An Evaluation of Methods to Quantify PCB Concentrations

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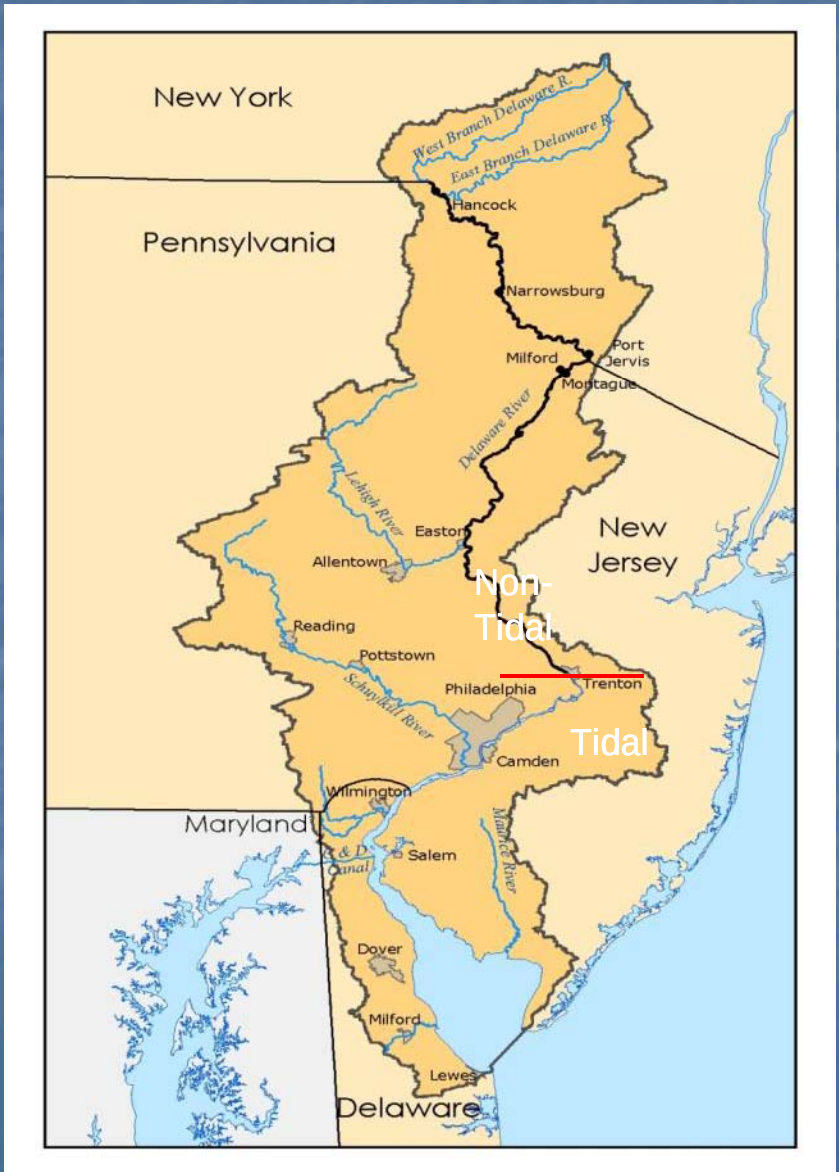
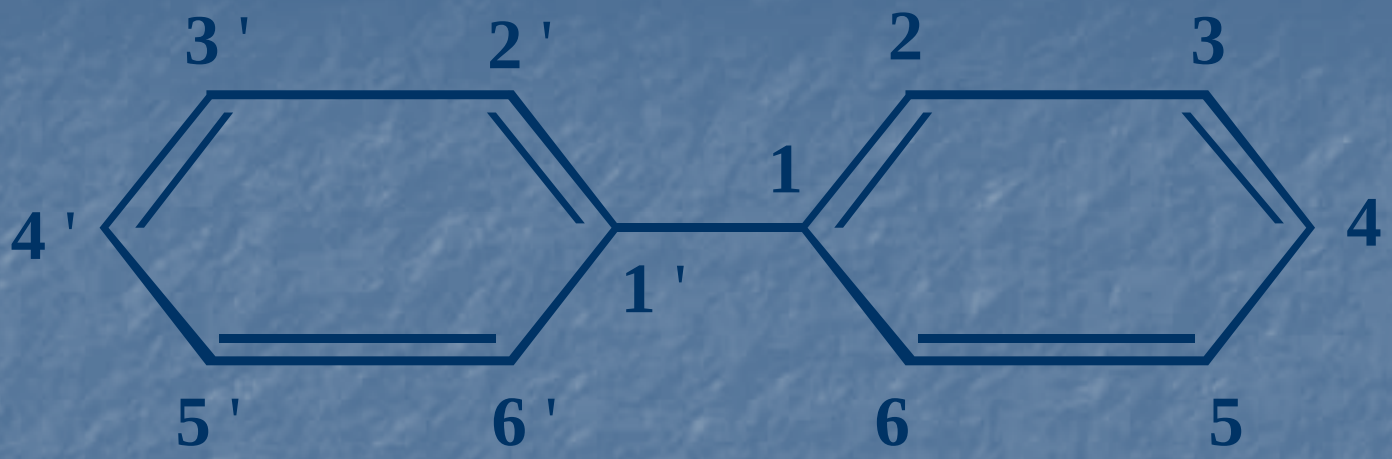
Gregory J. Cavallo, P.G.
Thomas J. Fikslin, Ph.D.

Background: Delaware River Basin Commission



- Formed in 1961 as an Interstate Compact Organization
- Encompasses 4 States and 2 EPA Regions
- Regulatory Authority for issues pertaining to water quality and quantity
- Tidal Delaware River has been included on the Section 303(d) lists of impaired waters (PCBs)
- TMDL established for the Estuary in 2003 and Bay in 2006.

PCBs



- Class of organic chemicals with a biphenyl base structure and 209 possible chlorine substitution patterns.
- Terminology: Aroclors, congeners, homologs.
- Properties: Hydrophobic, tend to accumulate in sediments and tissues.

Introduction

- Different methods are available for the analysis of PCBs:
  - EPA Method 608
  - EPA Method 1668, Revision A
- Substantial differences in analytical approaches yield differences in both the type of results and detection limits achieved
- Data quality objectives drive method selection

DRBC Objectives

- Analyze PCBs in ambient and wastewater samples with:
  - Information on PCB congener distribution
  - Reduced analytical uncertainty
  - Improved comparability between datasets
- Generate accurate PCB loading estimates
- Provide low level PCB concentration information for modeling purposes

Note: Water Quality Criterion - 16 pg/L (ppq)

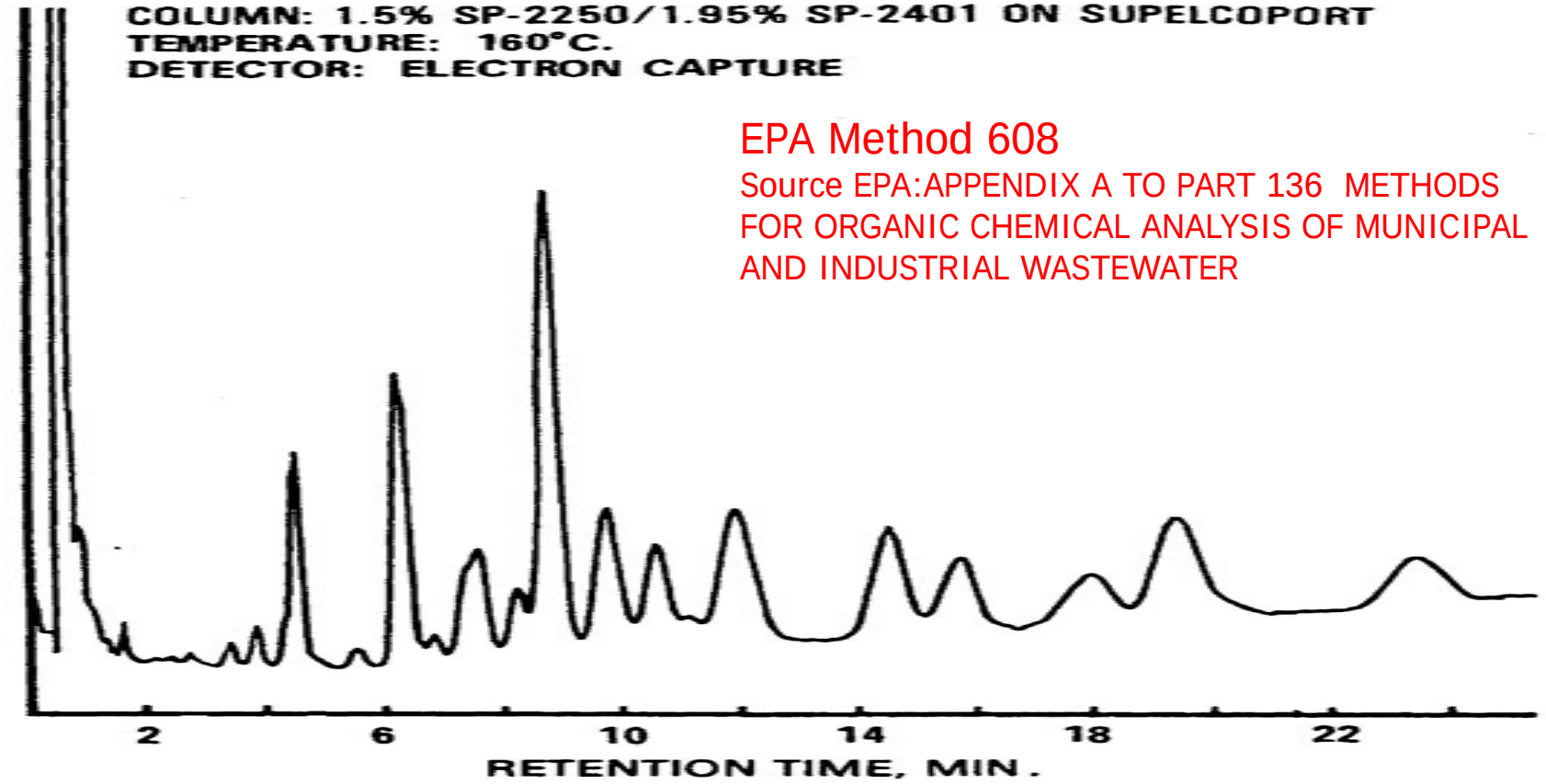
EPA Method 608

- Wastewater method
- Analyzes for PCBs as Aroclors (commercial mixtures)
- A gas chromatographic (GC) method, utilizing a whole pattern recognition approach
- Detection limit 0.065 ug/L (65,000 pg/L or ppt for Aroclor 1242)

Issues

- Environmental samples are compared to an unweathered reference standard
- Single calibration standard added at 50ug/mL (50 ppm)
- Does not analyze for all 209 PCB congeners (compounds)

Gas Chromatogram for Aroclor 1242



EPA Method 608

Source EPA:APPENDIX A TO PART 136 METHODS FOR ORGANIC CHEMICAL ANALYSIS OF MUNICIPAL AND INDUSTRIAL WASTEWATER

Aroclor 1242 contains 157 individual PCB compounds

EPA Method 1668 Revision A

- Method applicable to water, sediment and tissue analysis
- Performance based High Resolution GC/High Resolution MS method
- Multiple point calibration standard (5-6)
  - Lowest calibration point equivalent to 5 pg/L
- Provides results for all 209 congeners
- Detection limits in the single pg/L range

Advantages

- Identifies individual PCB compounds
  - Critical when evaluating weathered samples
- Reduced analytical uncertainty
  - Better identification and characterization of sources
  - More accurate TMDL
- Comparability between samples and across media
  - Long-term trend analysis
  - Used for water quality modeling of homologs

Results

- In >1,000 samples collected from >90 NPDES dischargers, detection limits ranged from 1-3 pg/L per congener
- Detection limits four orders of magnitude lower than EPA Method 608
- Better characterization of loadings and trends

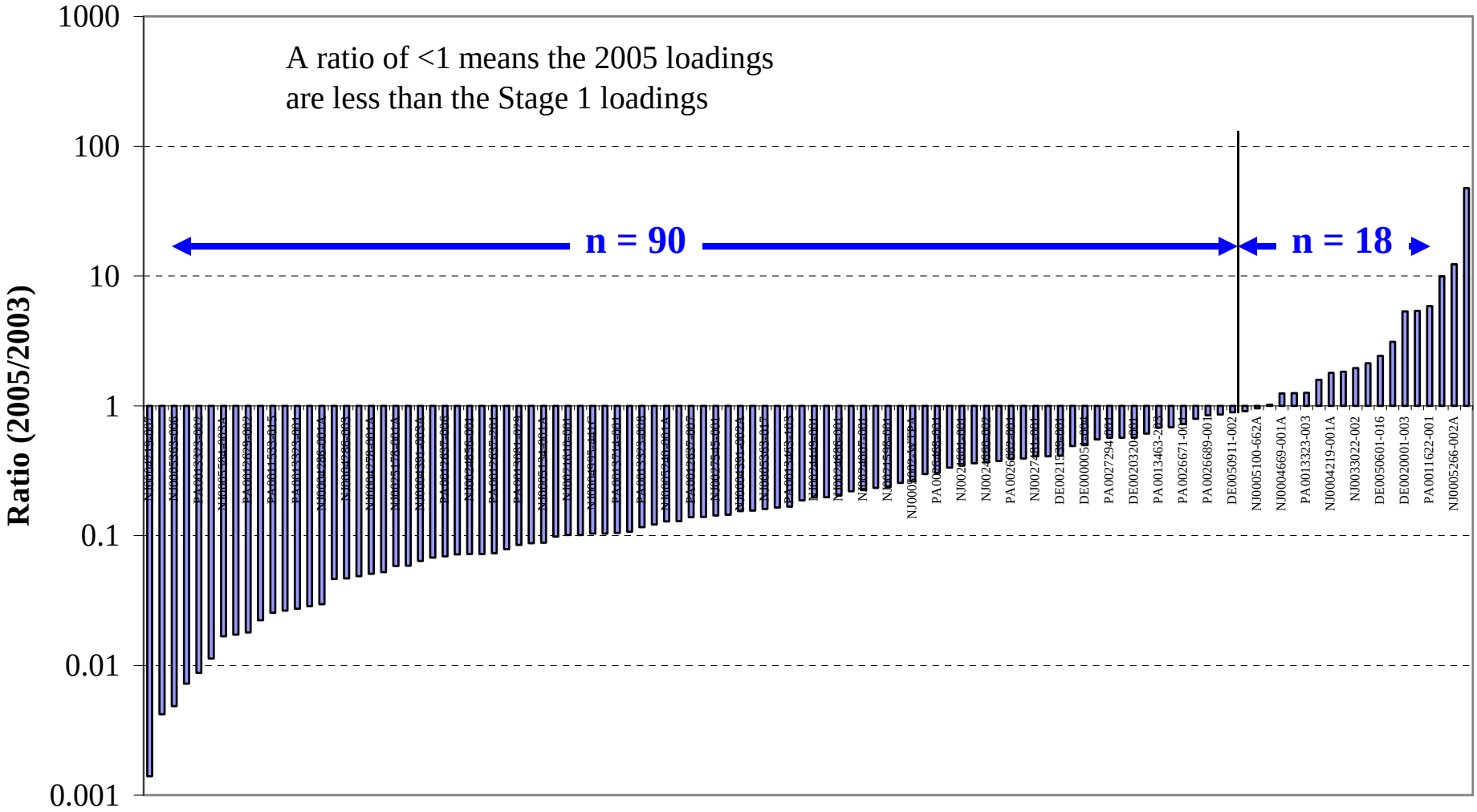
Management Benefits

- Prioritize PCB loading sources and track remedial efforts
- Provide a basis for determining effectiveness of pollutant reduction initiatives
- A uniform and accurate analytical method provides for direct and candid communication between the regulated community, environmental community and the regulatory agencies

Management Benefits

- Dynamic database was created which can be readily amended to include new information and transferred to any Windows based operating system
- This system has been transferred to state agencies for their use. PA and NJ have intrastate issues with PCBs

Ratio of Stage 1 penta-PCB loads to 2005 loads (Total n=108)



Total PCB Concentrations in Point Source Discharges by Discharge Flow