

Evidence that Comal County Residents Are at Risk for Exposure to PM_{2.5}

Airborne Particulate Matter (PM) is a recognized pollutant that is produced by limestone aggregate processing, e.g., quarrying, rock crushing, cement, concrete, and asphalt manufacture.

Exposure to airborne PM is also recognized as a serious health hazard by biomedical researchers and health authorities such as the World Health Organization (WHO).

Over the past decade or more the aggregate processing industry has undergone significant expansion in Central Texas, most notably in counties that boundary Texas Highway 46 between New Braunfels and Boerne. This expansion depends upon Air Permits issued by the Texas Commission on Environmental Quality (TCEQ), which has issued 58 air permits for Comal County alone over the past decade, and no denials.

TCEQ grants air permits based upon mathematical modeling of anticipated emissions of PM (and other pollutants) based upon assumptions, some of which come from companies applying for permits, and **without any measurement or monitoring of PM exposure of Texas residents that could be affected by PM emissions.**

This document summarizes what is known about quarry related PM emissions, and a relatively new satellite-based method that generates estimates of PM exposure, Aerosol Optical Density.

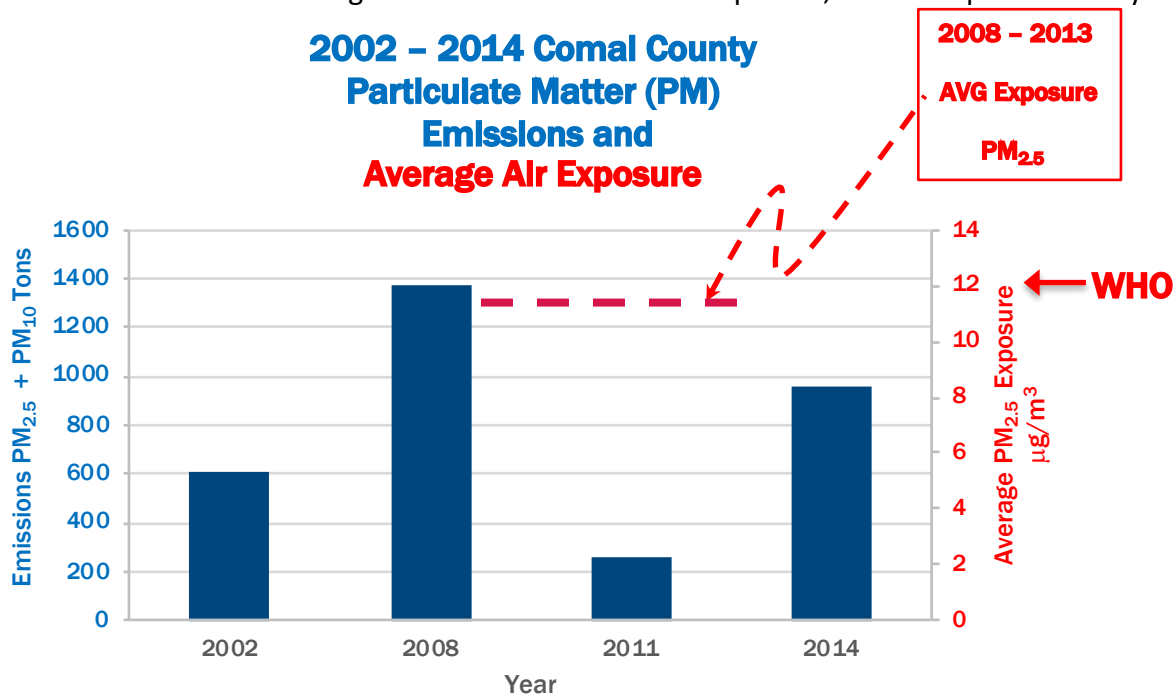


FIGURE EXPLANATION

The Left axis (blue bars) depicts aggregate industry sourced Particulate Matter (PM) emissions data obtained from the Environmental Protection Agency (EPA) National Emissions Inventory database for the years 2002 – 2014. These are the only data available.

<https://www.epa.gov/air-emissions-inventories>

The Right axis (red line) depicts the estimated atmospheric PM_{2.5} exposure in Comal & Bexar Counties 2008 – 2013 from satellite-based aerosol optical density measurements. Data obtained from: Zhang, X, Chu, Y, Wang, Y, Zhang K. Science of the Total Environment 631–632 (2018) 904–911 (UT Houston Health Science Center)

The GOLD arrow right axis: World Health Organization's (WHO) health hazard exposure level threshold = 12 µg/m³ PM_{2.5}.

The map of Texas shown below is the visual rendering of the 2008 - 2013 averaged satellite-based aerosol optical density measurement of PM_{2.5}. Bexar and Comal Counties are indicated by the dashed circle and the label.

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Note that the Bexar, Comal County PM_{2.5} compares to that in metropolitan Austin, Houston, and the Dallas-Fort Worth areas, all exhibiting average PM_{2.5} levels at or above 11.5 µg/m³.

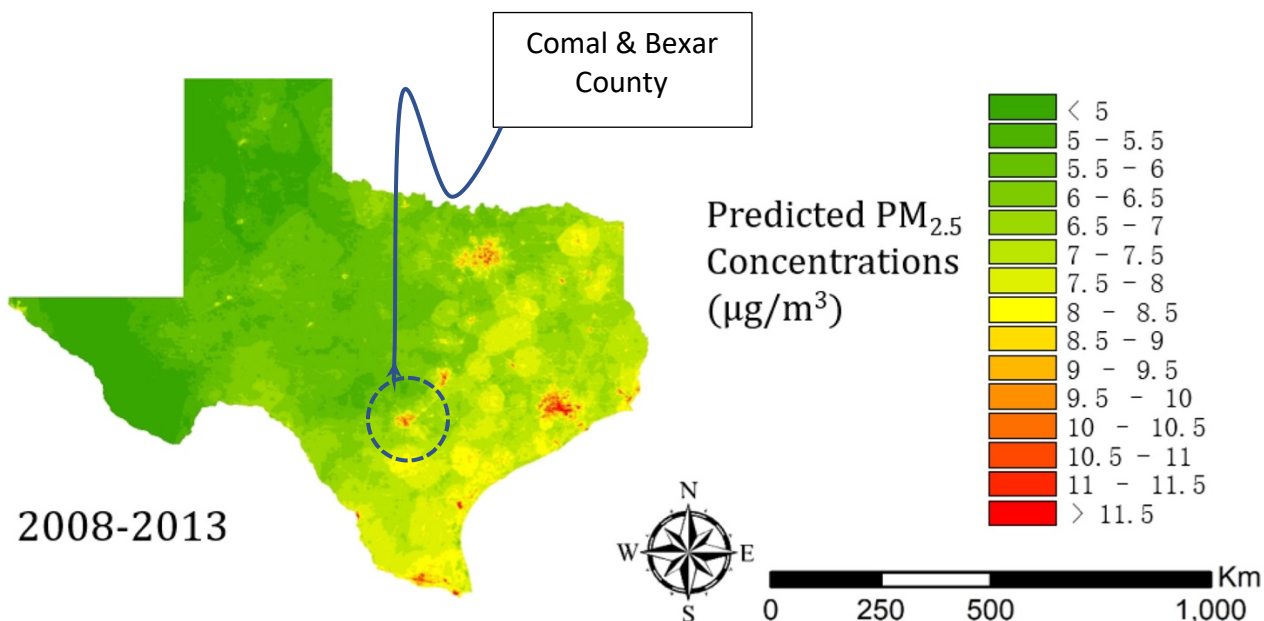


IMAGE: 2008 – 2013 Satellite-Based Aerosol Optical Density

Source: Zhang, X, Chu, Y, Wang, Y, Zhang K. Science of the Total Environment 631–632 (2018) 904–911 (UT Houston Health Science Center)

Recently, there has been a significant publication by researchers from the Harvard University TH Chan School of Public Health that revises the WHO health risk exposure threshold to PM_{2.5} downward from ~12 µg/m³ to less than 10 µg /m³. This meta-analysis research, based upon results from 53 separate studies, reports significant risk for increased mortality for PM_{2.5} exposures as low as 10 µg /m³ (see Table below).

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Table 2, from this publication, summarizes the all cause mortality risk increase for PM_{2.5} exposure at levels of 10 µg /m³.

Estimates from meta-regression for the association between long term PM_{2.5} exposure on Overall and Specific Mortality risk.

Mortality	Coefficient	SE	p-value	Percent increase at PM _{2.5} =10, (%)
Inverse transform of average PM _{2.5} = $\frac{1}{PM_{2.5}}$	0.071	0.038	0.060	–
Intercept (All-cause mortality) ^a	0.006	0.003	0.033	1.29(1.09–1.50)
<i>Cause specific mortality</i>				
Cardiovascular mortality	0.002	0.001	< 0.001	1.46 (1.25–1.67)
Lung cancer mortality	0.002	0.001	0.008	1.22 (0.87–1.39)
Respiratory mortality	– 0.002	0.001	0.139	1.13 (0.85–1.41)
Cardiopulmonary mortality	0.006	0.001	< 0.001	1.92 (1.59–2.25)
Elderly studies only (yes/no)	0.003	0.001	< 0.001	1.61 (1.35–1.85)
Female studies only (yes/no)	0.0002	0.001	0.892	1.31 (1.01–1.62)

^a All-cause, all-ages mortality represents the reference group to indicators for cause specific mortality.

Source: E Vodonos A, Awad YA, Schwartz J. Environ Res. 2018 Oct;166:677-689.

Summary

Particulate matter emissions from aggregate industry sources have varied between 2002 and 2014 in Comal County from 600 tons/year to 900 tons/year.

Average exposure of Comal County residents to PM_{2.5} has been ~11.5 µg /m³ during the 2008 - 2013 timeframe.

The most current health risk assessment science provides evidence of increased risk for all cause mortality from average exposure to PM_{2.5} levels as low as 10 µg /m³.

Available emissions data for Comal County since 2013 suggest that PM_{2.5} exposure may be higher now than 2008 - 2013.

Conclusion

There is good evidence that residents of Comal County have increased health risks from exposure to PM_{2.5}.

This evidence is sufficient to warrant the need for PM_{2.5} monitoring and a curtailment of the continued expansion of PM_{2.5} producing industrial operations (such as aggregate processing).

Prepared by R Keith Randolph, PhD, March 3, 2019