Advanced Analysis of Stormwater Monitoring Data

Lester McKee and Lisa Sabin
RMP annual meeting, October 14, 2021
Problem

- San Francisco Bay is polluted with PCBs
- Peak use period 1975! So these bioaccumulative chemicals are persistent!
- Stormwater agencies are identifying the most polluted catchments, looking for sources, determining the best management response, and treating sources to reduce stormwater loads
- Takes a lot of time and money
RMP Support

● Many sites characterized for PCB concentrations in water and on suspended sediment during one storm

● However, catchment prioritization using this data is hampered by variations in flow and sediment erosion

● In addition, even after identifying a catchment of interest, it is difficult to identify source properties upstream
Methods

Small Tributaries Pollutants of Concern Reconnaissance Monitoring: Loads and Yields-based Prioritization Methodology Pilot Study

Prepared by:
Lester J. McKee, Alicia N. Gilbreath, Jennifer A. Hunt, Jing Wu, Don Yee, and Jay A. Davis
San Francisco Estuary Institute

Small Tributaries Pollutants of Concern Reconnaissance Monitoring: Pilot Evaluation of Source Areas Using PCB Congener Data

Prepared by:
Jay A. Davis and Alicia N. Gilbreath
San Francisco Estuary Institute
Loads and Yields

- Catchment mass loads of PCBs and yields from the old industrial area in each of the catchments were computed by:
  - Combining rainfall with a modeled estimate of runoff, and PCB concentrations measured during storms
  - Adjusting load to a standard storm size and dividing the load by the area of older industrial land use in each catchment

- Yield computed in this way allows us to directly compare and rank PCB sources areas one to another rather than whole catchments
The Power of Loads and Yields

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Aroclors

- Commercial mixtures of PCB congeners

- Each mixture had slightly different properties making it ideal for certain uses

- Selected congeners were used to fingerprint our samples and determine the Aroclors present at each watershed sampling site

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Examples of major uses:
- Capacitors
- Transformers
- Caulk
- Hydraulic fluids and other lubricants

Fingerprint congeners:
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Concentration in stormwater (ng/L)

Yield from older industrial areas (g/km2)
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1. Concentration on suspended sediment (ng/g)
2. Concentration in stormwater (ng/L)
3. Yield from older industrial areas (g/km²)
Ranking Catchments by each Indicator

- Concentration on suspended sediment (ng/g)
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Ranking watersheds by yields

- Concentration on suspended sediment (ng/g)
- Concentration in stormwater (ng/L)
- Yield from older industrial areas (g/km²)
Yields and Aroclors

Case 1: Rodeo Creek (CCC)

- 4% old industrial
- 14 ng/L (Rank = 37)
- 5 ng/g (Rank = 135)
- 1.2 g/km2 (Rank = 2)
- Primary Aroclors: 1260, 1242
Part II: Practical Uses and Benefits of the Stormwater Monitoring Data Advanced Analysis Methods

Support for PCBs Source Investigations
Stormwater Programs Current Method for Prioritizing Areas for Source Investigation

- Collect screening-level stormwater samples at catchment outlets
- Apply thresholds to identify catchments for source investigation

PCBs Concentrations on Suspended Sediment

- Threshold for "Elevated" sites = Top 15th Percentile
- 0.5 mg/kg

OR

PCBs Concentrations in Water

- Threshold for "Elevated" sites = Top 15th Percentile
- 34 ng/L
Stormwater Program Data Needs:

1. Identify High Priority Catchments
   = Areas contributing to elevated stormwater loads
   • i.e., above urban background

2. Identify low priority catchments
   = Areas not contributing to elevated stormwater loads

- Normalized Yields provide another metric to prioritize catchments for management actions
- Allows direct comparison of source area loads across catchments
- Reduces risk of false negatives
- Identifies sites that require re-sampling
- Aroclor Indicators can hint at potential sources within a catchment

Supports Source Identification!
Example: Elevated Yields

Sites with elevated yields that are BELOW the concentration threshold = Missed Opportunity to Target Sources!!
Example: Re-Sample
Example: Aroclor Indicators
Stormwater sample collected downstream of a former caulk manufacturer:

- High PCB concentrations
- Catchment has high PCBs yield, indicating a source.
- Congener data show Aroclor 1254 is the primary Aroclor in the sample.

Caulk was a major use of Aroclor 1254!!
Summary

- The RMP has developed new methods for stormwater monitoring data analysis to gain insights about pollution sources and locations where management actions can have greater water quality benefit.
- The old methods of ranking based on concentration only allowed us to make comparisons at the scale of whole watersheds. Now, by estimating yields, we are able to directly compare PCB loads coming from older industrial areas - the actual scale at which management effort occurs.
- By fingerprinting Aroclors, we can get further hints about the possible sources in these older industrial areas.
- The methods are starting to be put into practical use.