



Spatial and Temporal Analysis of the Composition of Fine Particulates in Fairbanks, Alaska

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OCM

Source Specific Emissions

Organic
Carbon Mass
(OCM)



Sulfate
 SO_4^{2-}

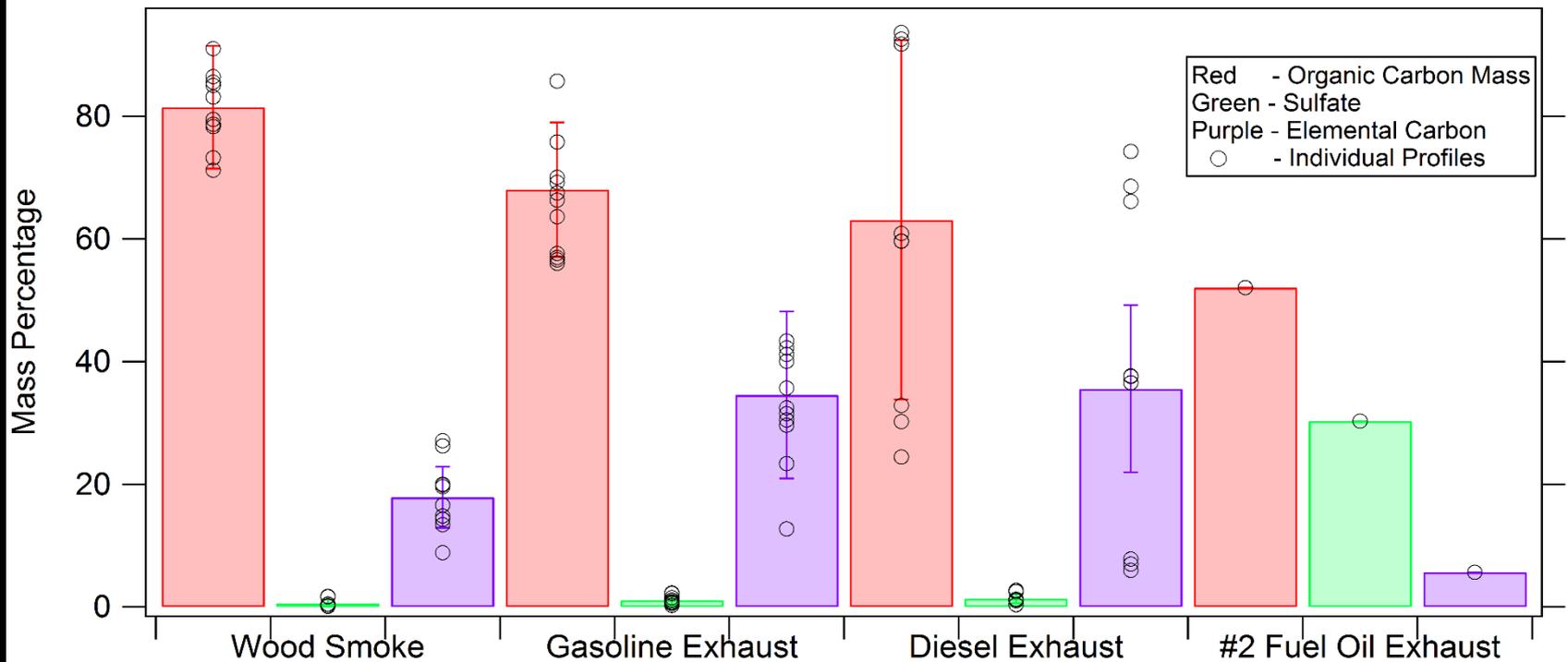
Elemental
Carbon
(EC)

OCM

OCM



Source Profile Averages



Source profiles from: <https://cfpub.epa.gov/si/speciate/>
For details see the full thesis: <http://hdl.handle.net/11122/6830>

Previous Research

Contribution of Wood Smoke to Total PM_{2.5} Mass

Chemical Mass Balance
Model Results

60%-80% Wood Smoke
with EPA profiles

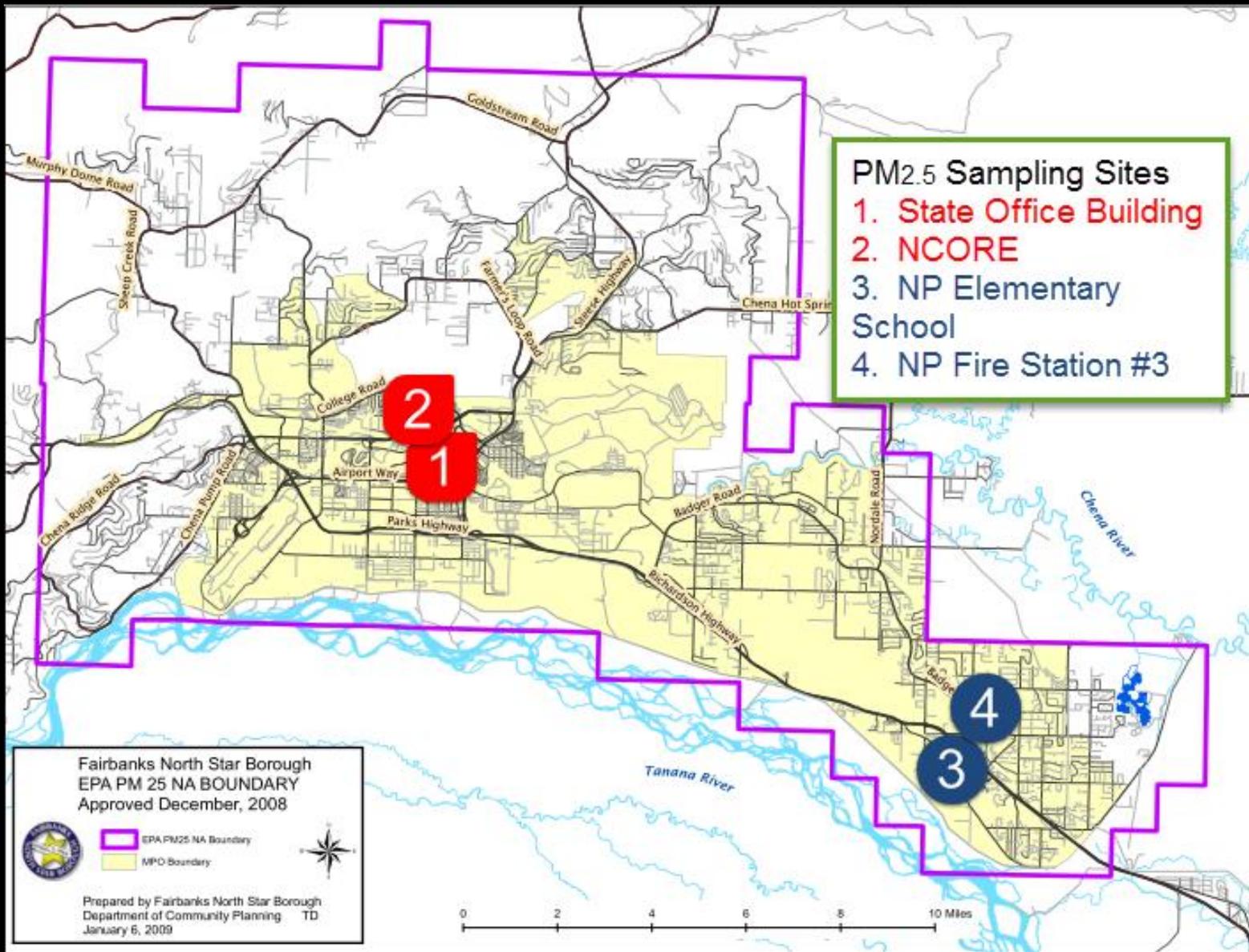
30%-77% Wood Smoke
with Fairbanks Specific
Profiles

*(Ward, 2013) Apportionment Research
Study Final Report*

Positive Matrix
Factorization Model
Results

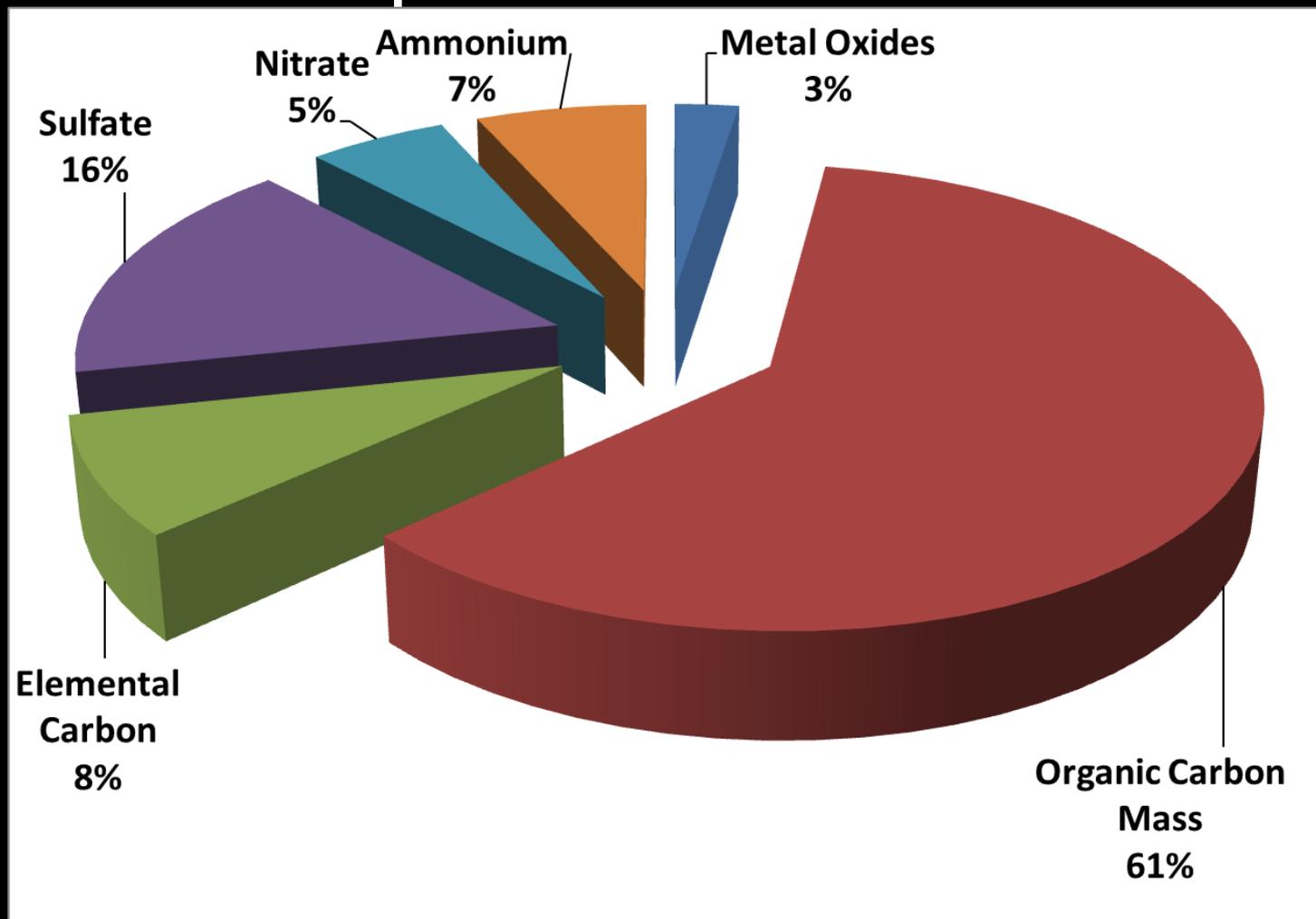
40% Wood Smoke

(Wang and Hopke, 2014)
doi:10.4209/aaqr.2014.03.0047

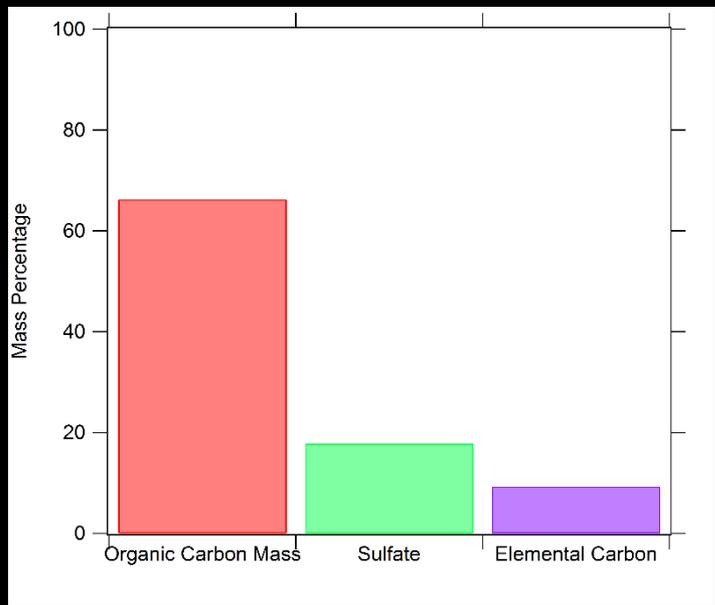


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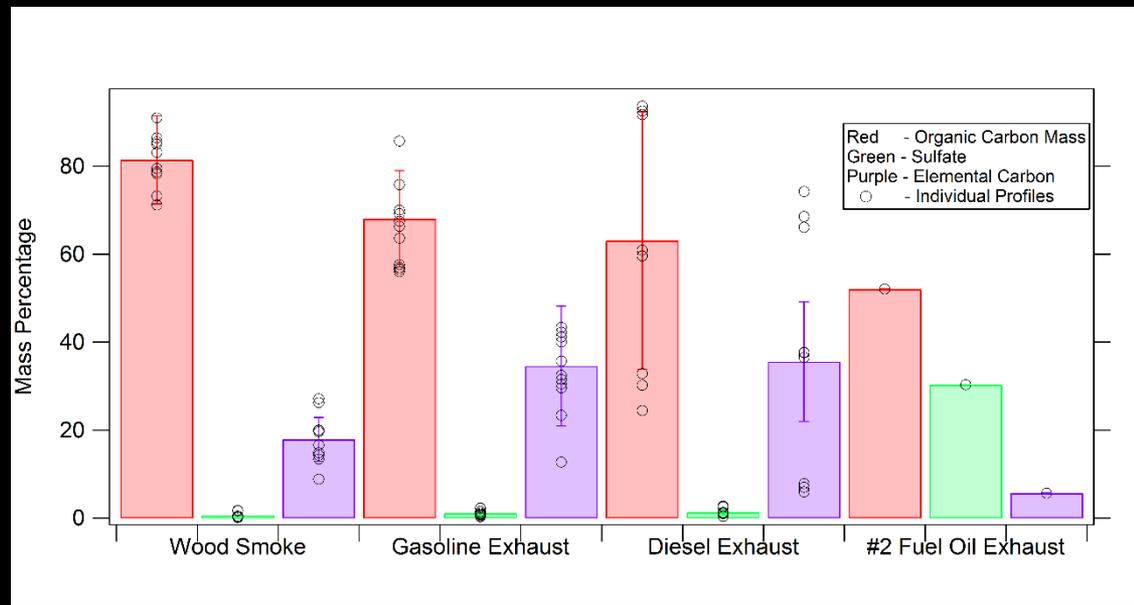
Fairbanks SOB Mean PM_{2.5} Composition 2006-2014



Major PM_{2.5} Composition 2006-2014 Compared with Source Profiles

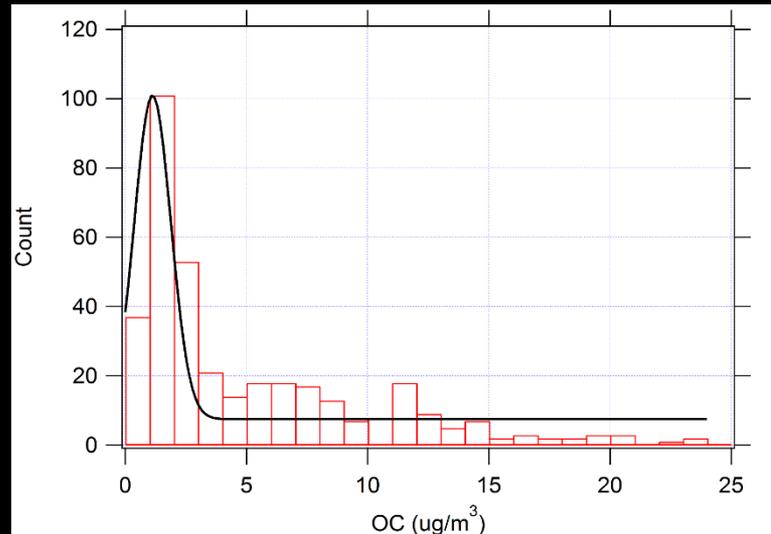


Ambient Particles

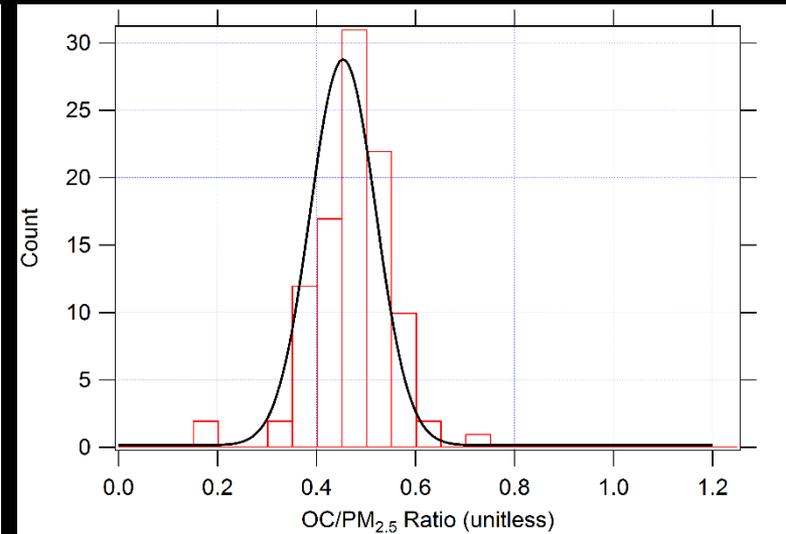


Common Emitters

Normalization allows use of t-test



Raw EPA data



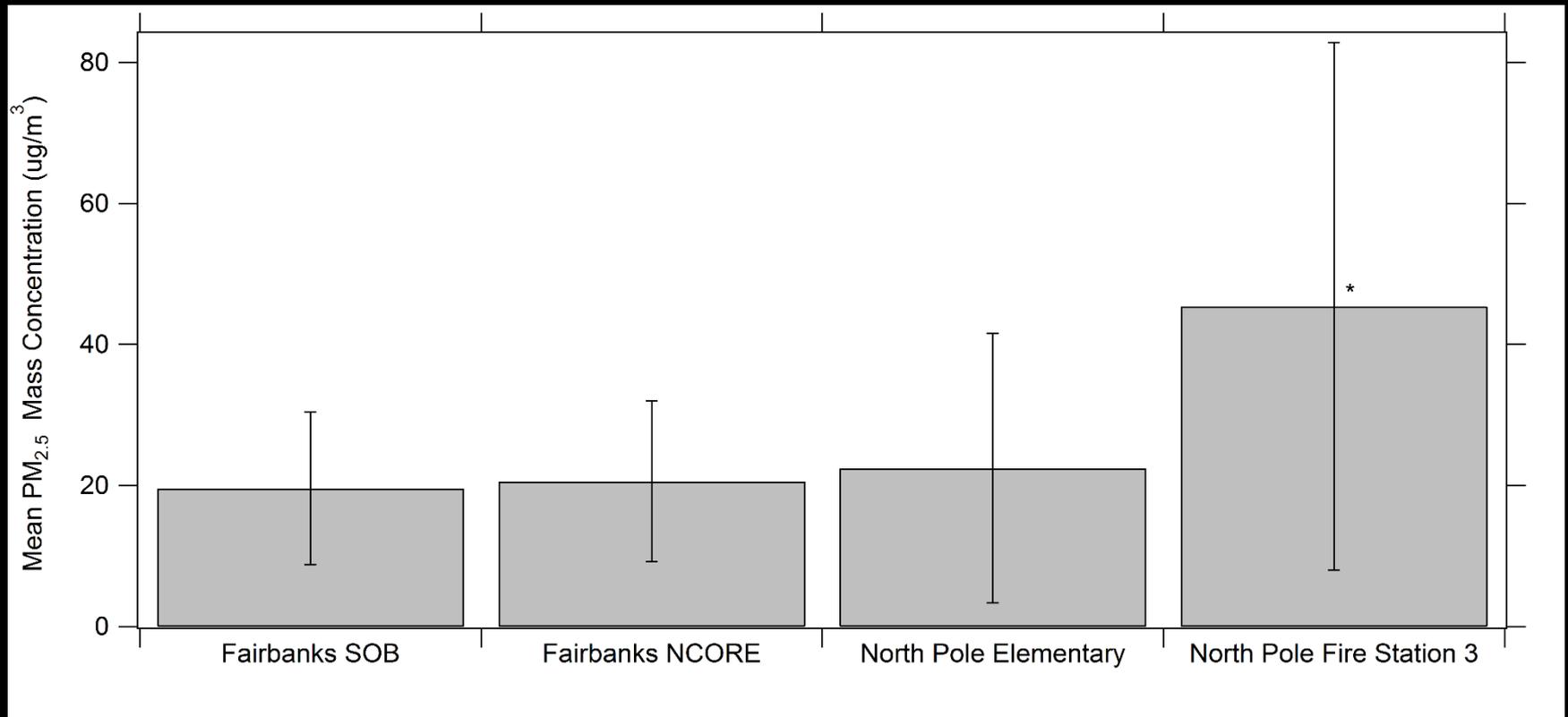
Normalized data

Spatial Comparison

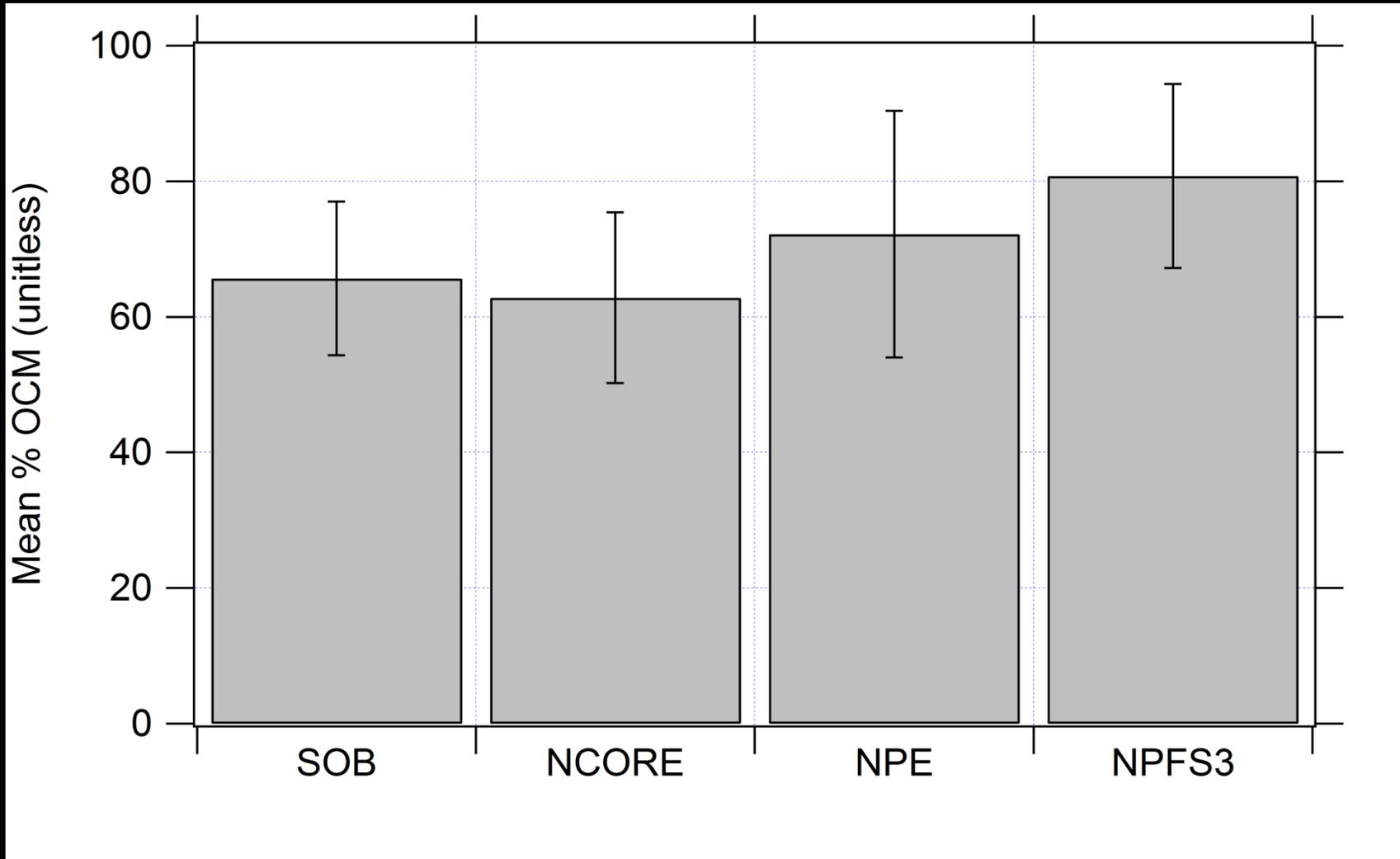


Will the particulate composition be different between North Pole and Fairbanks?

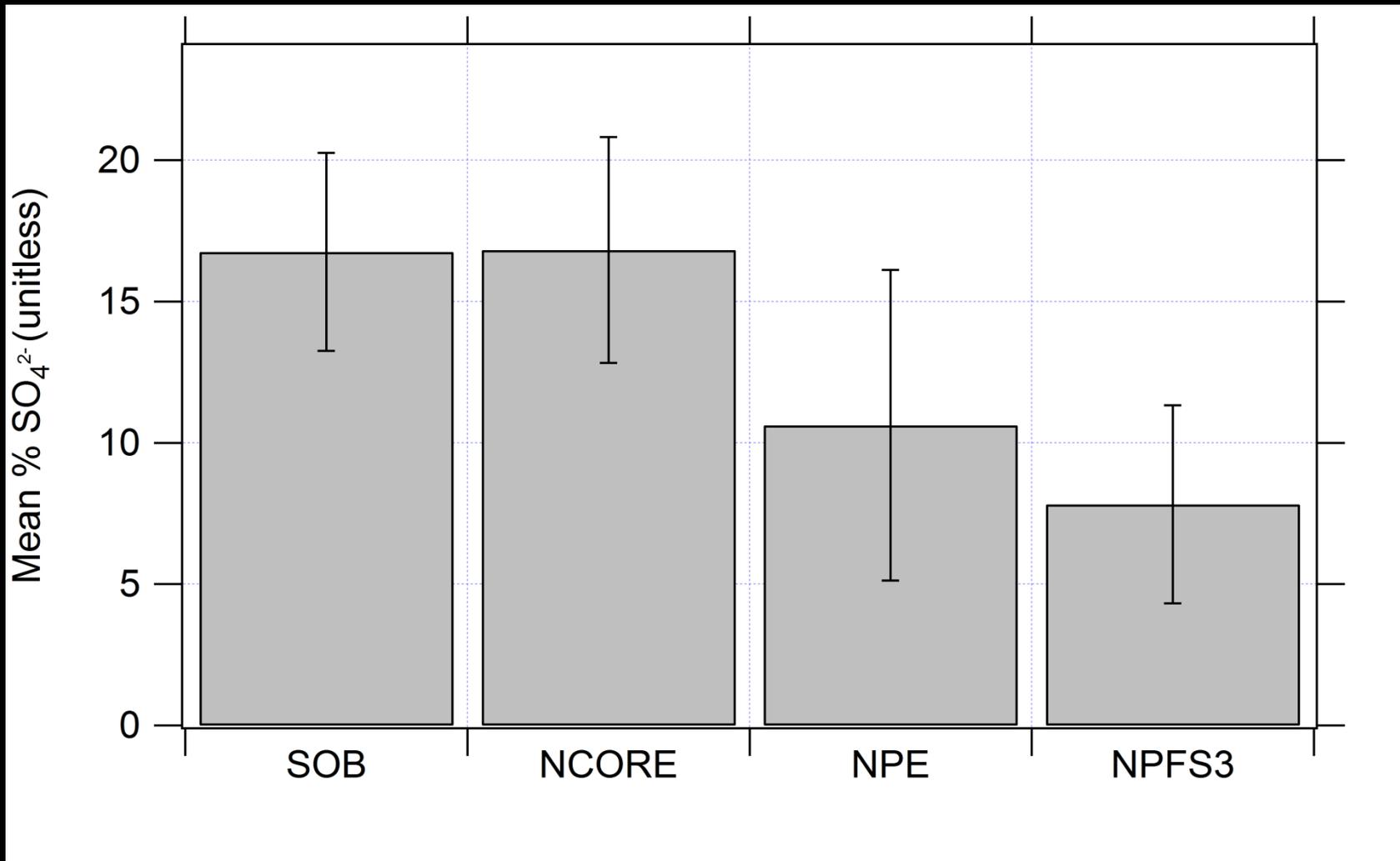
Mean Gravimetric Particle Mass Concentration is Significantly Larger at NP Fire Station



% Organic Carbon Mass



% SO_4^{2-}



For details see the full thesis: <http://hdl.handle.net/11122/6830>

OCM

Source Specific Emissions



Organic
Carbon Mass
(OCM)



Sulfate
 SO_4^{2-}

OCM

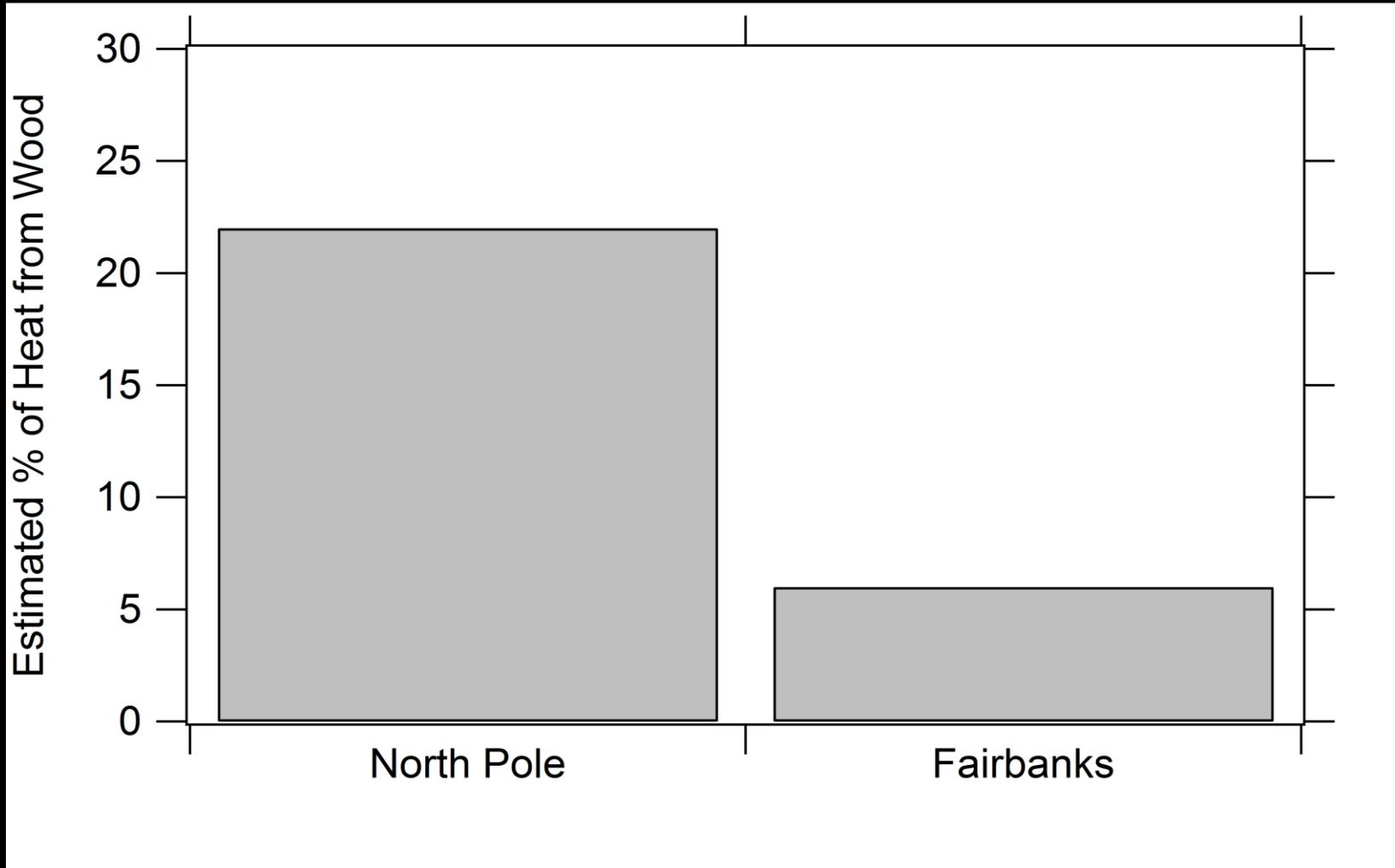
Elemental
Carbon
(EC_)

OCM

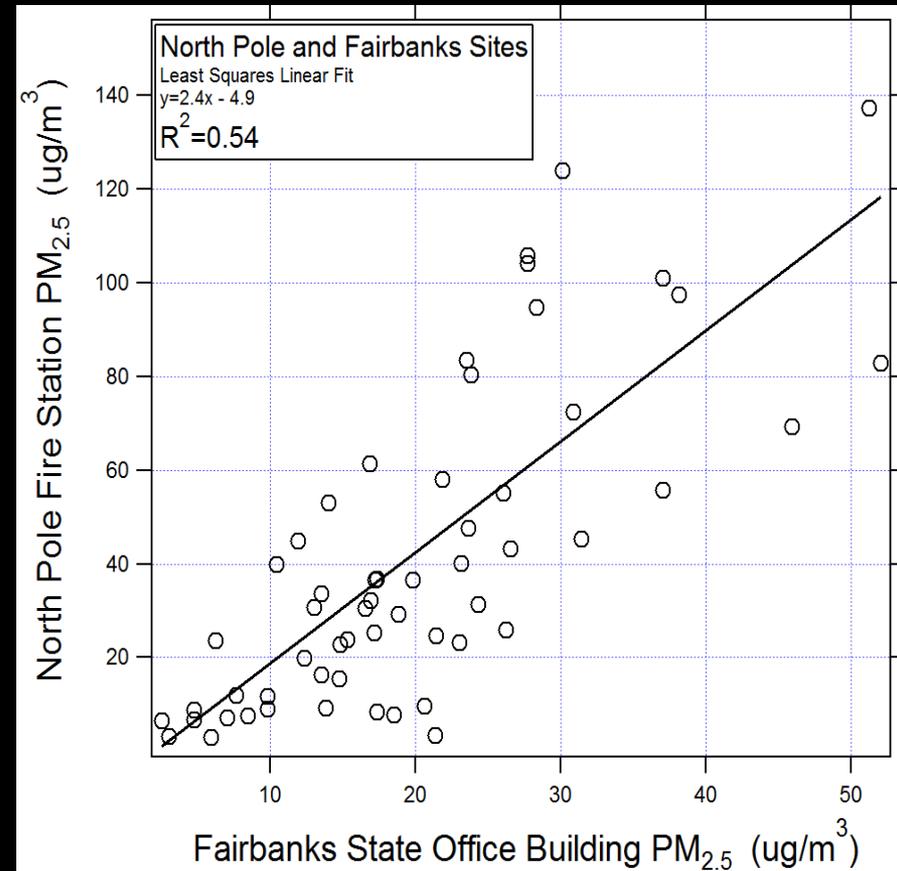
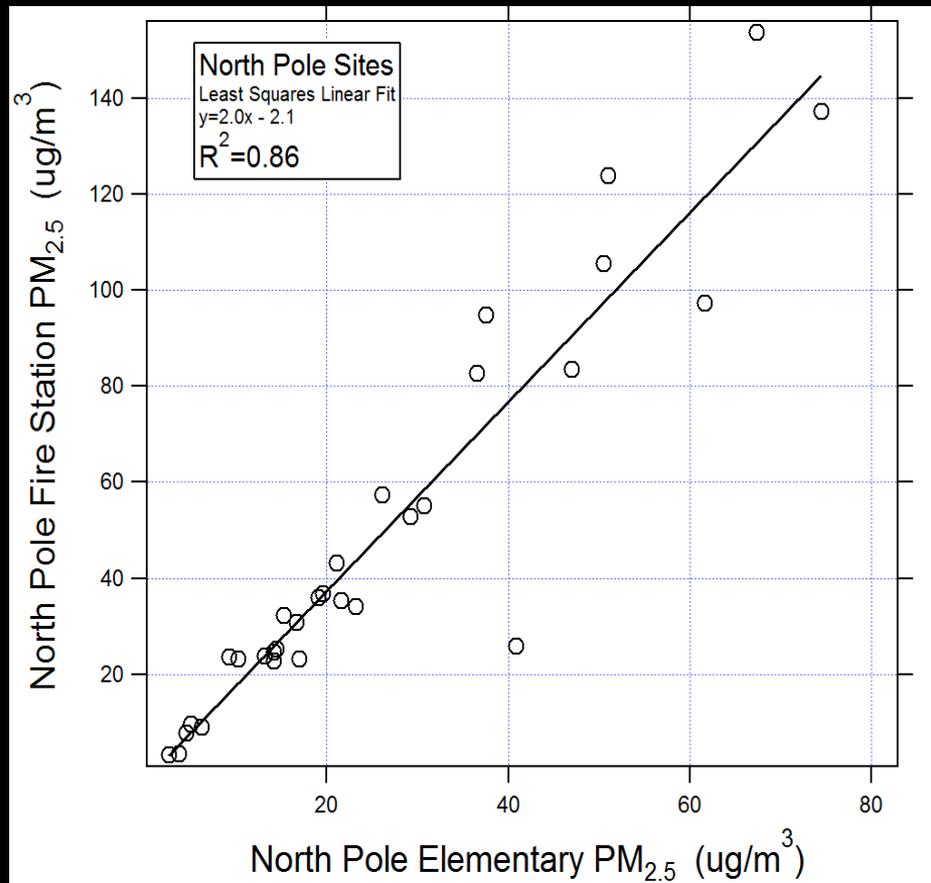


How much heat do people get from wood?

Home Heating Phone Survey Results



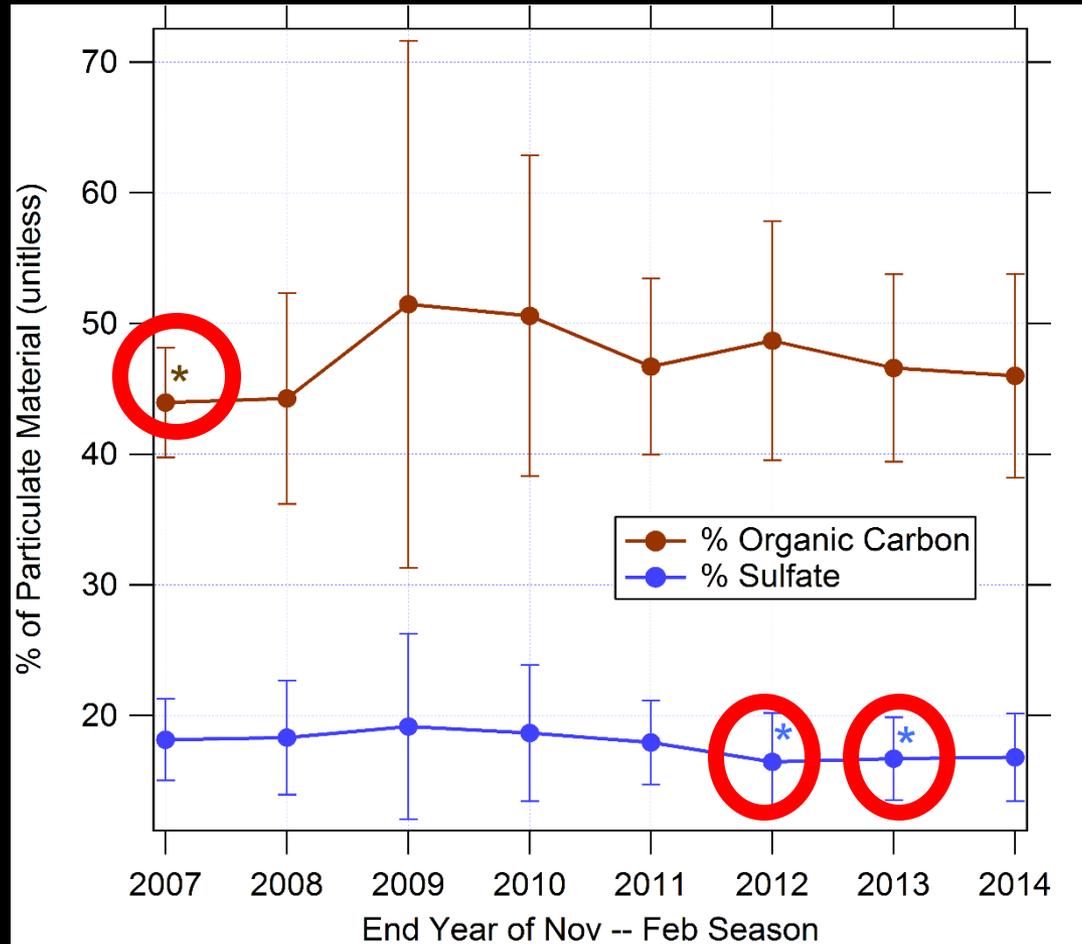
Gravimetric Mass Correlates Better for Sites in the Same City



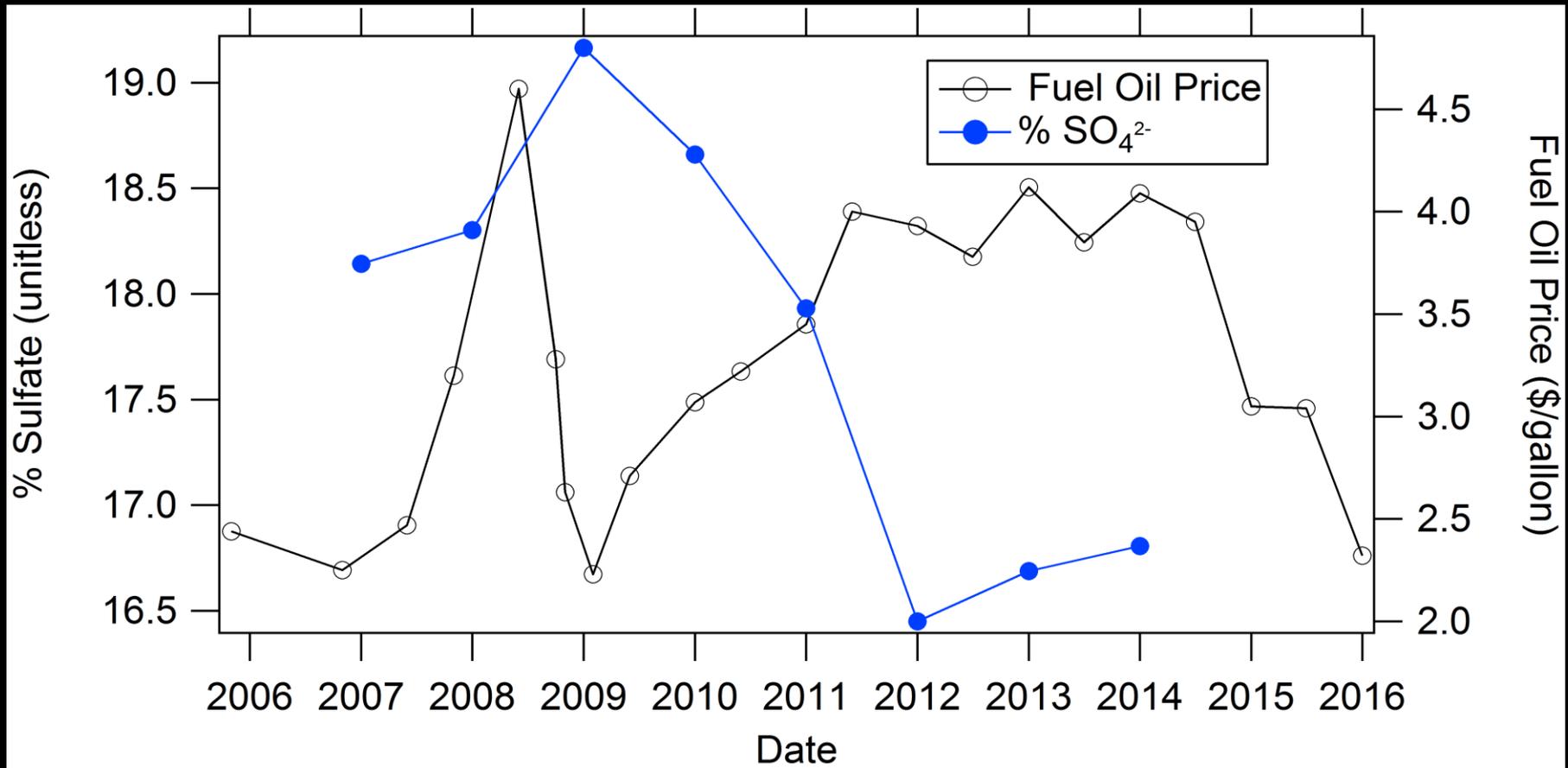
How does the particle composition change with time?

- Used 2006-2014 data set from the State Office Building

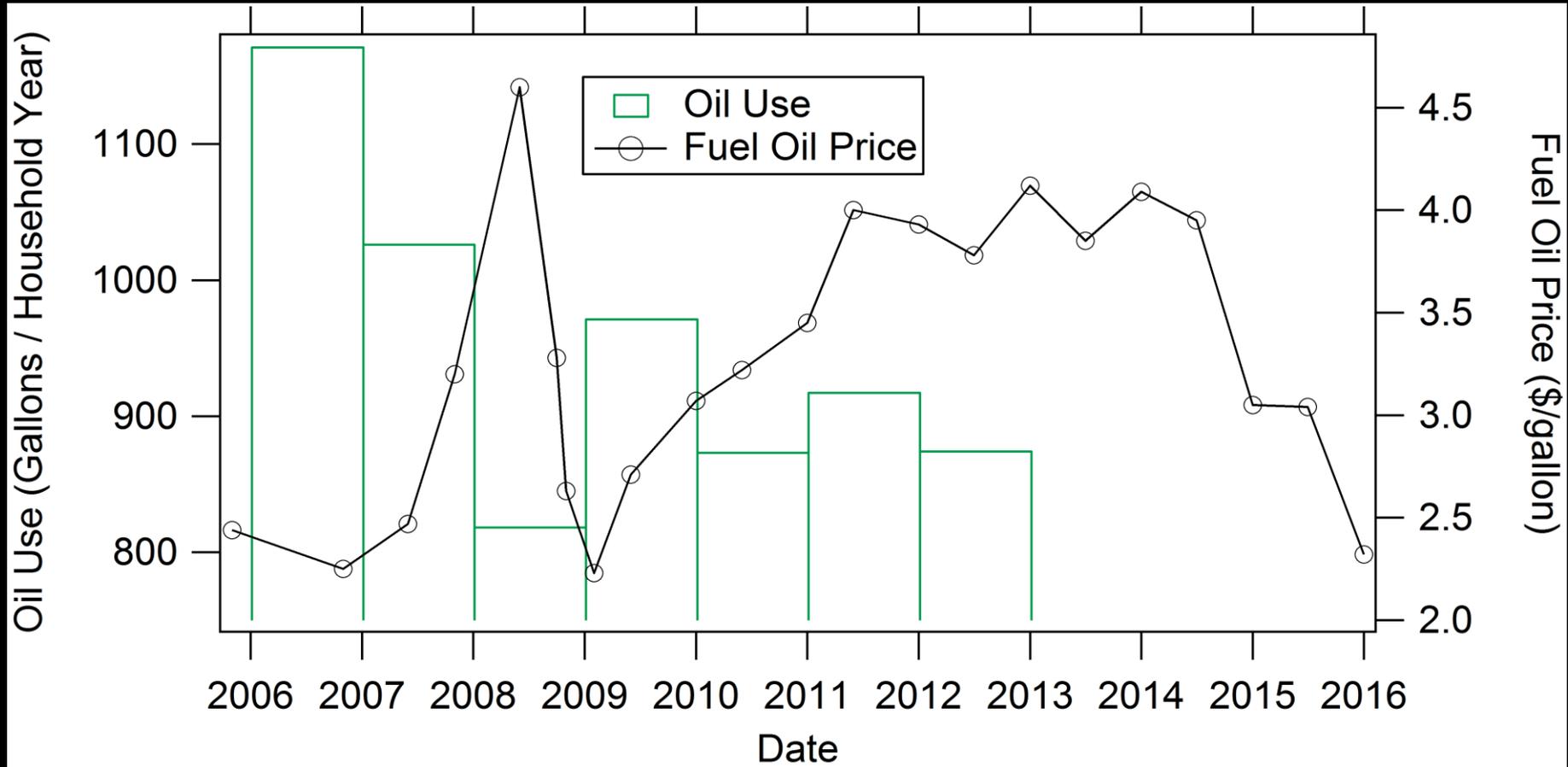
Interannual Variability and Statistically Different Years



Decrease in % SO_4^{2-} after 2008



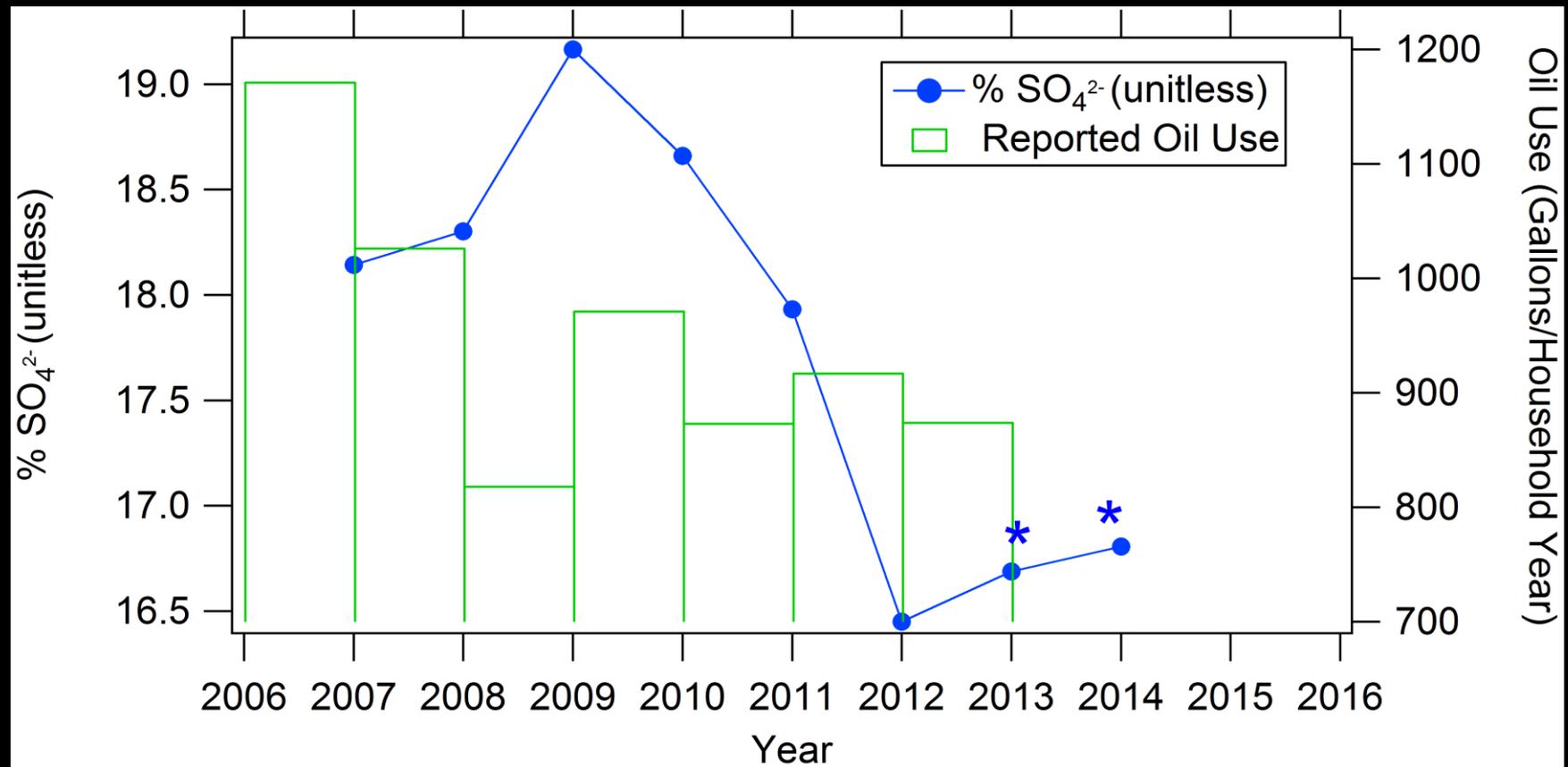
Decrease in Reported Use of Fuel Oil after 2008



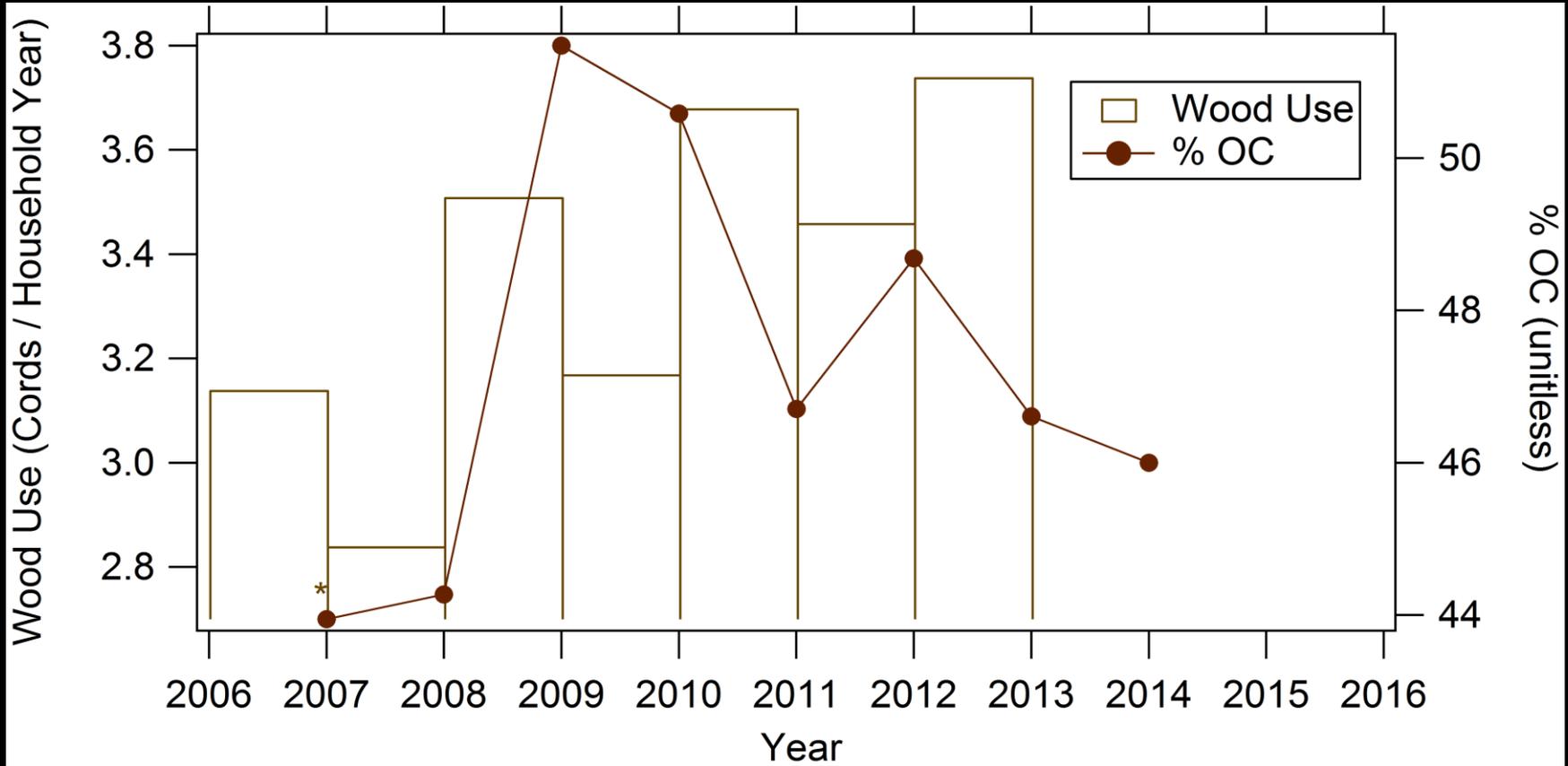
Survey Results from: Fairbanks Home Heating Survey

For details see the full thesis: <http://hdl.handle.net/11122/6830>

Survey Discrepancy with PM_{2.5} Composition



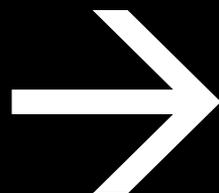
Increase in Reported Wood Use



Survey Results from: Fairbanks Home Heating Survey

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Wood Stove Changeout Program



2010 - current

Will there be a change in particle composition due to the incentive programs?

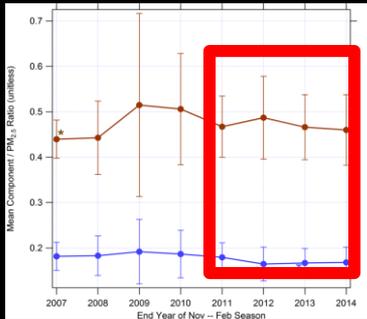
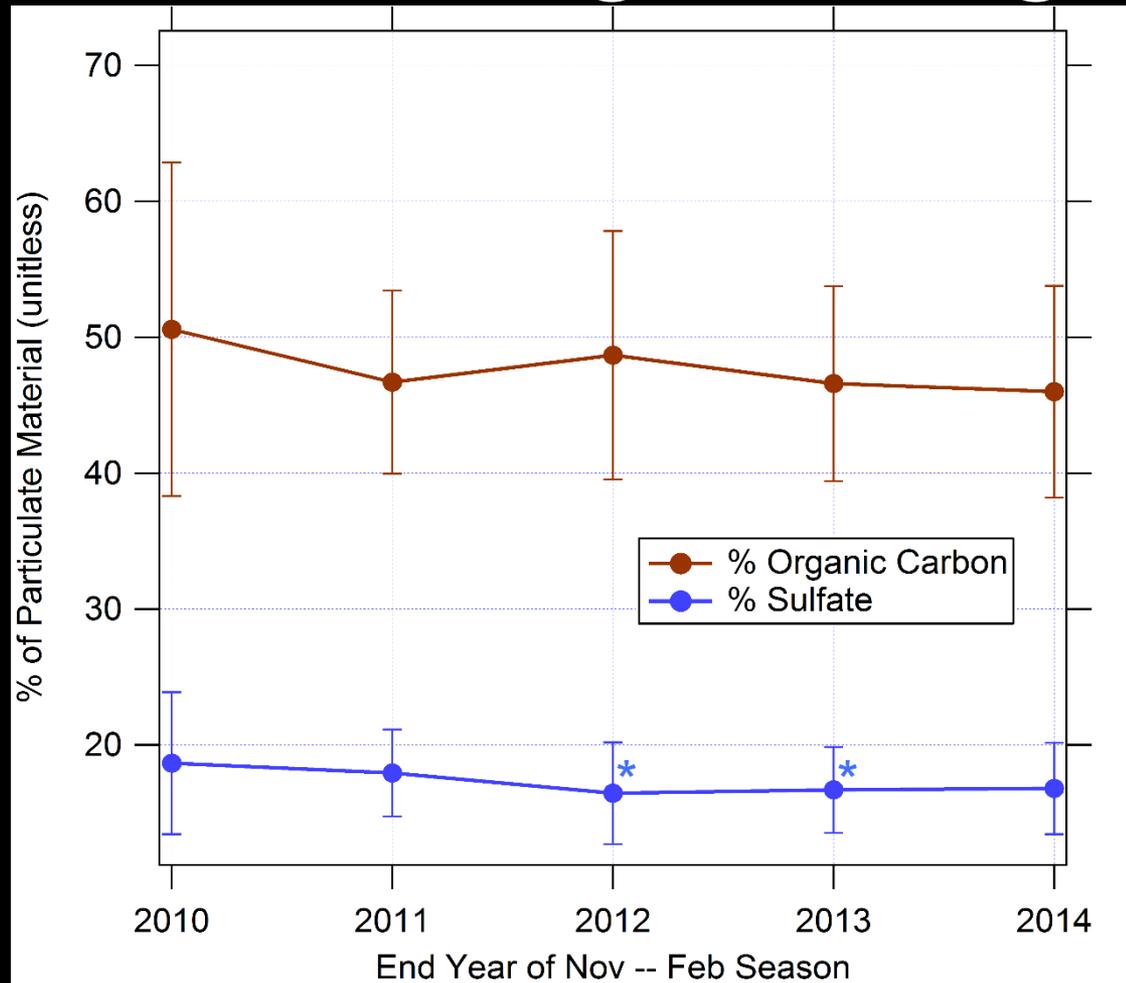
Time Period	# Stoves Replaced
End of 2011	325
End of 2013	1187

(Alaska State Implementation Plan, IIID5.6)

Organic Carbon Mass (OCM)



Temporal Change after beginning of Wood Stove Changeout Program



How this research may help Fairbanks

- Quantifying spatial differences, temporal changes may inform policy
- Statistics and trend based analyses may improve confidence in modeling results



Thanks to the State of Alaska Department of Environmental Conservation, US EPA, and Fairbanks North Star Borough for collecting such excellent data.

Thanks to the Geophysical Institute and UAF College of Natural Sciences for TA and RA support.

Special thanks to William R. Simpson, Jennifer Guerard, Cathy Cahill, Deanna Huff, and the Simpson Lab Group!



