

Coal Tar Sealants and Urban Sediments: A Forensic Chemist's Perspective

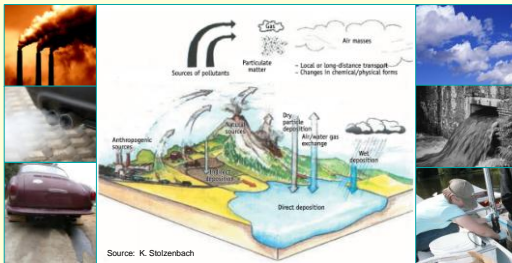
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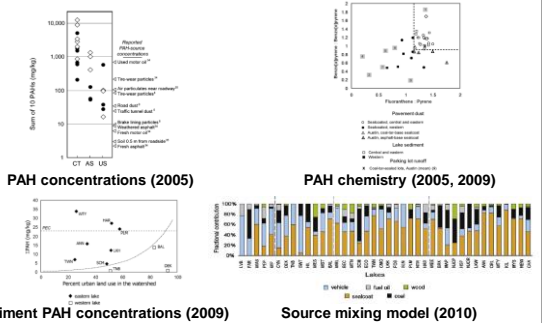
Background

- **Traditional hypothesis**
 - Atmospheric deposition is a primary source of PAHs in urban sediments
- **USGS hypothesis**
 - Coal tar sealants are a significant source of PAHs

Traditional Hypothesis: Atmospheric Deposition Is a Primary Source of PAHs



USGS Hypothesis: Coal Tar-Sealants Are a Significant Source of Sediment PAHs



What is the USGS's evidence?

- Similarity of PAH chemistry in sealants and sediment in a few urban systems
- PAH concentrations of coal tar -sealants
- Apparent regional differences in sediment chemistry



Is similarity enough to convict?

- Are they similar or the same?
- Are other sources just as similar?



Which two are the same?

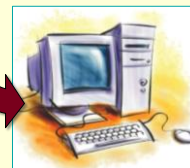
Project Goal

- Use environmental forensics to evaluate the hypothesis that coal tar sealants are a significant source of PAHs in urban sediments



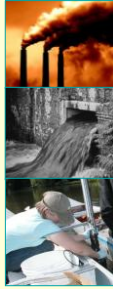
Forensic Data Evaluation

- 200+ samples
- 16+ compounds per sample
- Multiple sources
- Many urban sediments
- Relative source similarities
- Range of sediment chemistries
- Similarity of sediments and sources
- Effect of source mixing



Our Study Evaluated More Sources and Sediments Than the USGS

- Data from over 200 samples compiled from peer-reviewed articles and agency reports with individual sample results
 - Atmospheric particles
 - Roof dust
 - Coal tar sealed parking lots
 - Highway runoff
 - Soils
 - Urban pond sediments

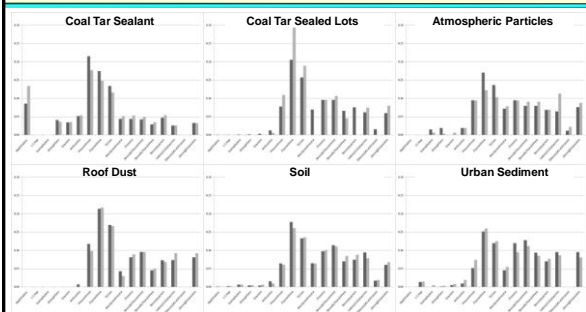


Our Study Applied a Wider Range of Data Evaluation Methods

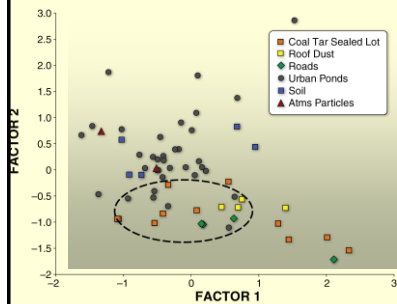
- PAH fingerprints
- PAH double ratios
- Statistical correlation
- Multivariate analysis



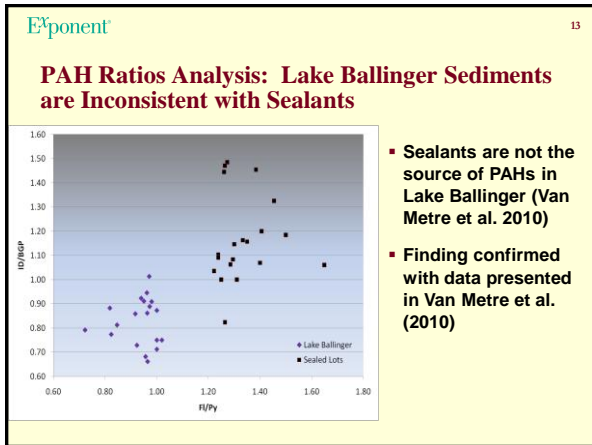
Example Data Input: Samples with Similar PAH Fingerprints



Principal Component Analysis: Sealants are Not a Unique Source of Sediment PAHs



- Limited overlap between sealant and sediment samples
- Similar results with other environmental sample types



- Exponent 14
- ## Problems with the USGS's Application of the Chemical Mass Balance Model (Van Metre et al. 2010)
- Insufficient number of sources considered
 - Insufficient consideration of changes in PAH profiles because of chemical and biological transformations
 - No confirmation of results
 - Model output is not consistent with data evaluation methods used in prior USGS publications

- Exponent 15
- ## Conclusions
- PAH chemistry of coal tar-sealants is similar to other environmental sources
 - Sediments are not more like sealants than these other sources
 - Most sediments can be distinguished from sealants
 - Sealants are not a unique source of PAHs
 - Data are consistent with the traditional hypothesis that atmospheric sources are a major contributor to PAHs in sediments
 - The results do not eliminate sealants as a potential PAH source in some locations

Exponent 16

Acknowledgment

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