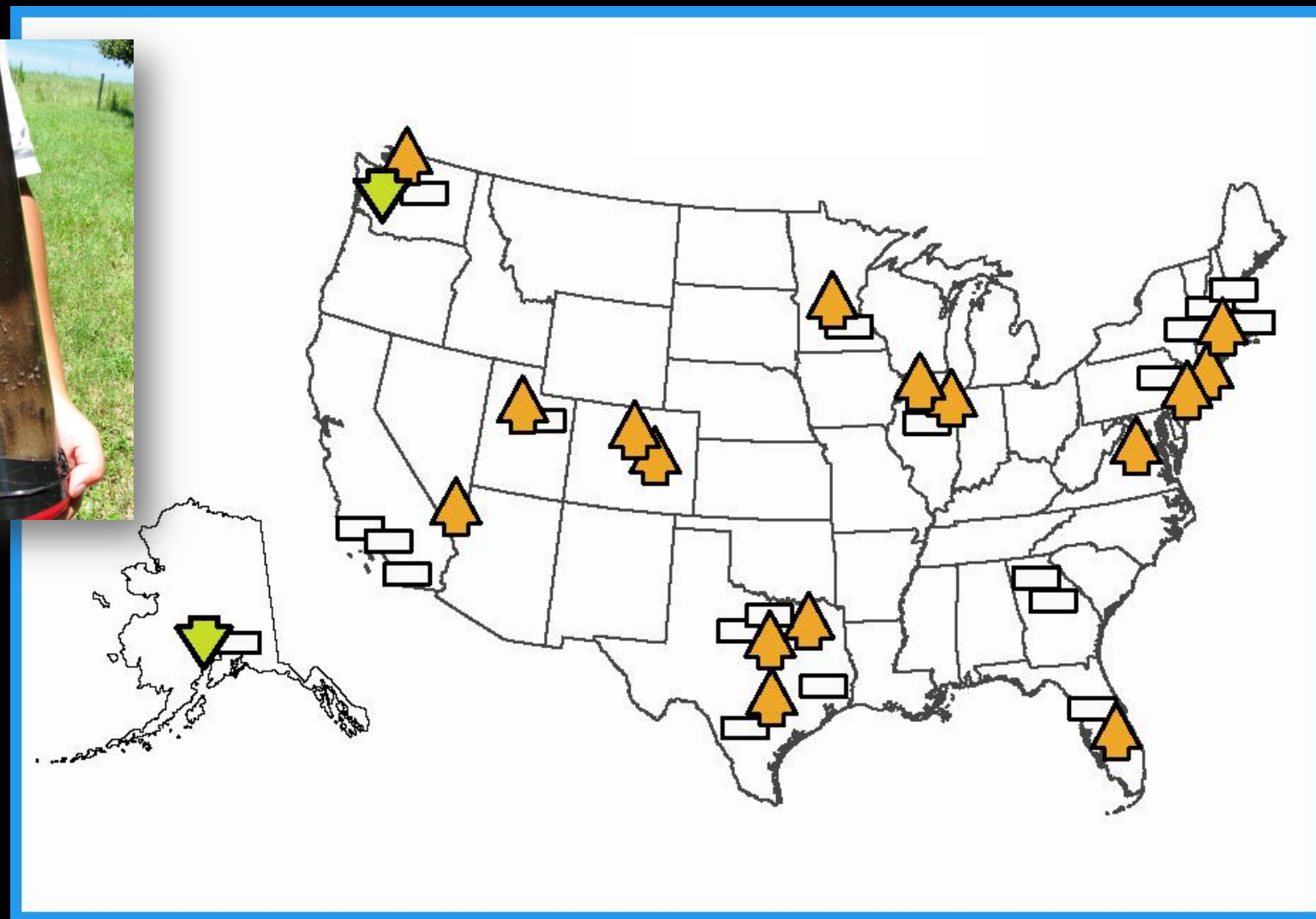


# Causes of Increasing Concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) in U.S. Lakes



Sampling Lake in the Hills, 2007

# PAHs are increasing in urban lakes



*Van Metre and others, Environ. Sci. Technol., 2005*



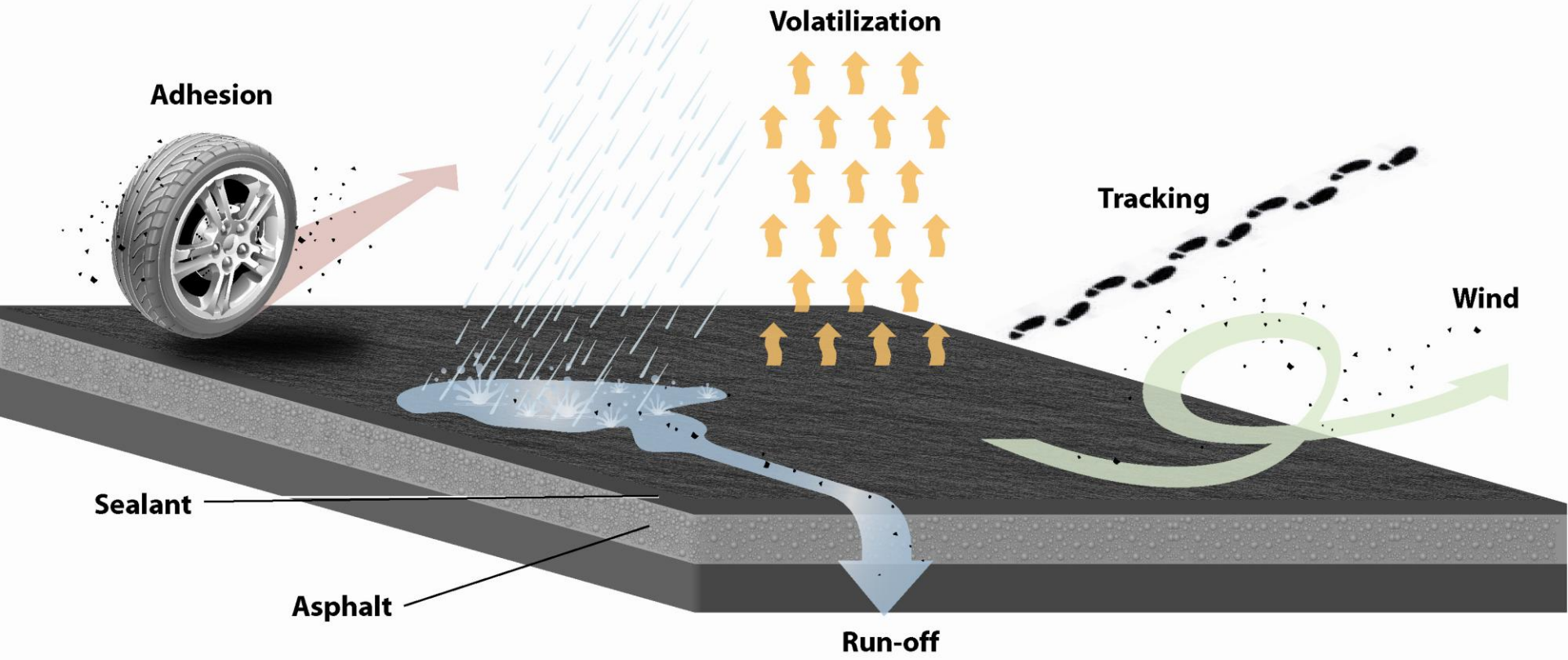
City of Austin measured PAH  
concentrations greater than 1,500 mg/kg

# What could be the source?

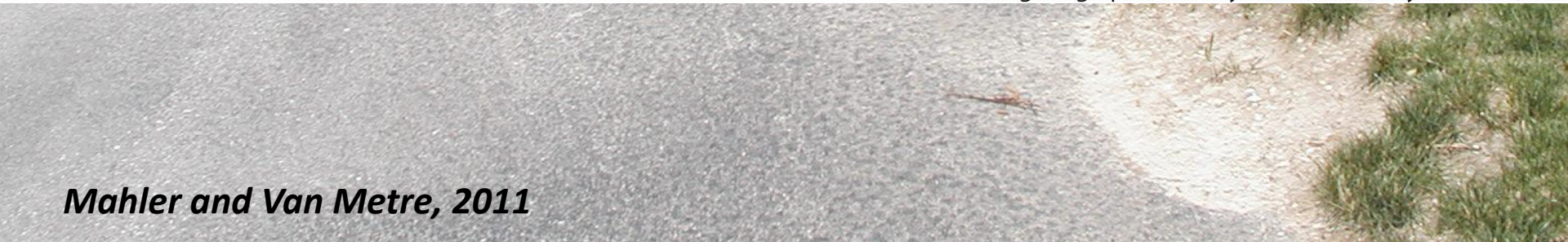
*1,500 mg/kg in creek sediment*

- Fresh asphalt **1.5**
- Weathered asphalt **3**
- Fresh motor oil **4**
- Brake particles **16**
- Road dust **24**
- Tire wear particles **86**
- Diesel engine **102**
- Gasoline engine **370**
- Used motor oil **440**
- Asphalt-based sealcoat **50**
- Coal-tar-based sealcoat **100,000**

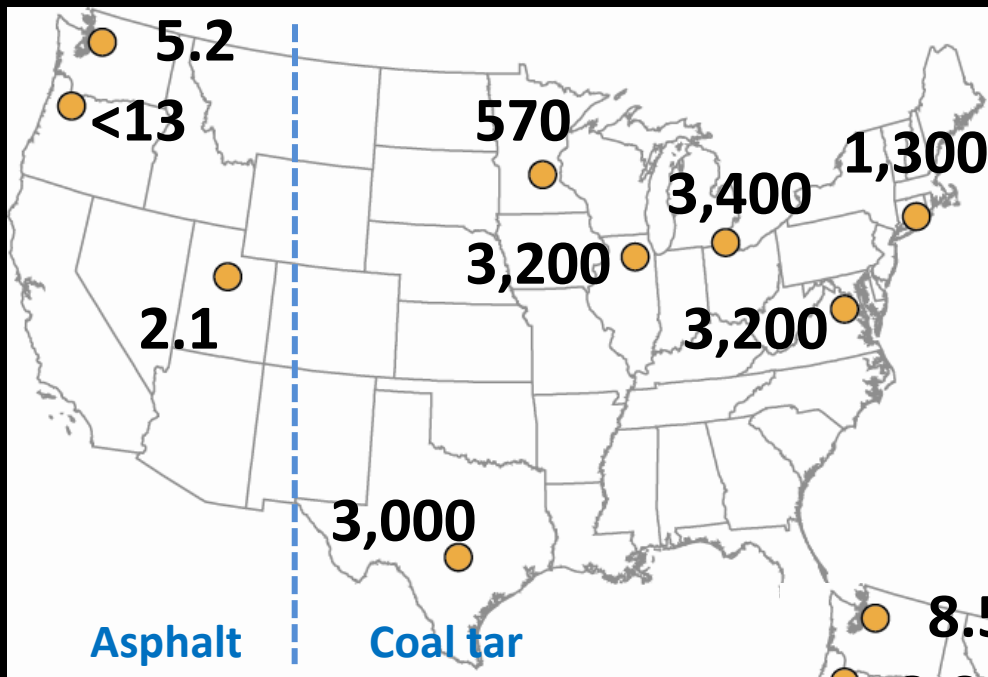
All concentrations in mg/kg (averages of 1-6 studies)



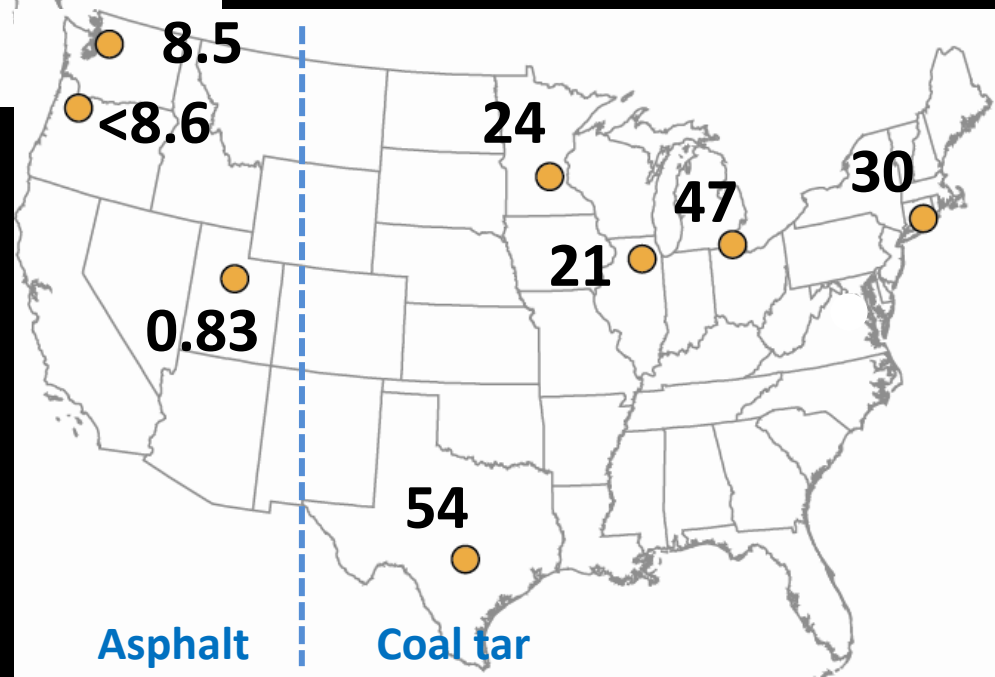
Original graphic courtesy Aaron Hicks, City of Austin, Tex.



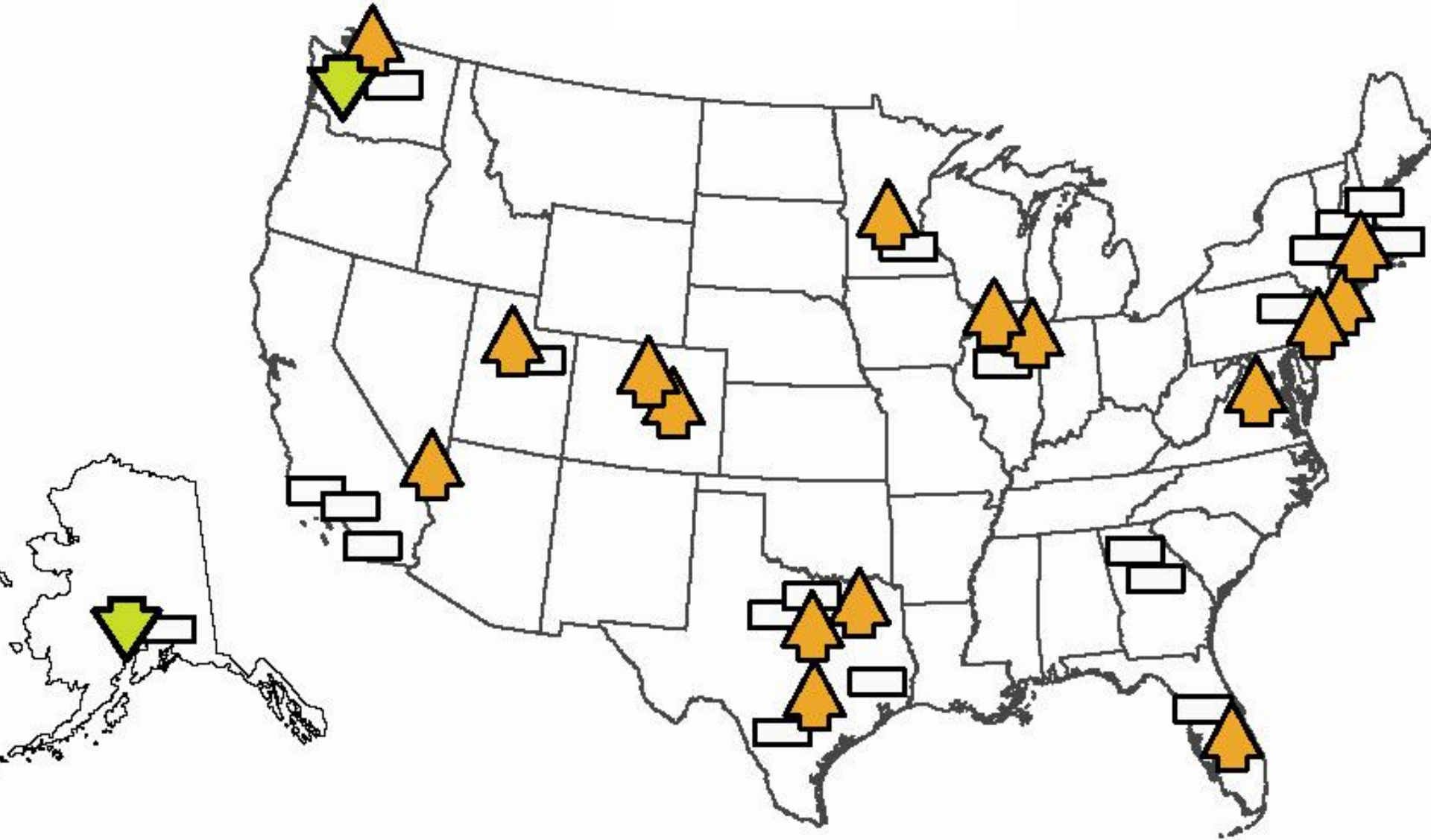
# Sealed Parking Lots (mg/kg)



# Unsealed Parking Lots

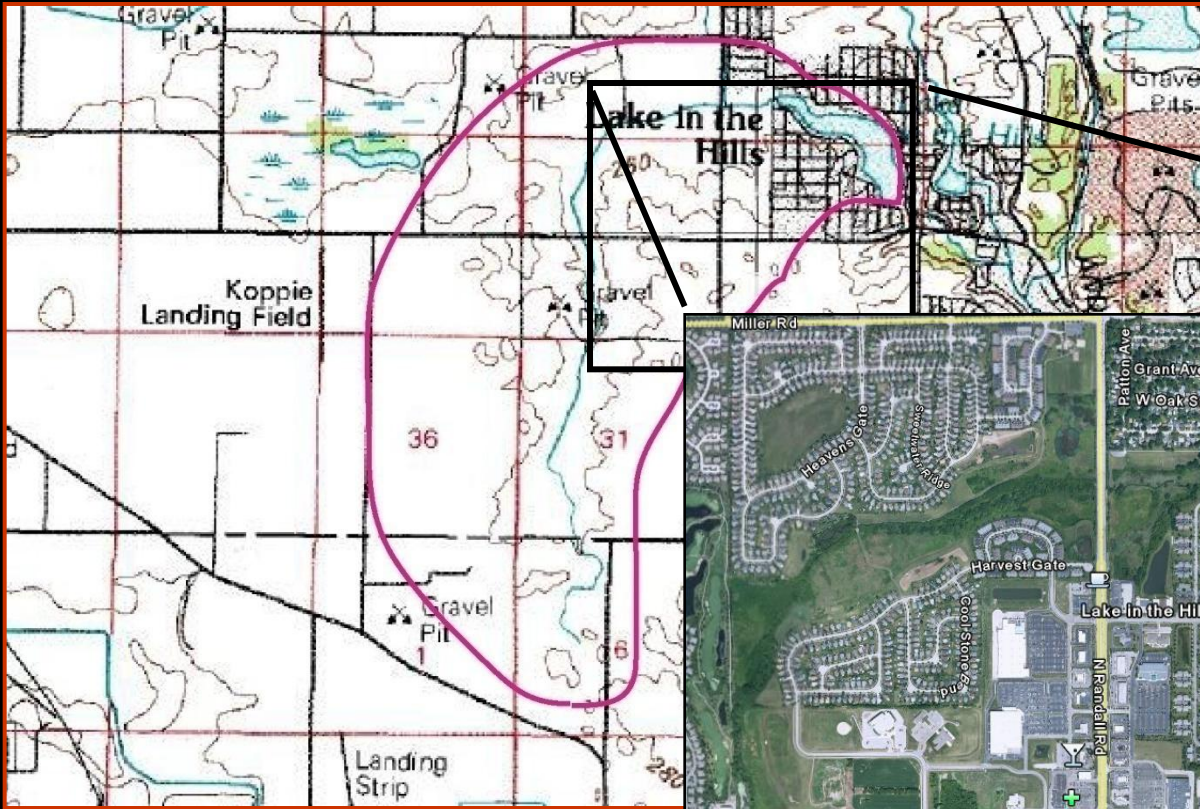


# What is causing upward trends in PAHs?

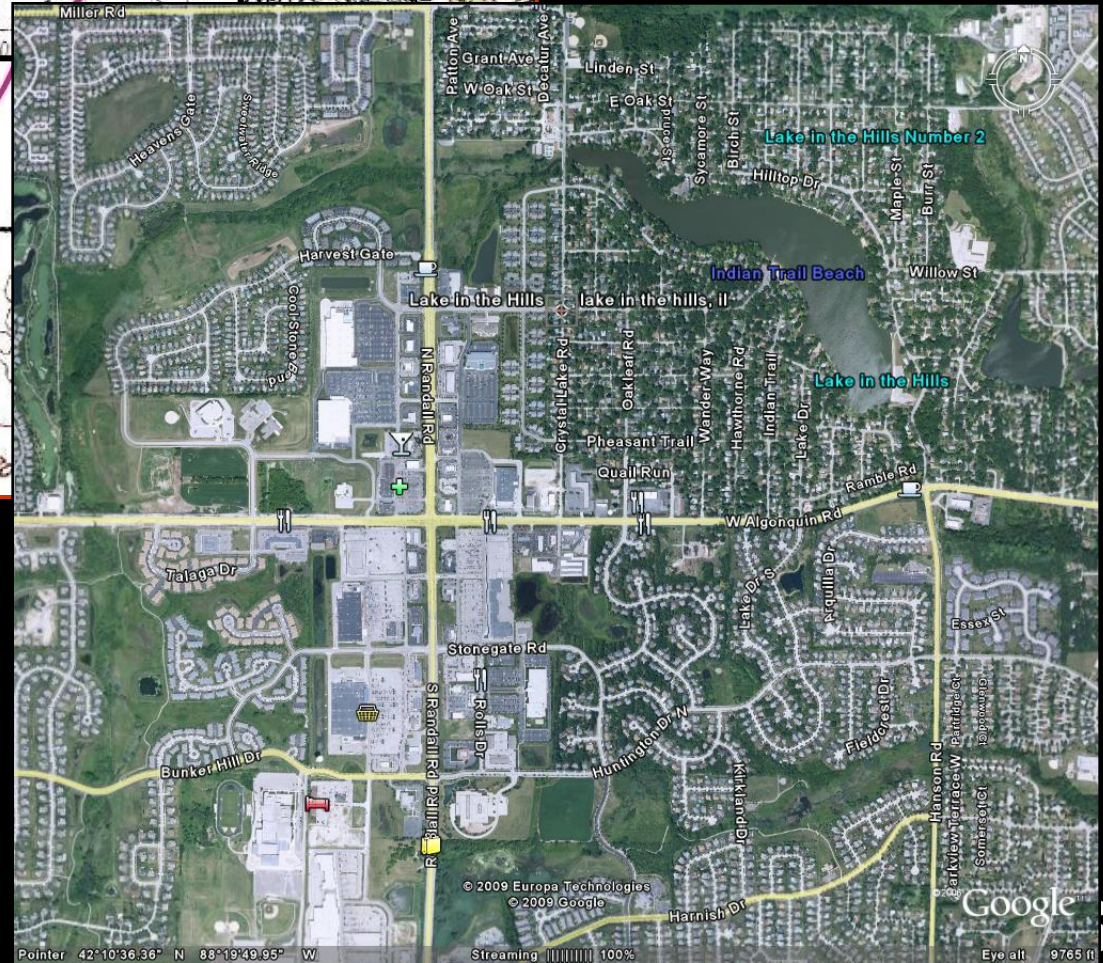


# Lake in the Hills

In 1975, 11% urban



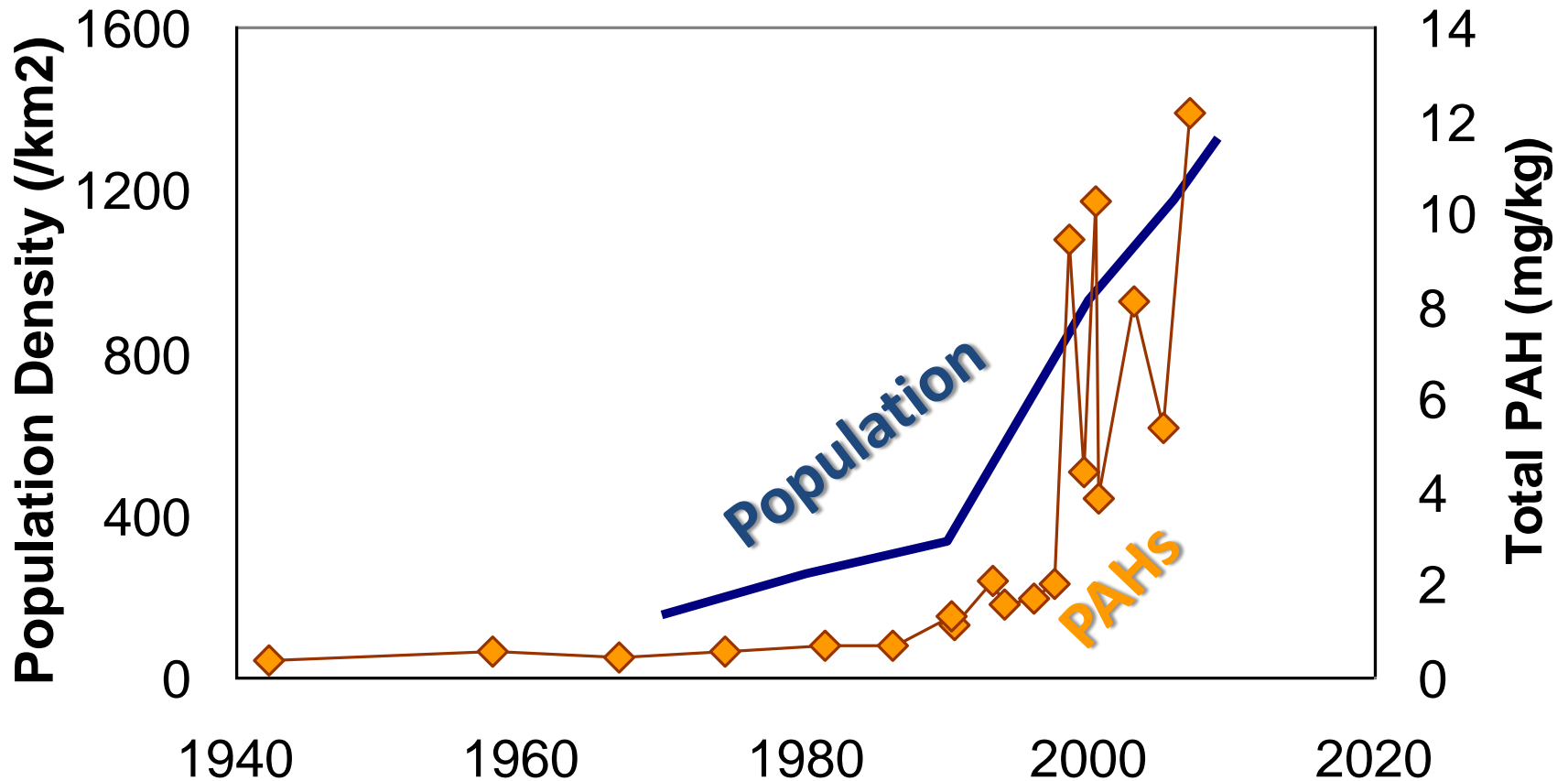
In 2000, 78% urban





# Population growth and PAH

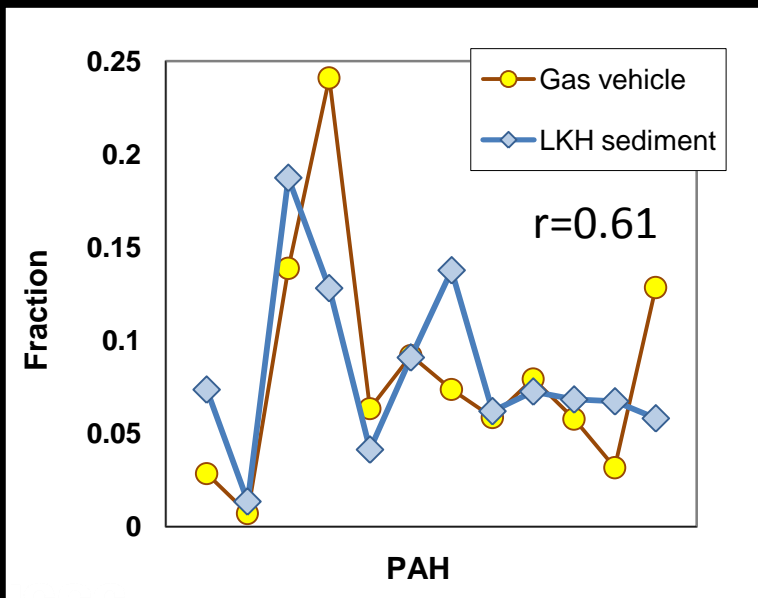
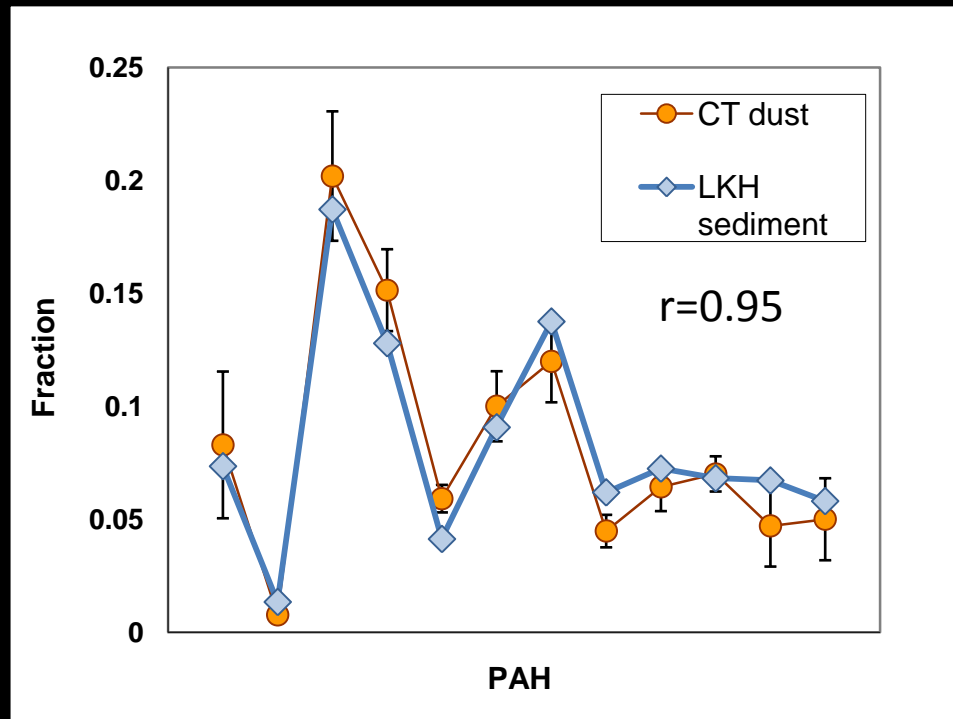
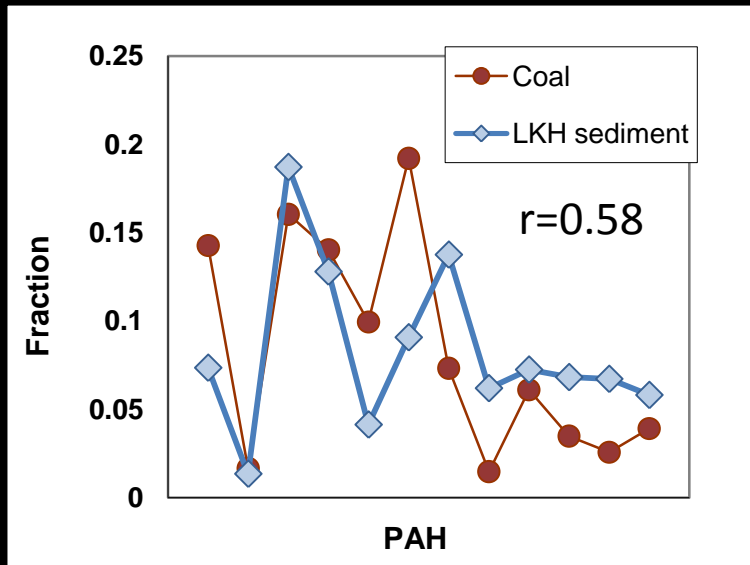
## Lake in the Hills, IL



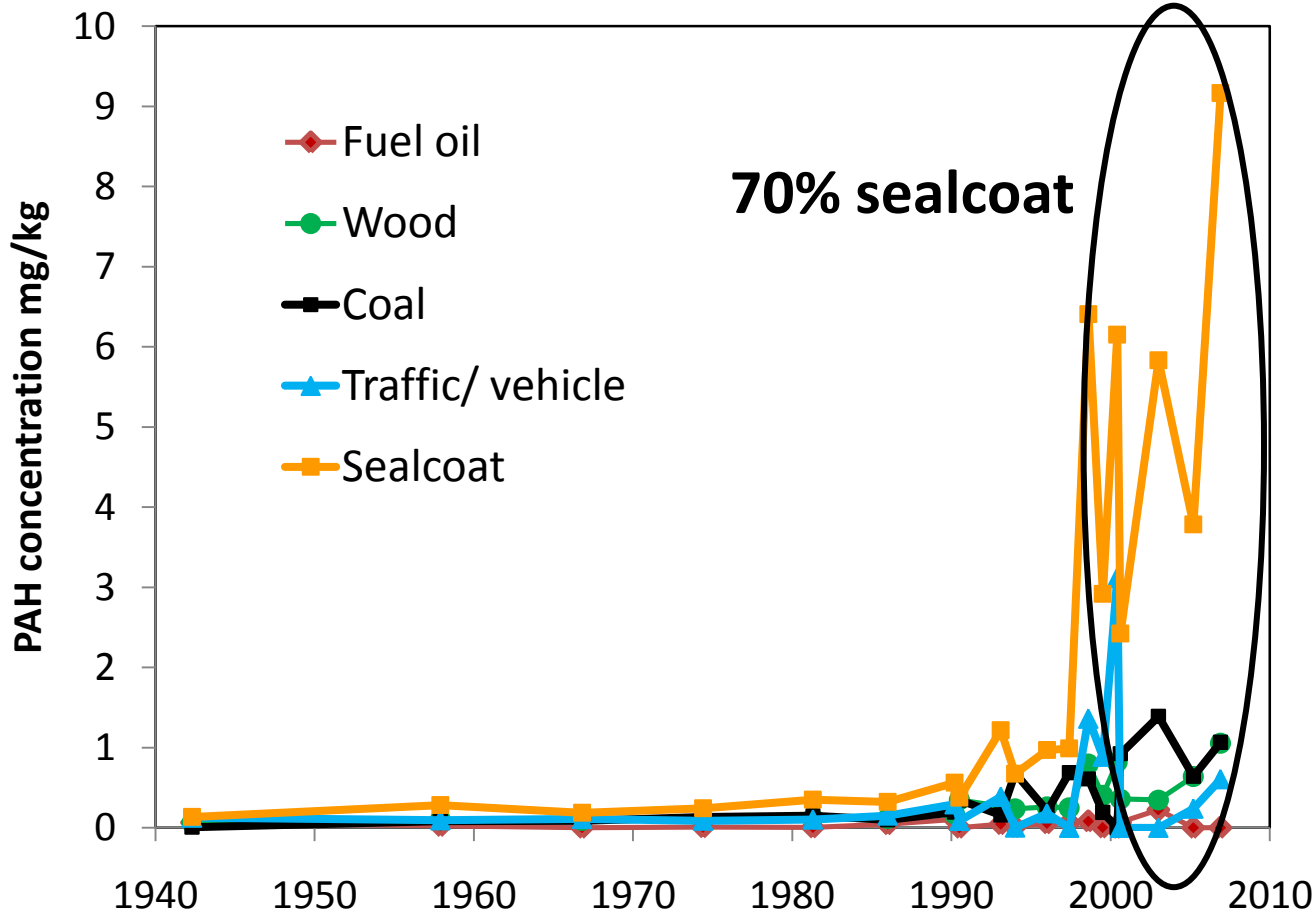
# Environmental forensics: PAH “fingerprints”



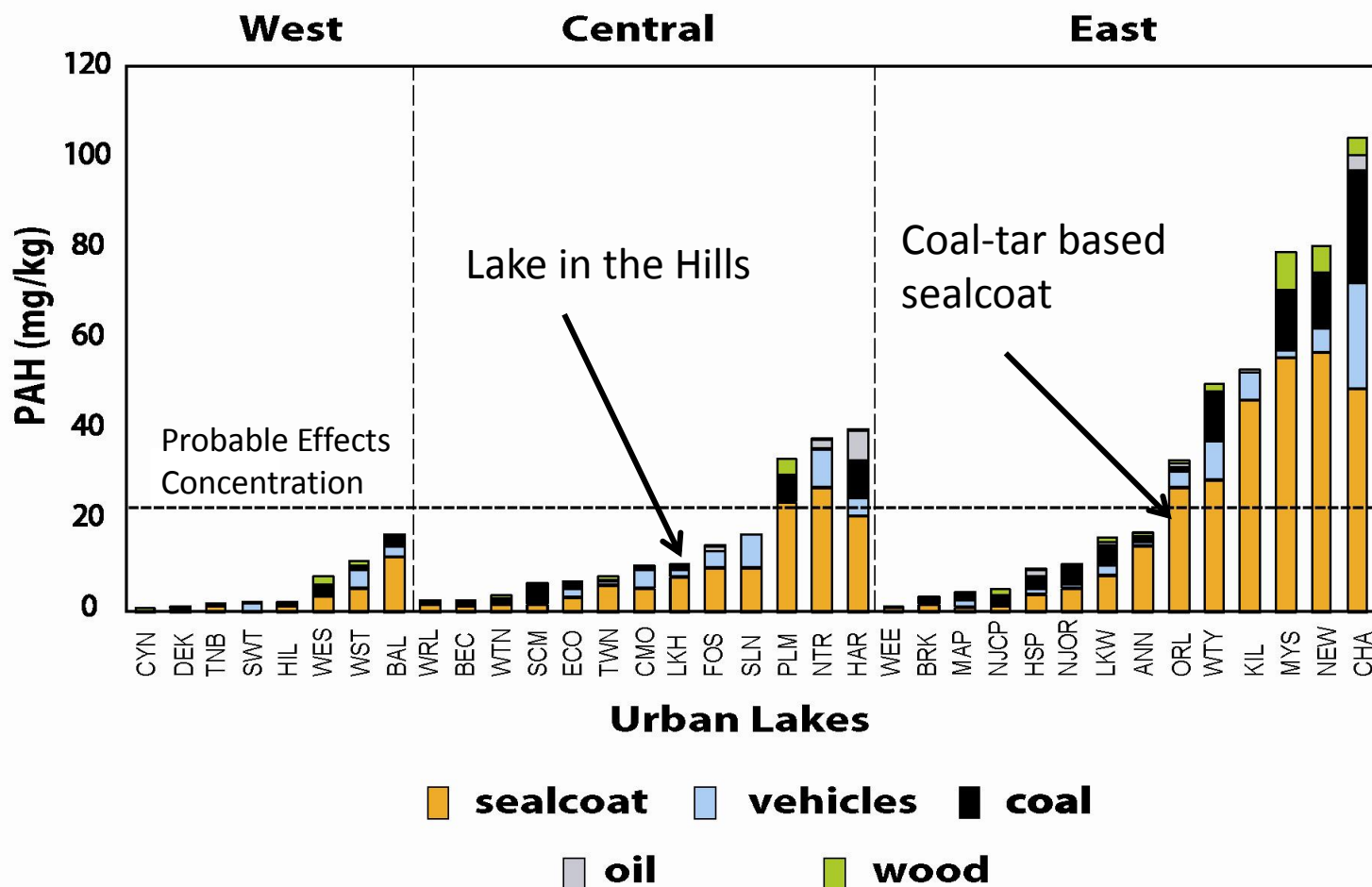
# PAH fingerprint at Lake in the Hills



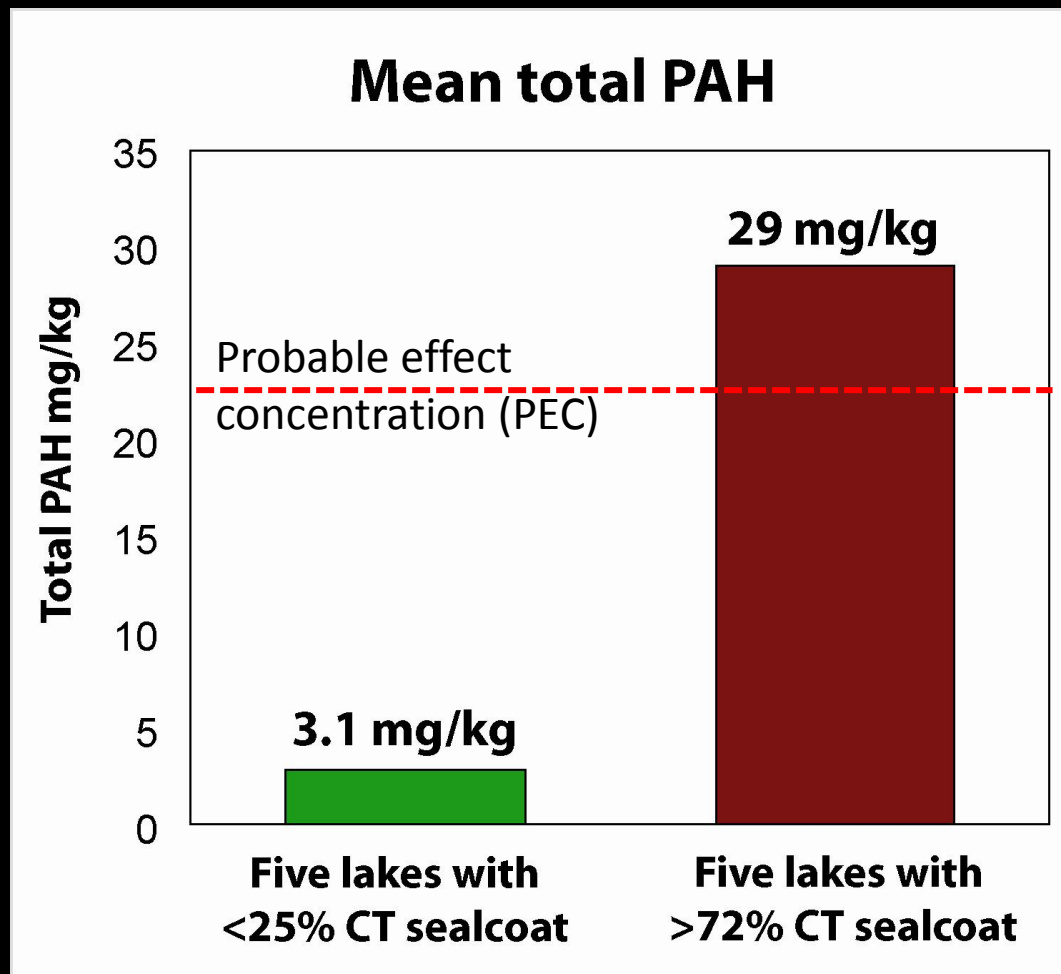
# Sources of PAHs to Lake in the Hills



# PAH sources to U.S. urban lakes



# A large coal-tar-sealcoat contribution translates to high PAH concentrations



# Biological effects



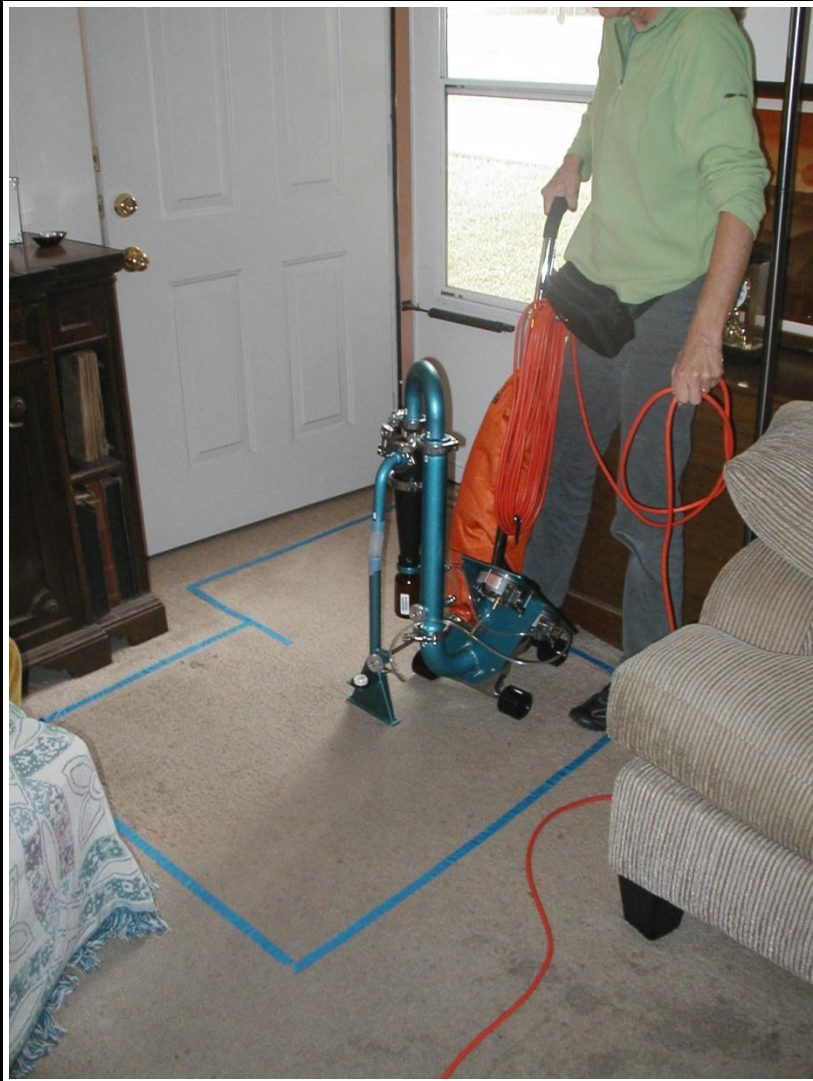
Bommarito et al., 2010, Ecotoxicology  
Bommarito et al., 2010, Chemosphere  
Bryer et al., 2009, Environ. Poll.  
Bryer et al., 2006, Ecotoxicology  
Scoggins et al., 2006, J. NABS



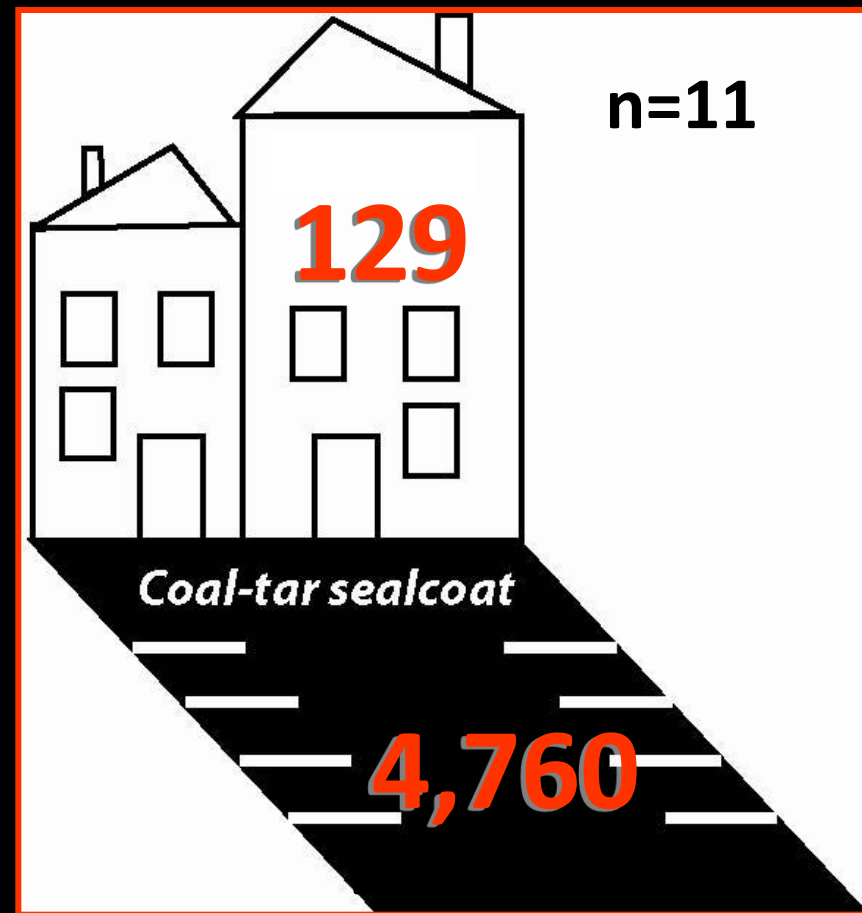
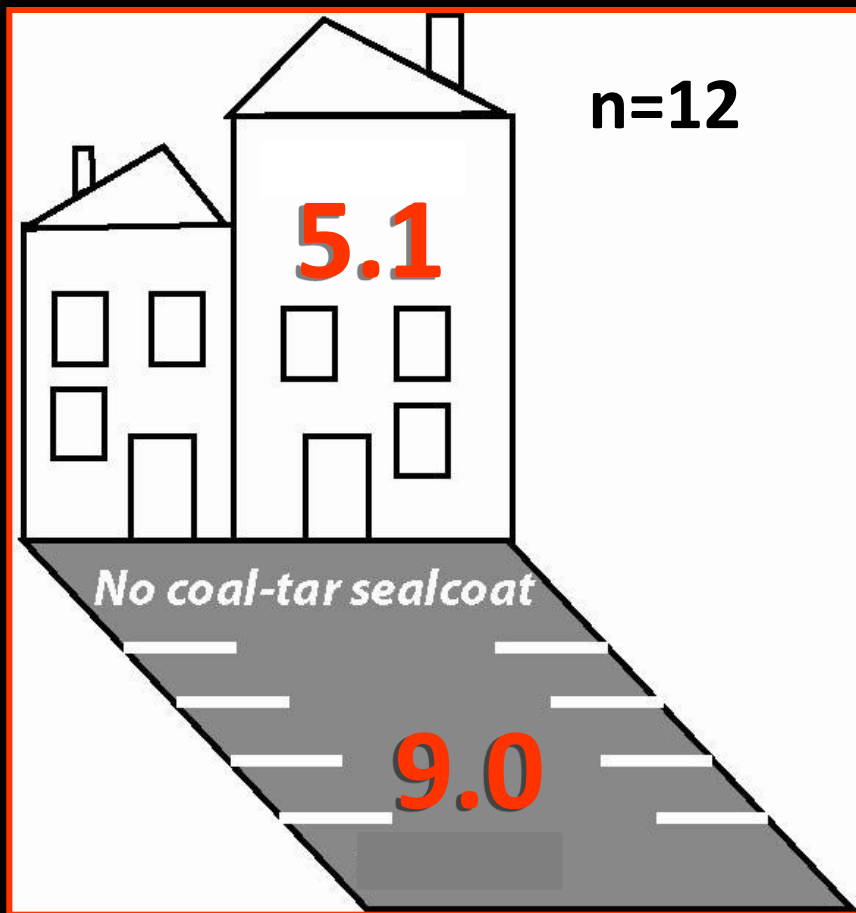
Photos from Jupiter Images and Corbis Images, Inc.



# 23 ground-floor apartments



# Median total PAH [mg/kg]



PAHs are increasing in urban lakes nationally



High PAH concentrations? ✓  
Use is extensive? ✓  
Particles are mobile? ✓



Coal-tar-based sealcoat is the largest contributor of PAHs to urban lakes

PAHs in house dust are elevated where coal-tar-based sealcoat is used

# USGS publications on sealcoat and PAH in peer-reviewed scientific journals

- Van Metre, P. C.; Mahler, B. J. ., 2010, Contribution of PAHs from Coal-Tar Pavement Sealcoat and Other Sources to 40 U.S. Lakes. [Science of the Total Environ., v. 409, 334-344.](#)
- Mahler, B. J.; Van Metre, P. C.; Wilson, J. T.; Musgrove, M.; Burbank, T. L.; Ennis, T.; Bashara, T. J., 2010, Coal-tar-based parking lot sealcoat: An unrecognized source of PAH to settled house dust. [Environ. Sci. Technol. Vv 44, 894-900.](#)
- Yang, Y., Van Metre, P.C., Mahler, B.J., Wilson, J.T., Ligouis, B., Razzaque, M.M., Schaeffer, D.J., and Werth, C.J., 2010, Influence of coal-tar sealcoat and other carbonaceous materials on polycyclic aromatic hydrocarbon loading in an urban watershed: [Environ. Sci. Technol., v. 44, p. 1217-1223.](#)
- Van Metre, P. C.; Mahler, B. J.; Wilson, J., 2009, PAHs underfoot: Contaminated dust from sealcoated pavements. [Environ. Sci. Technol. ,v. 43, \(1\), 20-25.](#)
- Van Metre, P.C., and Mahler, B.J., 2005, Trends in Hydrophobic Organic Contaminants in Lake Sediments Across the United States, 1970-2001: [Environ. Sci. Technol., v. 39, no. 15, p. 5567-5574.](#)
- Mahler, B. J.; Van Metre, P. C.; Bashara, T. J.; Wilson, J. T.; Johns, D. A., 2005, Parking lot sealcoat: An unrecognized source of urban PAHs. [Environ. Sci. Technol.,v. 39, \(15\), 5560-5566.](#)