STATISTICAL FINGERPRINTING OF PCBs USING THE SUBSET WITH DIOXIN-LIKE ACTIVITY

Timothy Towey, Noémi Barabás, Avery Demond, Lynn Zwica, Kristine Knutson, Alfred Franzblau, David Garabrant, Peter Adriaens
The University of Michigan– Ann Arbor, Michigan, USA; LimnoTech – Ann Arbor, Michigan, USA

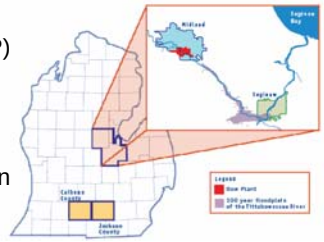
Introduction & Objectives

- Polytopic vector analysis (PVA) is a multivariate statistical fingerprinting technique that was used to better understand the distribution of congeners in the University of Michigan Dioxin Exposure Study (UMDES) soil and dust datasets.
- This poster presents results of statistical fingerprinting using the 12 polychlorinated biphenyl (PCB) congeners included in the WHO 29 dioxin-like compounds
- Although these 12 compounds are a small subset of the 209 PCB congeners, this analysis demonstrates that the resulting fingerprints may be linked to Aroclor sources.
- Distributions of the contributions of each Aroclor to the dust and soil of the different study populations are compared.

Methods

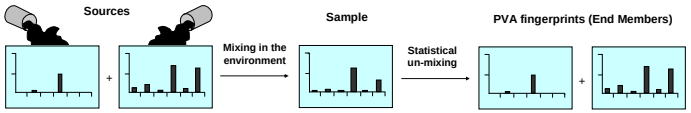
Sample Collection

- Four of the five study populations were located in counties surrounding the Dow Chemical Plant:
  - (Tittabawassee River) Floodplain (FP)
  - Near Floodplain (NFP)
  - Other Midland/Saginaw (MS)
  - Midland Plume (PL)
- One study population, Jackson/Calhoun (JC), was far removed from the Dow Chemical Plant and served as the reference population.



- Chemical analysis was performed on:
  - 2081 soil samples from 766 properties
  - 764 household dust samples

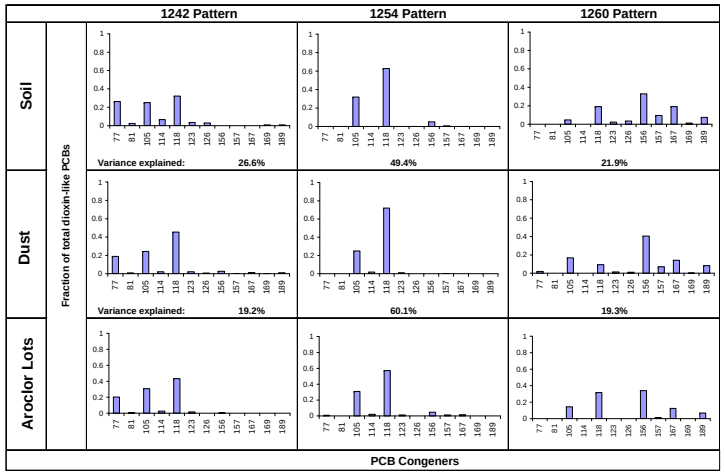
Polytopic Vector Analysis

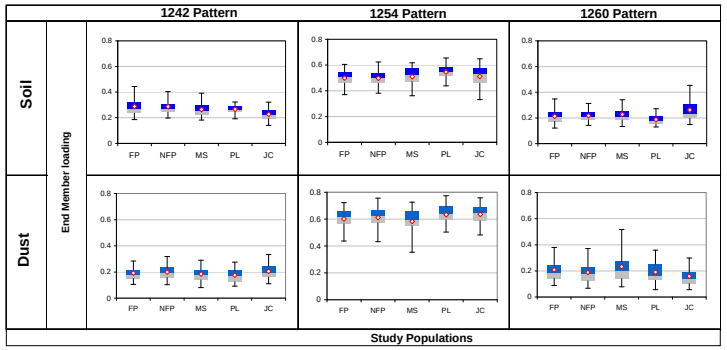


- PVA is a type of factor analysis that has been demonstrated to be useful in “un-mixing” source contributions in environmental systems.
- PVA uses the correlations among congeners to establish which occur together in stable patterns. Each sample is decomposed into these stable patterns, yielding fingerprints that have contributed to the mix in each sample.

Results

- The results from the PVA demonstrate that the subset of 12 PCB congeners can be used to make comparisons to, and differentiate between, some Aroclor patterns.
- For all study populations,for both dust and soil, the Aroclor 1254 pattern has the greatest loading.
- There are slight regional differences in the loadings of the patterns associated with Aroclors 1242 and 1260 for both dust and soil; however, these differences are inconsistent between the two matrices.





-The top figure shows the congener profiles from the three end-member soil and dust models. The profiles show each PCB congener as a fraction of the total of the dioxin-like PCBs. For comparison, profiles based literature values of the three most common Aroclors (1242, 1254, and 1260) are also included (Frame, GM, Cochran, JW, Boewaldt, SS. 1996. *J. High Res Chromatogr.* 19: 657-668).
-The bottom figure presents the distribution of loadings of the three EMs by study population for soil and dust. The whiskers in the box-and-whisker plots represent the 5th and 95th percentiles, the edges of the box represent the 25th and 75th percentiles, the line in the box between colors represents the median, and the hollow dot indicates the mean.

Financial support for this study comes from the Dow Chemical Company through an unrestricted grant to the University of Michigan.