

Traffic-Related Pollutant Levels: Near-Road Compared to Allen Park

An Analysis of Sites Proximate to Southfield Freeway

Timothy M. Barzyk, BJ George, Alan Vette, Ron Williams,
Carry Croghan, Carvin Stevens

Outline

1. Near-Road
2. DEARS Near-Road
3. Methods
4. Results
5. Future Work

Near-Road

The environment or area

Mobile Sources

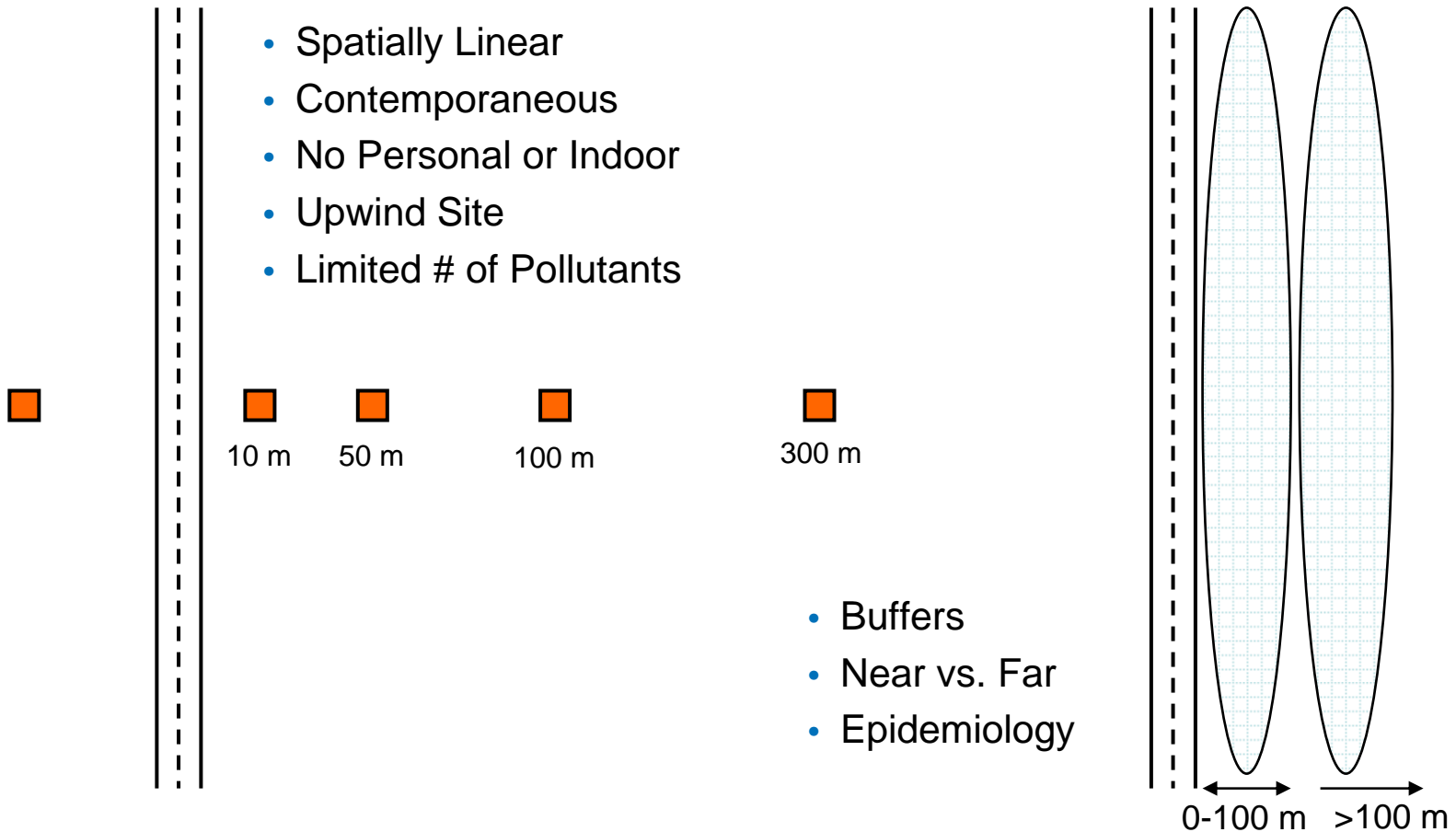
The sources: vehicles

Traffic-Related Pollutants (& Mobile Source Air Toxics)

The chemicals or constituents

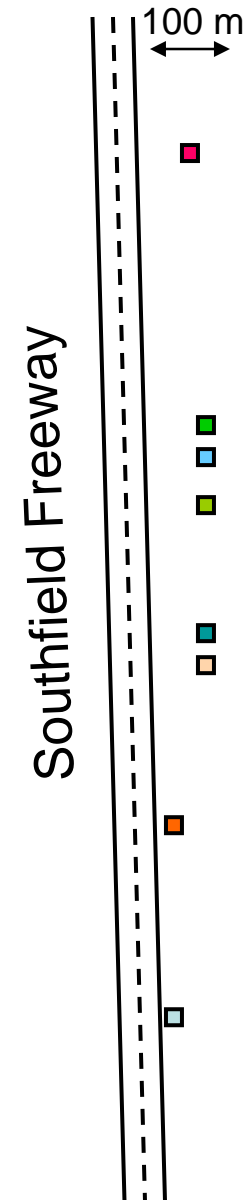
*Mobile sources contribute to both the
regional airshed & near-road
microenvironment*

Traditional Near-Road Approaches



DEARS Near-Road

- Proximate Residential
- Spatially & Temporally Distributed
- Personal, Indoor & Outdoor
- Comparison to Central Site Monitor
- Suite of Pollutants



Methods

Statistical

- Univariate Repeated Measures Model
 - Concentrations = f(Distance)
 - Accounts for Autocorrelation
 - Outdoor normalized with Ambient (O/A)
 - Regional Temporal Variability
 - Measurement Error
-

$$\text{Log}(O) = \text{Log}(A) + \beta D$$

$$\text{Log}(O) - \text{Log}(A) = \beta D$$

$$\text{Log}(O/A) = \beta D$$

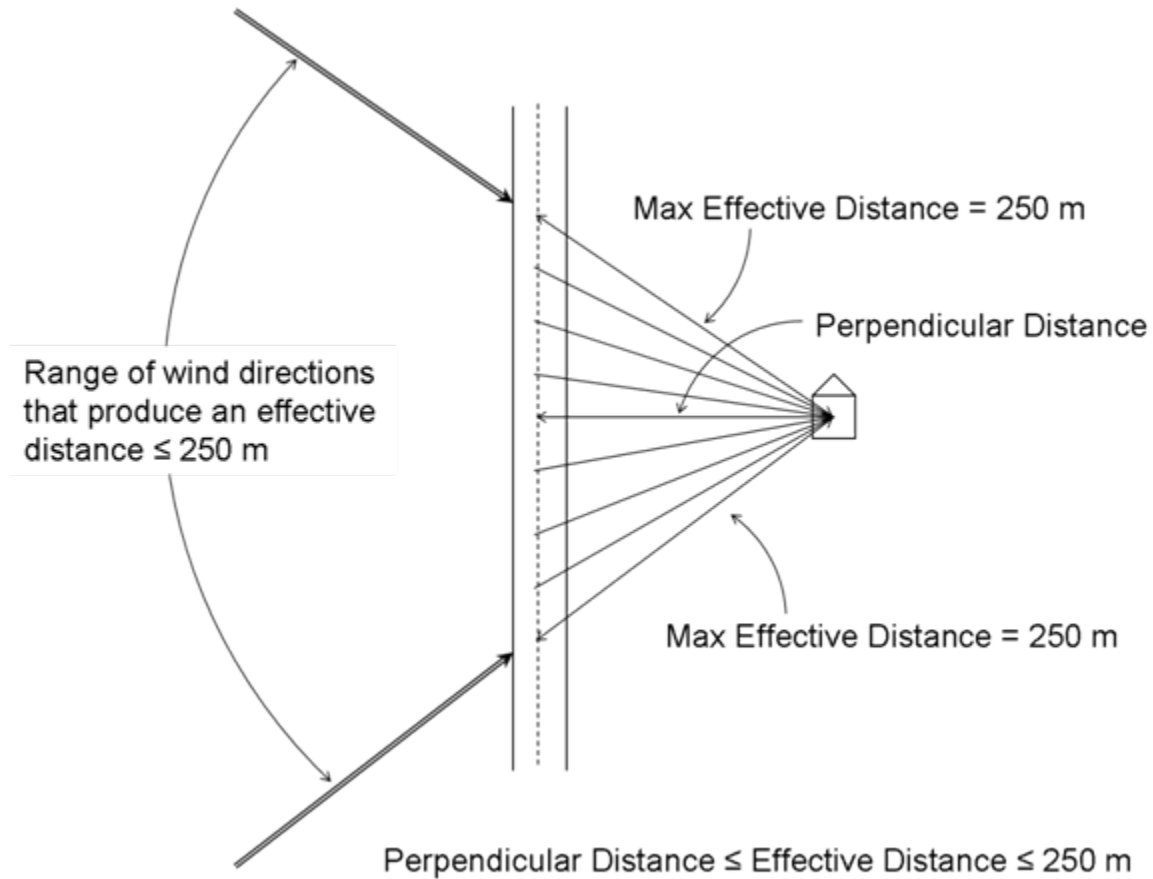
$$e^{\text{Log}(O/A)} = e^{\beta D}$$

$$O/A = e^{\beta D}$$

$e^{\beta D}$ describes the *shape* of the near-road gradient

Methods

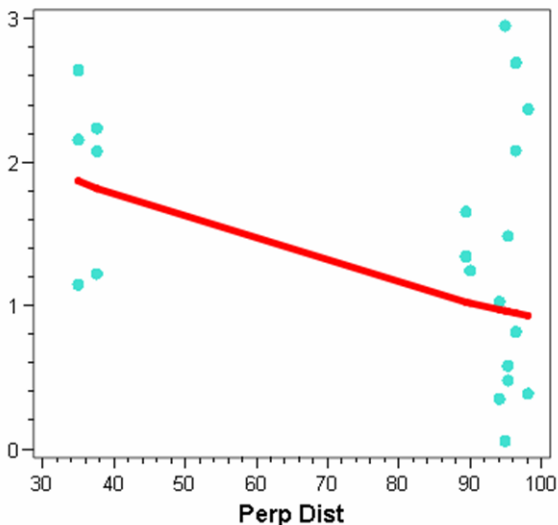
Analytical



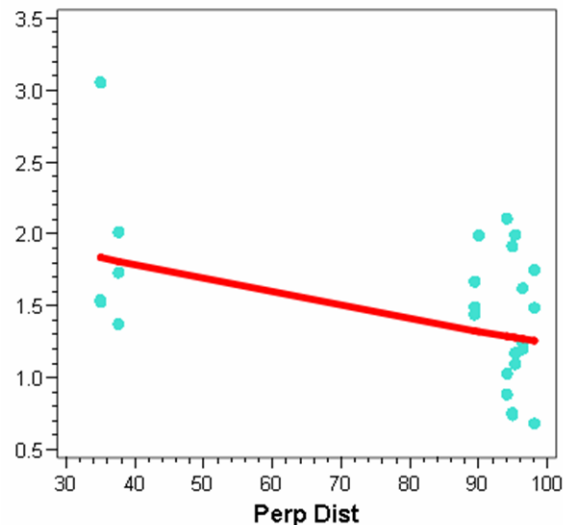
Results

Perpendicular Distance

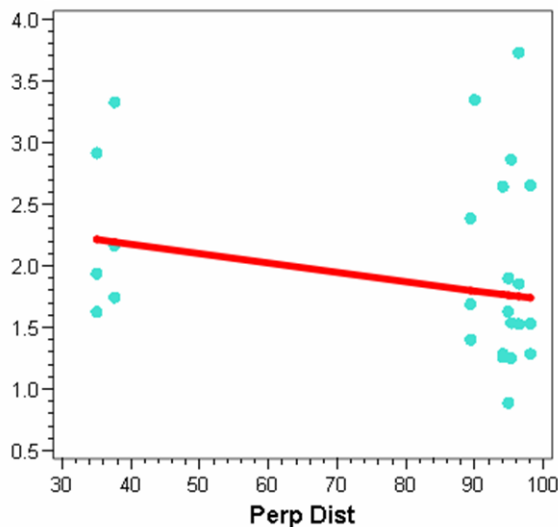
OA_BENZ



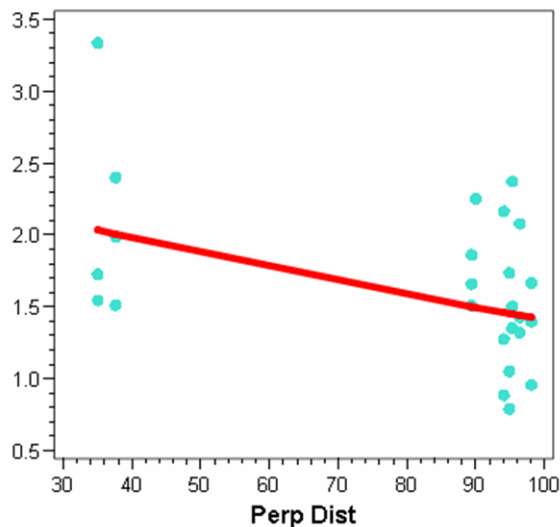
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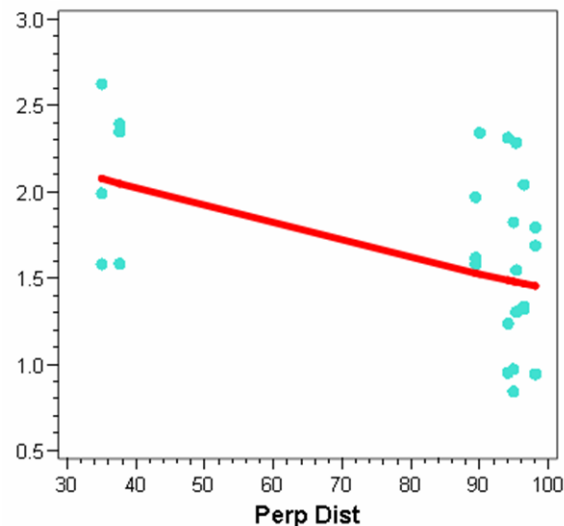
OA_TOLU



OA_MPXY



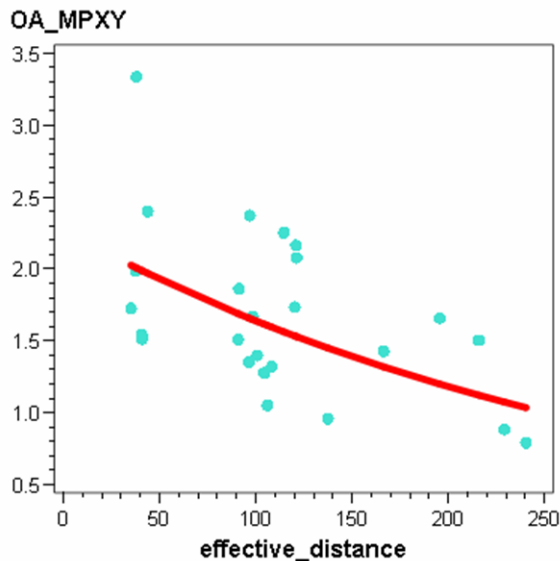
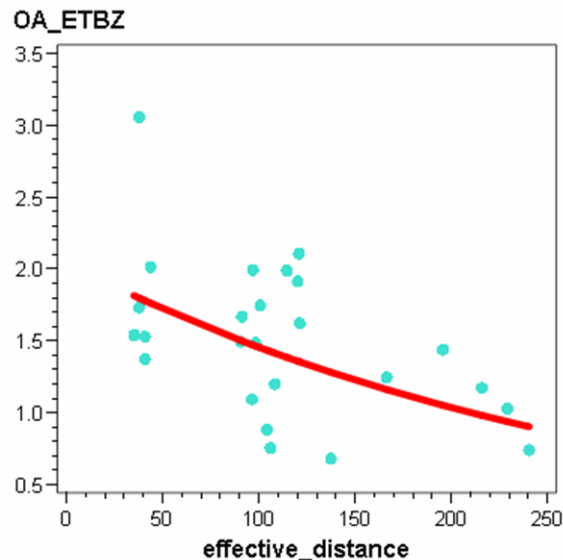
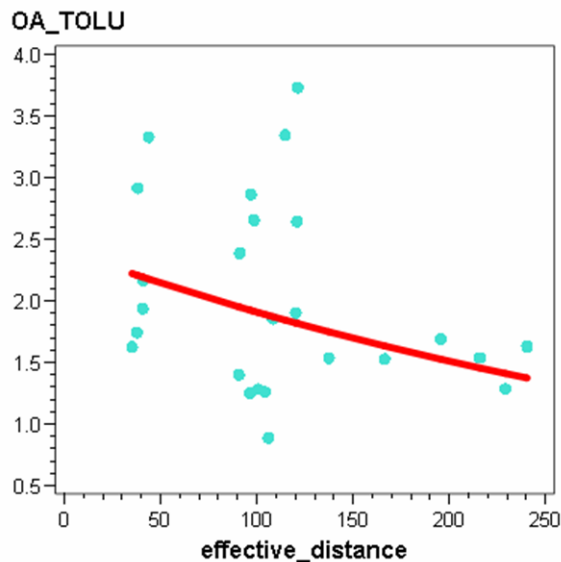
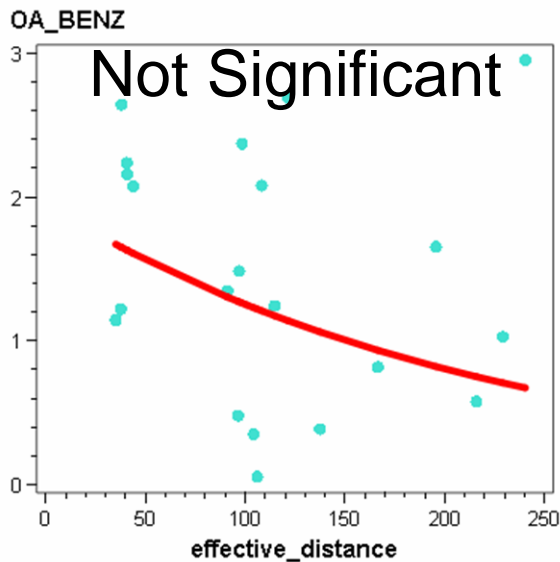
OA_OXYL



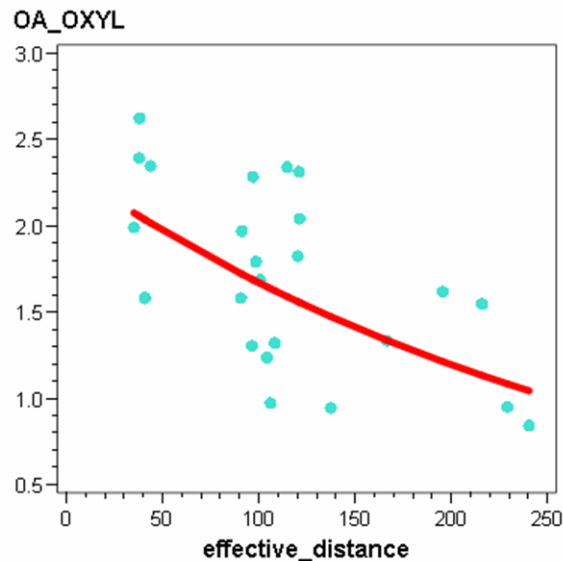
Limited to site distances
Doesn't explain ratio variability
Linear slopes questionable

Results

Effective Distance



Range of distances to 250 m
Better explains ratio variability
Curvilinear slopes
More significant & Better fit



Summary

Season 3

Pollutant	Median ($\mu\text{g}/\text{m}^3$) Effective Distance	Median ($\mu\text{g}/\text{m}^3$) All DEARS
Benzene	2.54	2.19
Toluene	5.59	4.84
Ethylbenzene	1.13	1.03
m,p-Xylene	3.20	2.84
o-Xylene	1.18	1.01

Which Pollutants Tell Us About Roadways?

Pollutant Group	Specific Pollutant	Representative?
<p style="text-align: center;">Gases (VOCs)</p>	<p style="text-align: center;">Benzene Toluene Ethylbenzene m,p-Xylene o-Xylene 1,3 Butadiene 1,3,5 Trimethylbenzene 4 Ethyltoluene</p>	<p style="text-align: center;">Yes</p>
<p style="text-align: center;">Carbon Particles (2.5 μm)</p>	<p style="text-align: center;">Elemental Carbon</p>	<p style="text-align: center;">Probably for Trucks</p>
<p style="text-align: center;">Small Particles (2.5 μm)</p>	<p style="text-align: center;">Arsenic Chromium Lead Manganese Nickel</p>	<p style="text-align: center;">A Few Are</p>

DEARS General Findings

(Confirms the science)

Wind

- Wind direction matters
- Nearby, downwind houses
- Air travels farther at different angles - and it matters!
(That's new)
- Upwind houses don't show fingerprint

Distance

- Right next to the road, levels are about 2½ times background
- Pollutant levels drop quickly
- Decrease to background levels by about 750'

The DEARS Advantage

Expand the Fingerprint *...and the science*

- What other pollutants?
- What else?
 - Traffic
 - Infiltration into Houses
 - Seasons? Weather?
- If we understand the contributing factors, then can a single community site help us predict what happens near roads?

Comprehensive Near-Road Exposure Study

- Are people who spend a lot of time near roads exposed to more pollution? How much more?
- Which factors contribute to high and low levels of exposure?
- What can be done to decrease exposure?

Disclaimer

Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.

The U.S. Environmental Protection Agency through its Office of Research and Development funded and conducted the research described here through contract 68-D-00-012 with RTI International, EP-D-04-068 to Battelle Columbus Laboratory, 68-D-00-206 and EP-05-D-065 to Alion Science and Technology.