Sources and Pathways of PCB-11: Initial Investigations

SRRTTF Meeting

September 22, 2021

Sources and Pathways of PCB-11: Initial Investigations
Background

- PCB-11 is of particular interest in the Spokane River watershed because of its prevalence in the water column
  - Desire to identify the sources of PCB-11
- Objective: Conduct mass balance for PCB-11 to identify:
  - What are the predominant known sources?
  - How important are unknown sources?

Approach

- Compile blank-corrected PCB-11 data from instream and discharges
- Conduct mass balance assessment
  - 2014, 2015, and 2018 synoptic surveys
  - Similar to what was done previously for total PCBs and individual homologs
- Calculate magnitude of loading from known and unknown sources

Mass Balance Approach

- Calculate load of PCB (mass per time) in river at several locations
  - Load = River PCB concentration x River flow
- Determine load of PCB added to river between two monitoring stations by comparing upstream and downstream load

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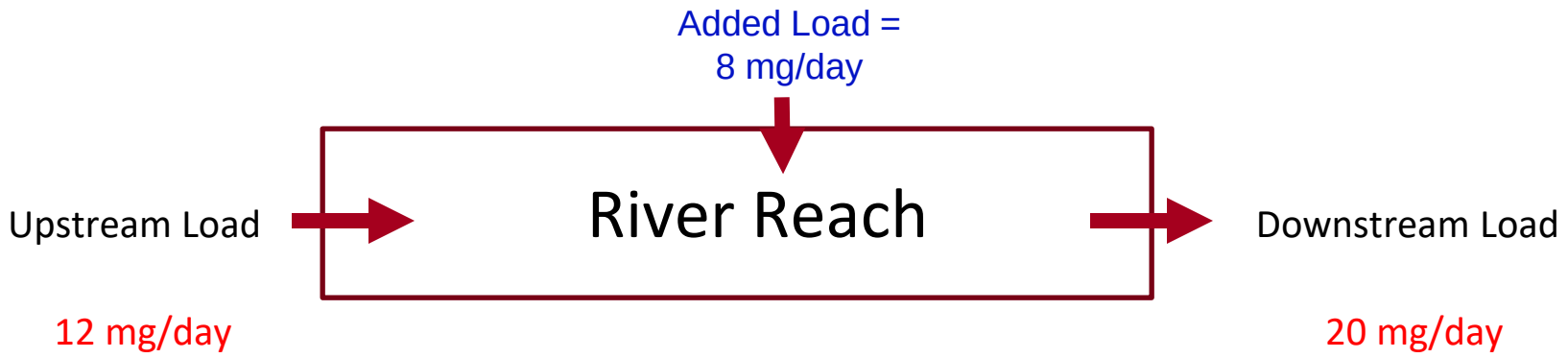
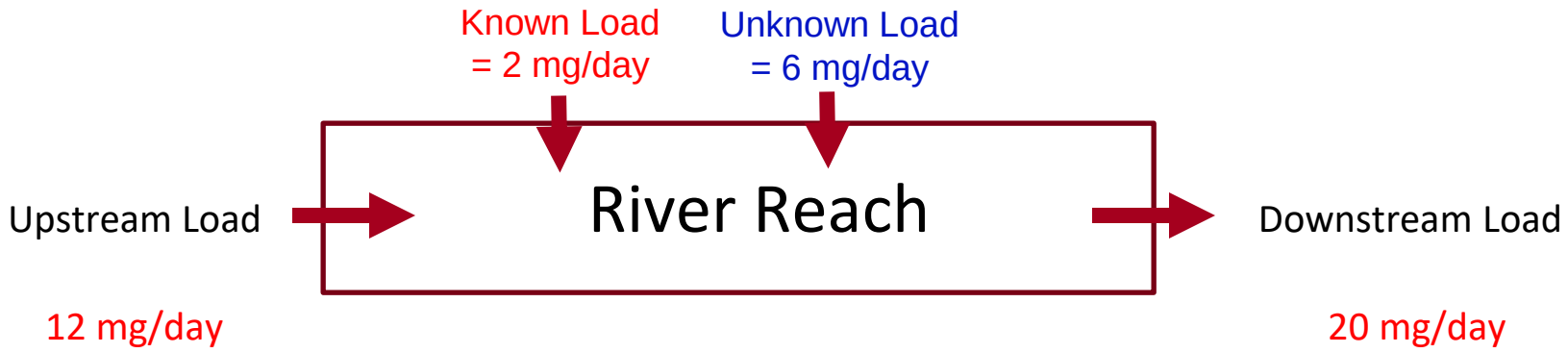
  - Added load = Downstream load – upstream load



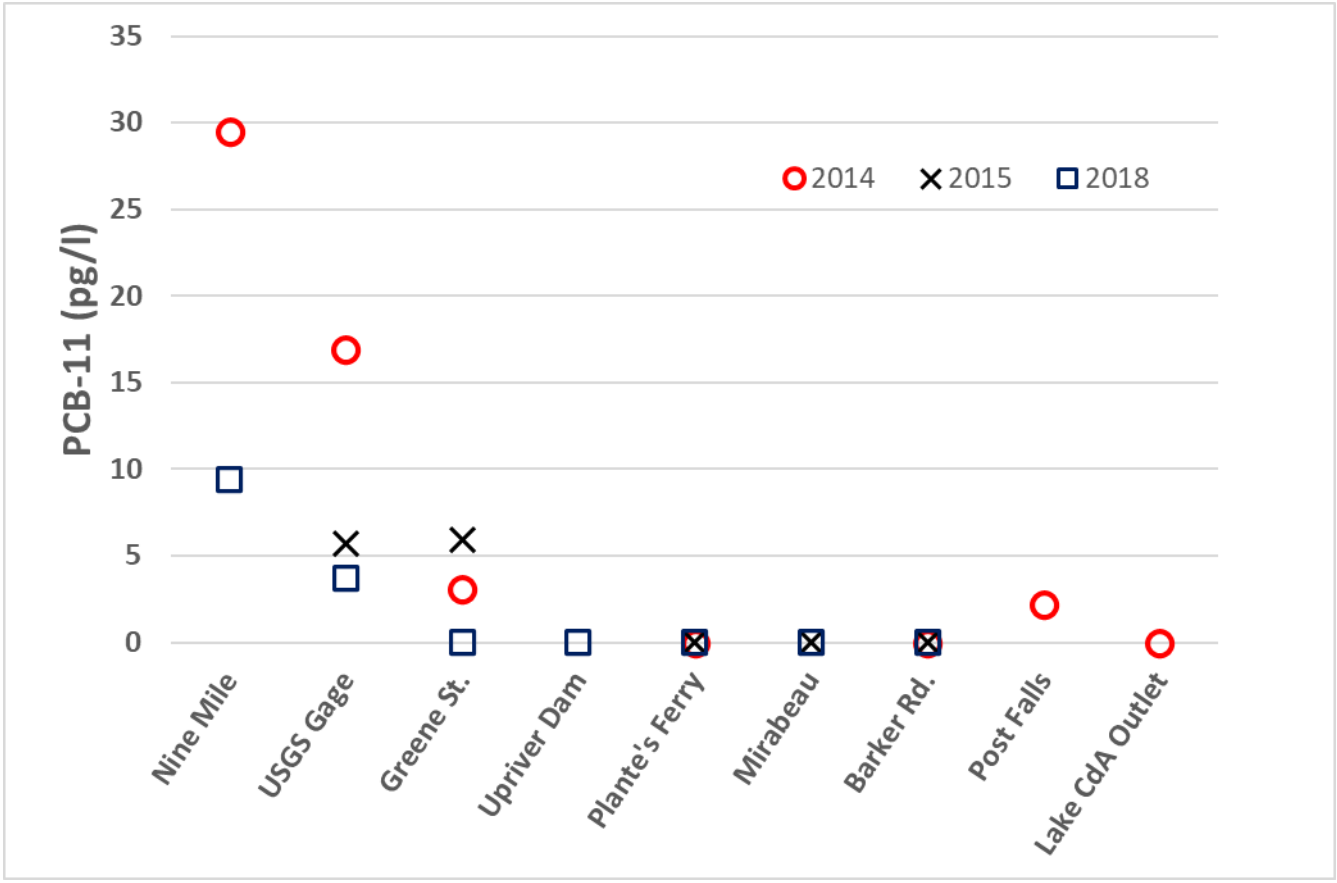
Mass Balance Approach

- Added load can be divided into known (e.g., point sources) and unknown components
  - Unknown load = Downstream load – upstream load – known load



Spokane River PCB-11 Concentrations

- Consistent pattern across all three surveys
  - Concentrations essentially indistinguishable from blanks at Upriver Dam and upstream
  - Concentrations increase at Greene St. and downstream



Known External Loading Sources

- City of Spokane and Inland Empire Paper are the largest known contributors of PCB-11
  - 4 to 6 mg/day
- Spokane County at intermediate level
  - 1 to 1.5 mg/day
- All other known sources less than 0.15 mg/day

Magnitude (mg/day) of Known PCB-11 Load by Source and Year

Time Period	Lake Coeur d'Alene Outlet	Post Falls WRF	Liberty Lake WRF	Kaiser Aluminum	IEP	Spokane County RWRF	Latah/ Hangman Ck.	City of Spokane RPWRF
2014	0	0.13	0.10	0	4.35	1.27	0.12	5.72
2015	-	-	-	0	4.05	1.45	-	-
2018	-	-	-	0	4.22	1.17	0	4.05

Mass Balance Results

Magnitude (mg/day) of Unexplained PCB-11 Load by River Reach and Year

Time Period	River Reach								Total
	Lake CdA to Post Falls	Post Falls to Barker	Barker to Mirabeau	Mirabeau to Plante's Ferry	Plante's Ferry to Upriver	Upriver to Greene	Greene to USGS Gage	USGS Gage to Nine Mile	
2014	2.8	-3.3	-0.94		40.7			-	40.4
2015	-	-	0	0	6.2		-1.9	-	4.3
2018	-	-	0	0	-4.2	-1.2	10.7	19.4	24.7

Summary

- PCB-11 concentrations are essentially indistinguishable from blanks in upper portion of study area (i.e., Upriver Dam and upstream)
- PCB-11 concentrations in lower portion of study area are at levels greater than can be explained by known loading sources
- The magnitude of the unexplained load appears large relative to known sources
  - Largest individual known load is 5.7 mg/day
  - Unexplained load ranges from 4 to 40 mg/day
- No obvious explanation for the origin of the unexplained load

Follow-Up Analyses
Based on Comments from TTWG & iPCB/TSCA Work Groups

- What do available groundwater data show?
  - PCB-11 concentrations in groundwater are indistinguishable from blank samples
- What do the SPMD data show?
  - PCB-11 concentrations are higher at Nine Mile Dam than all upstream stations
  - PCB-11 concentrations are lower at Nine Mile Dam than during synoptic surveys
- What do the biofilm data show?
  - PCB-11 concentrations at USGS Gage and Nine Mile Dam not noticeably higher than upstream
- How does the magnitude of unknown sources of PCB-11 compare to the magnitude of unknown sources of total PCBs?
  - Varies by year: 30 to 100%