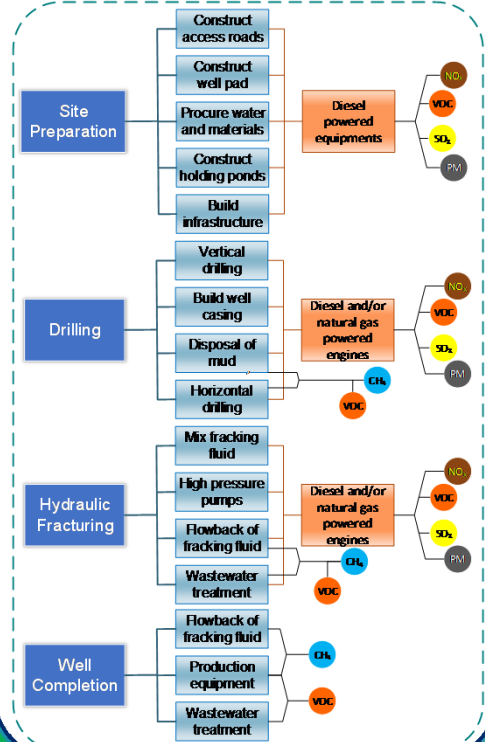
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## Abstract

Dallas-Fort Worth Metroplex is one of the most populated areas in the United States with a long history of ground level ozone pollution. In this research, Comprehensive Air Quality Model with Extensions (CAMx) is used to develop a photochemical model of DFW area. The impact of NO<sub>x</sub> and VOC emission from regional shale gas activities (in Barnett Shale) is studied. Results show that in order to effectively control ozone level to attain the national standard level it is necessary to include strategies and techniques to lower the emission levels of all shale gas production activities.

## Background

Ozone is one of the criteria pollutants with negative health effects on humans. Ground level ozone is formed by photochemical reactions of nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOC) in the atmosphere. Different facilities and activities involved in shale gas development are significant sources of NO<sub>x</sub> and VOC.



## Method

Complex cycles of photochemical reactions turn NO<sub>x</sub> and VOC molecules under sunlight into ozone. To evaluate the impact of shale gas activities on ozone level we developed a photochemical modeling based on TCEQ (Texas Commission on Environmental Quality) official CAMx model. Two hypothetical simulation cases were conducted with 50% and 100% reduction in NO<sub>x</sub> and VOC area emission loads from shale gas activities. Simulations were performed for two ozone episodes: June and August-September. Study area, Continuous Ambient Monitoring Sites (CAMS), and the location of gas and oil wells are shown in Fig. A. Maximum reduction in 8hr mean ozone value in year 2018 near-by CAMS is calculated for each case. Results are prepared in tabulated format, dispersion and concentration maps and animated GIFs.

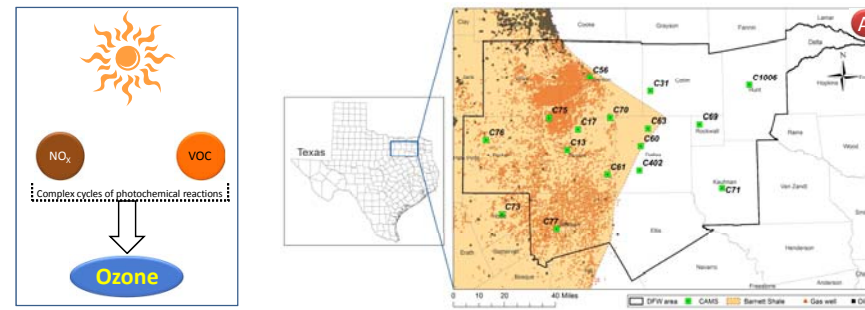


Fig. A. Study site: location of oil and gas wells and monitoring sites

## Results

Impact of different emission reduction cases on predicted ozone

CAMS	50% Reduction Oil/Gas Area Emission		100% Reduction Oil/Gas Area Emissions	
	June	August-September	June	August-September
Ft. Worth Northwest-C13	1.3	0.6	2.7	1.2
Keller-C17	1.5	1.0	3.1	2.1
Frisco - C31	0.5	0.5	1.1	0.9
Midlothian OFW - C52	0.2	0.5	0.4	1.0
Denton Airport South - C56	1.1	1.1	2.2	2.4
Arlington - C61	0.2	0.4	0.5	0.8
Dallas North - C63	0.2	0.5	0.4	1.1
Rockwall - C69	0.2	0.3	0.4	0.3
Grapevine - C70	0.5	1.1	1.1	1.1
Kaufman - C71	0.1	0.4	0.3	0.7
Granbury - C73	0.7	0.6	1.4	1.3
Eagle Mt. Lake - C75	1.4	1.4	2.8	2.9
Parker County - C76	0.8	1.0	1.7	2.0
Cleburne Airport - C77	0.8	0.5	1.6	1.1
Midlothian Tower - C94	0.2	0.5	0.4	1.0
Dallas Hinton St. - C401	0.2	0.4	0.3	0.8
Dallas Exec. Airport - C402	0.2	0.5	0.5	1.0
Italy/Ellis - C650	0.1	0.3	0.1	0.6
Greenville - C1006	0.3	0.2	0.6	0.5
Pilot Point - C1032	0.5	0.8	0.9	1.5

Numbers represent maximum predicted reduction in daily 8hr mean ozone (part per billion) in the year 2018 in each hypothetical emission reduction case

## Results

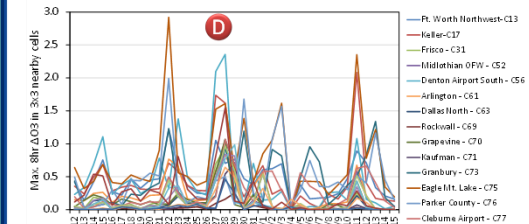
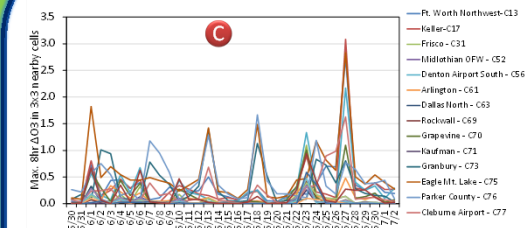


Fig. C and D. Reduction in maximum daily 8-hr ozone: 100% oil and gas area emission reduction case

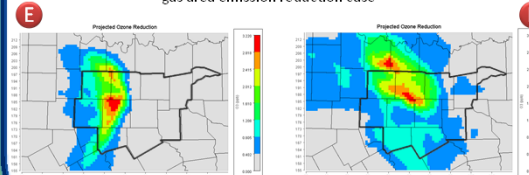


Fig. E. Predicted 8hr ozone map reduction on June 17<sup>th</sup>

Fig. F. Predicted 8hr ozone map reduction on August 28<sup>th</sup>

## Conclusion

Results for 100% reduction in oil and gas area emission show that most of the ozone reduction will happen in western portion of the metroplex where oil and gas wells are located. Considering the size and location of these area emission sources, local effect on ozone level is predicted. Reduction in 8hr mean ozone value for 50% reduction in oil and gas area emission reduction is as high as 1.5 (ppb) and with 100% reduction case, this can be as high as 3.1 (ppb).

Findings of this research are useful for air quality improvement strategies in DFW area. This can be very helpful considering the fact that several counties in DFW area have been designated ozone non-attainment for more than a decade.

### ACKNOWLEDGMENT

The authors wish to thank the Downwinders at Risk Educational Foundation for the financial support of this work.