

PCB sources to WWTPs in the  
Spokane River Basin  
**PRELIMINARY RESULTS**

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# Background

- 5 plants considered:
  - SCRWRF – has always been membrane filtration
  - CDA – upgraded during the study, before and after data available (and other treatment levels)
  - City of Spokane – not yet upgraded
  - HARSB – not yet upgraded
  - PF – not yet upgraded
- Data was mostly compatible, all used SPB-octyl column
  - Some small differences in coelution patterns
- Not included in PMF, analyzed separately:
  - IEP (biased the results)
  - LL (different GC column)

# Influent – non-Aroclor congeners

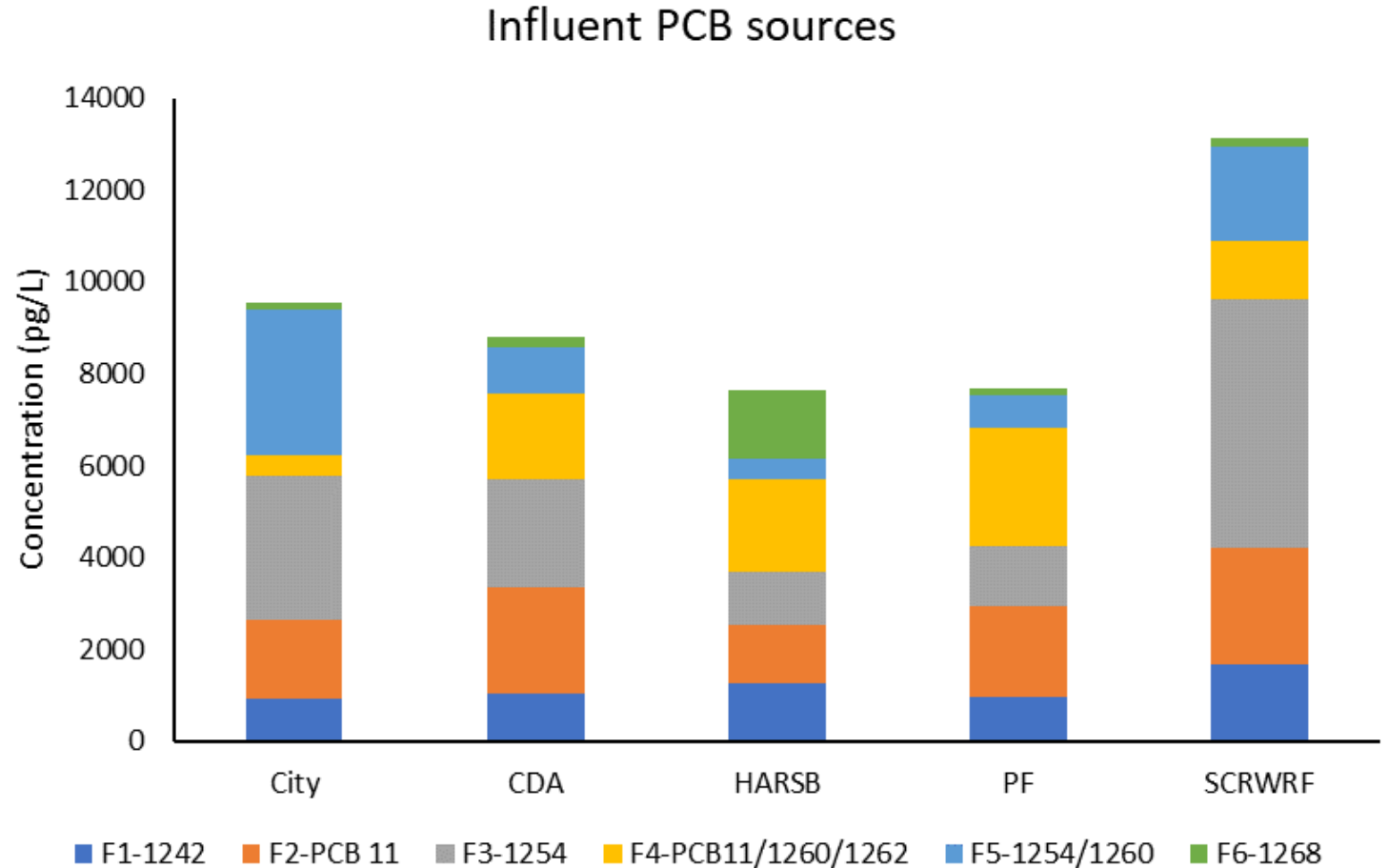
(based on raw data)

	PCB 11	PCB 68	PCB 209
City	3.2%	0.1%	0.2%
CDA	6.2%	0.2%	0.8%
HARSB	6.4%	0.4%	0.6%
PF	7.2%	0.2%	0.2%
SCRWRF	5.3%	0.1%	0.2%

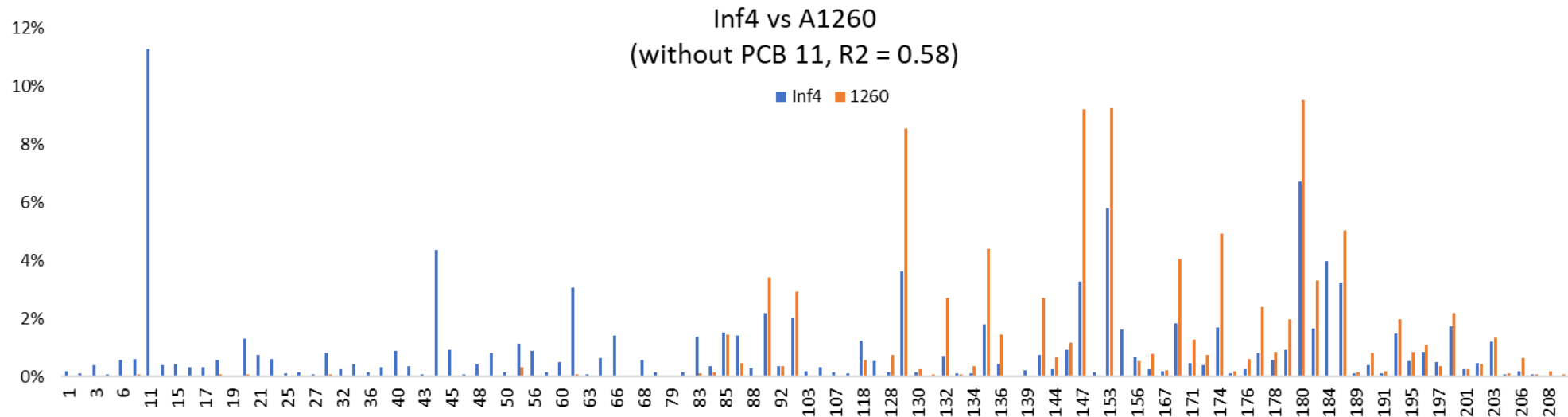
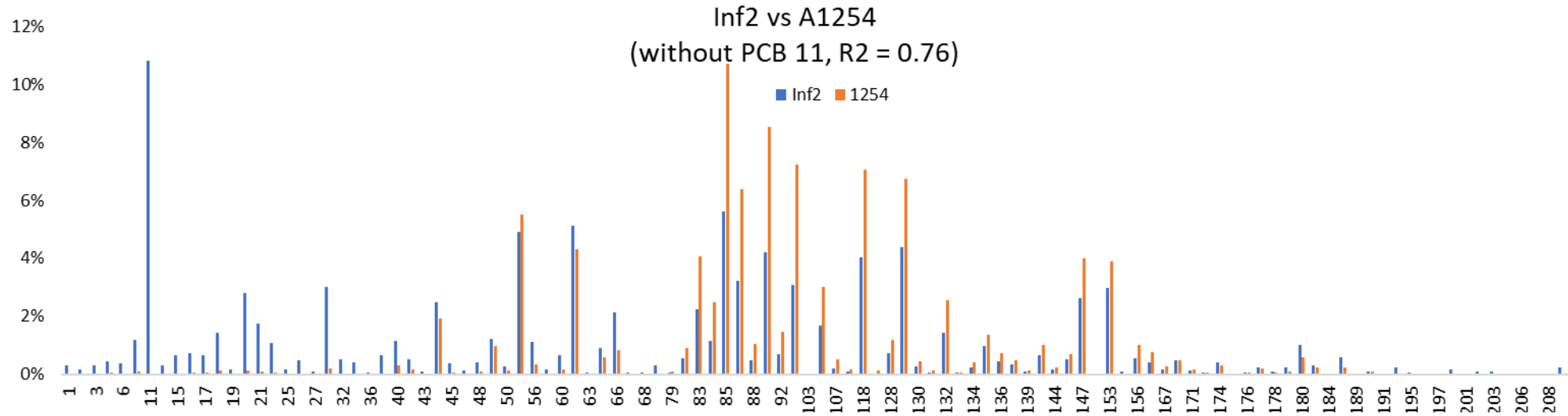
Note: Much of the 209 is actually from Aroclors  
>90% of PCBs in influent are from Aroclors

# Influent – PMF results

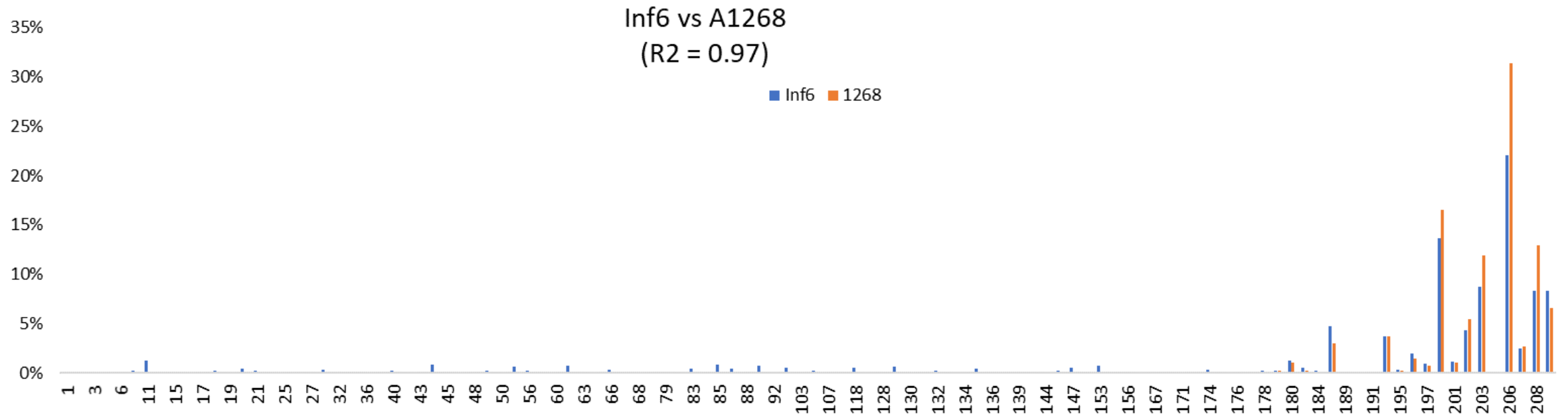
- PMF (110 peaks, 196 samples) finds six sources
- No obvious silicone factor
- Aroclor 1268 significant at HARSB
- SCRWRF has highest influent but lowest effluent



# In influent, PCB 11 travels with Aroclors



# Influent A1268 factor (R2 = 0.97)



Definitely not just PCB 209 from pigments

# Effluent – non-Aroclor congeners

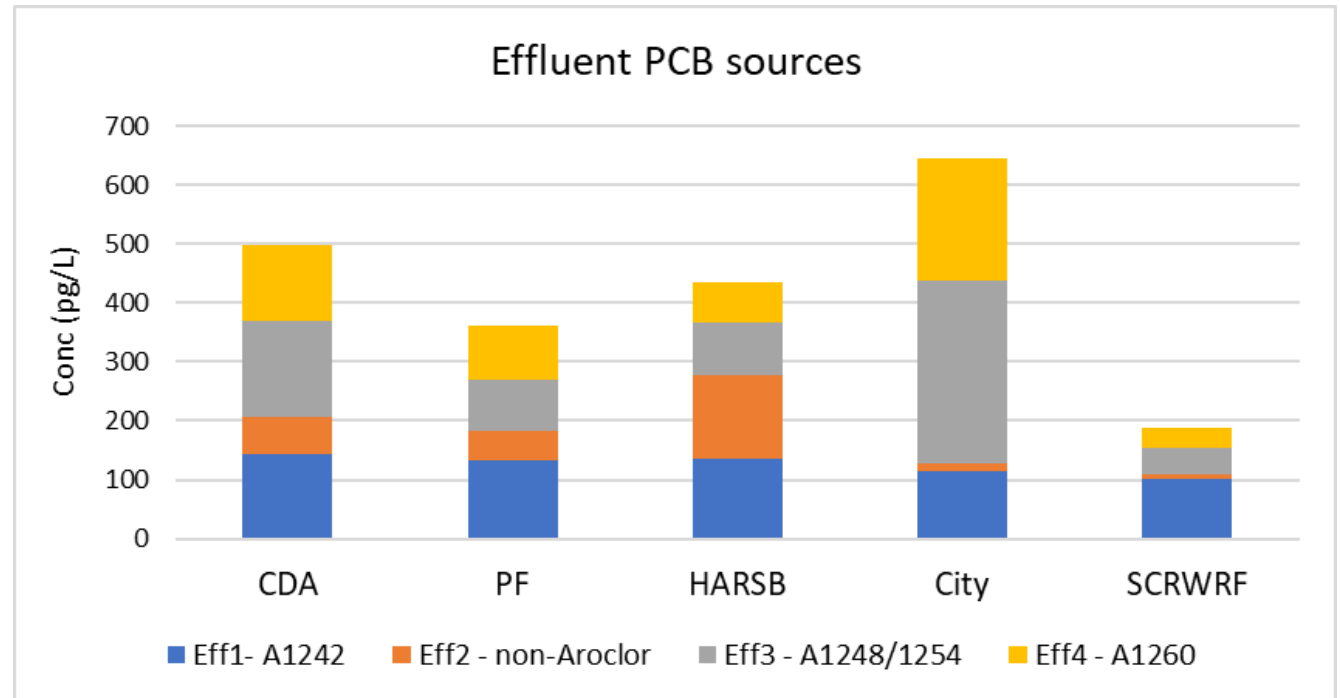
(based on raw data)

- PCB 11 is proportionately more important in effluent than influent
- Better treatment = higher proportions of PCB 11
- PCB 209 is effectively removed
- PCB 68, along with other congeners, appears to be present in effluent as blank contamination. **Not clear how much of PCB 11 is also due to blank contamination.**

	PCB 11	PCB 68	PCB 209
PF	13%	0%	0%
HARSB	13%	2%	0%
City	5%	0%	0%
SCRWRF	16%	0%	0%
CDA			
before	17%	0%	0%
after	22%	0%	0%
SEPS	13%	0%	0%
TMF	23%	1%	0%

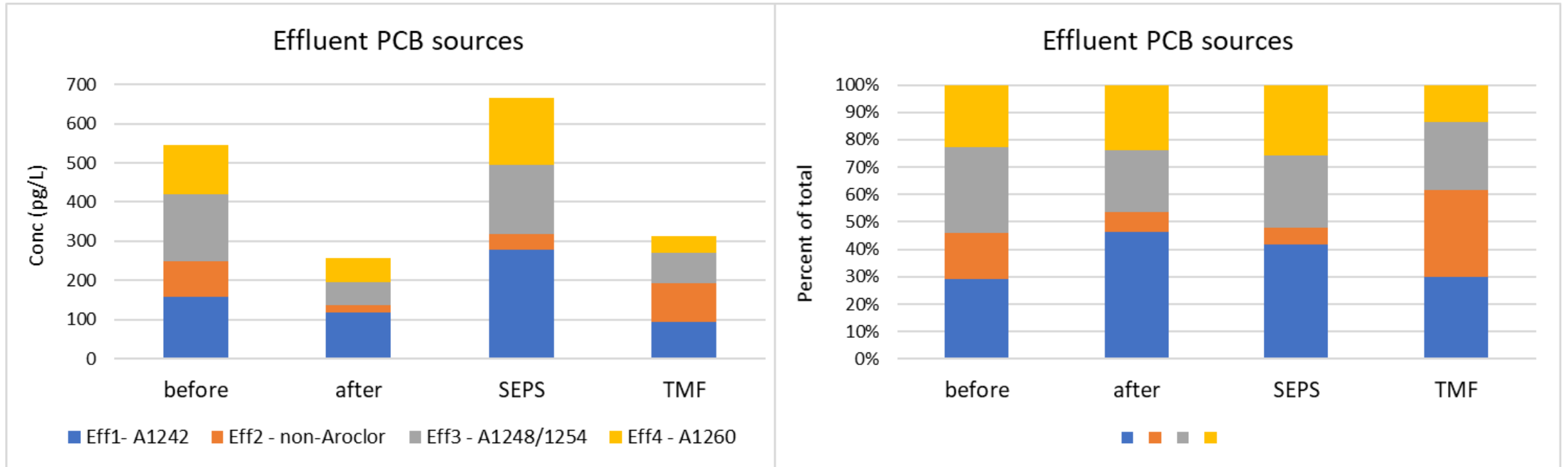
# Effluent – PMF results

- PMF (76 peaks, 120 samples) finds 4 factors
- Fewer peaks because many high MW congeners are usually BDL
- Silicone factor – biggest at HARSB – probably blank contamination
- SCRWRF has lowest levels, best treatment





# CDA – levels of treatment

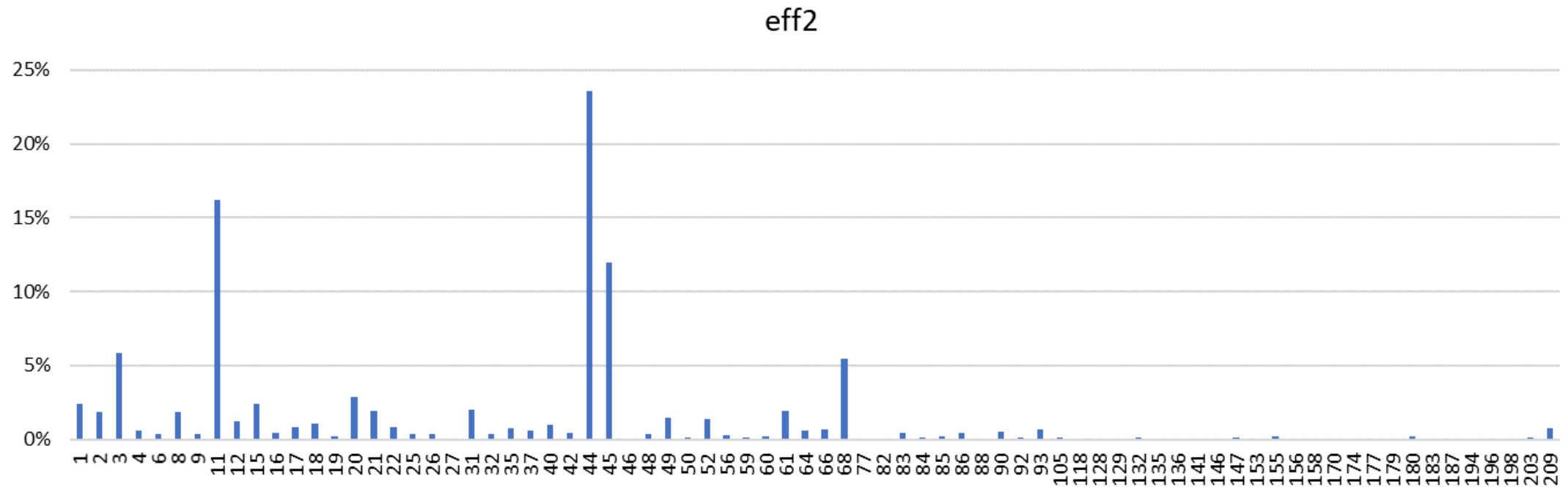


Concentrations are much lower after upgrade

SEPS = Secondary Effluent Pump Station, partial treatment

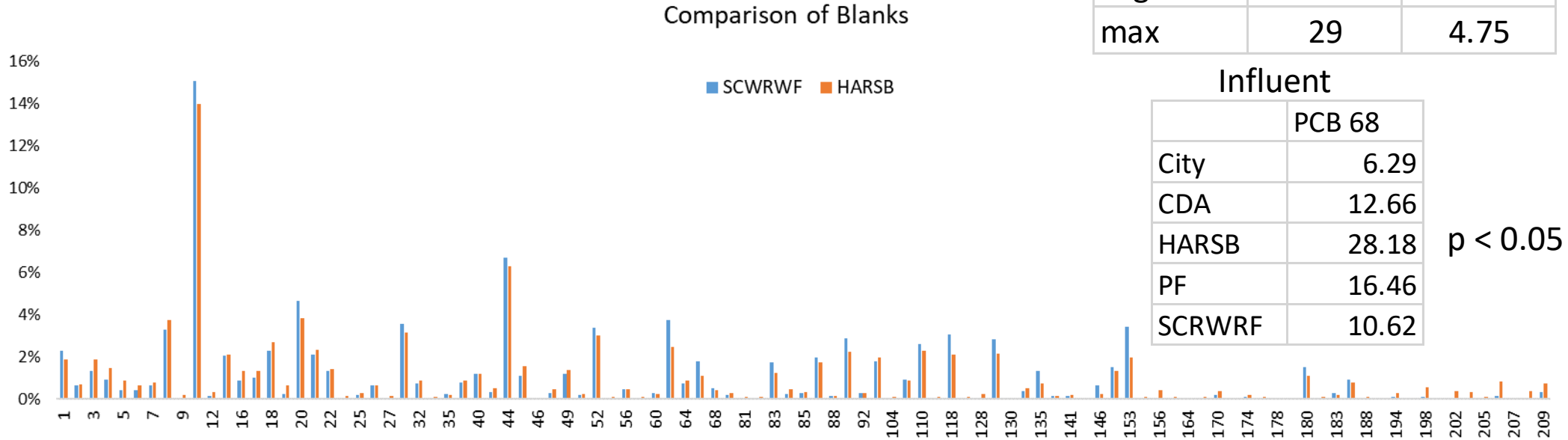
TMF = Samples collected after tertiary treatment when only 1 CFS was running through the membranes  
PRIOR to this flow being mixed with secondary effluent

# Effluent non-Aroclor factor



- PCBs 1, 2, 3, 11, 44+47+65, 45+51, 68 (and a little 209)
- Silicone? Polyurethane?
- Is this blank contamination? Is it real? Is it both?

# Comparison of blanks

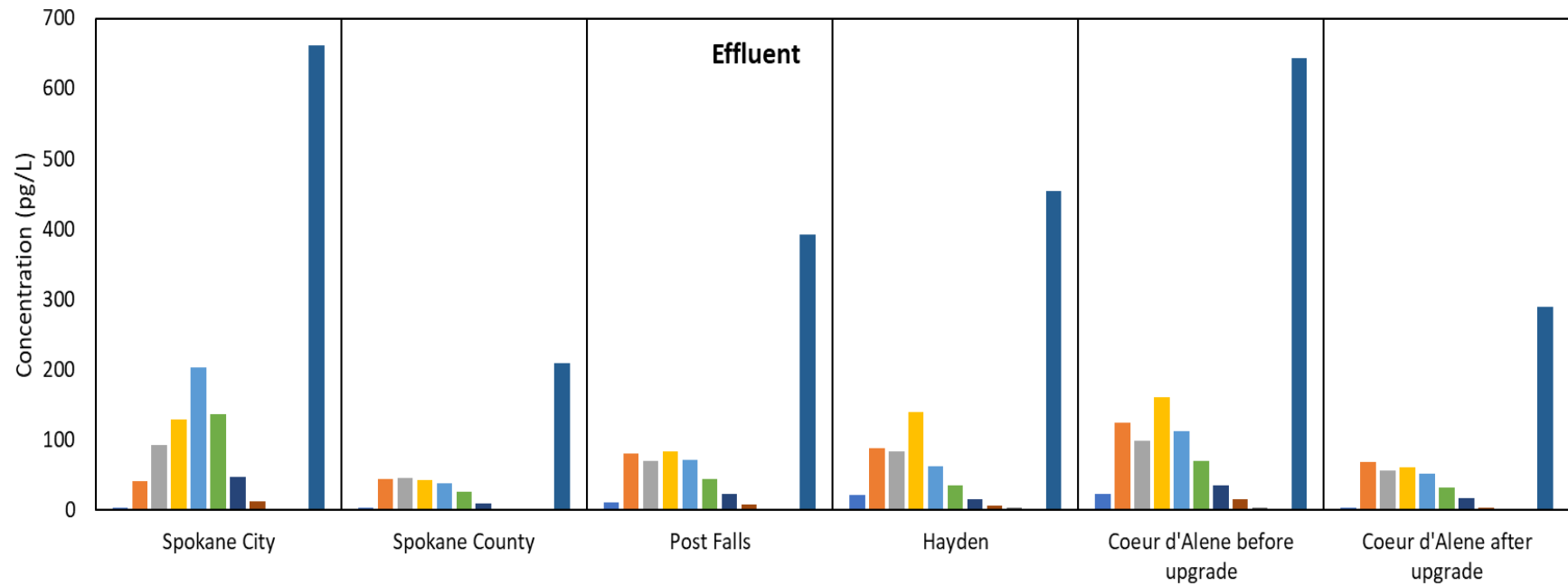
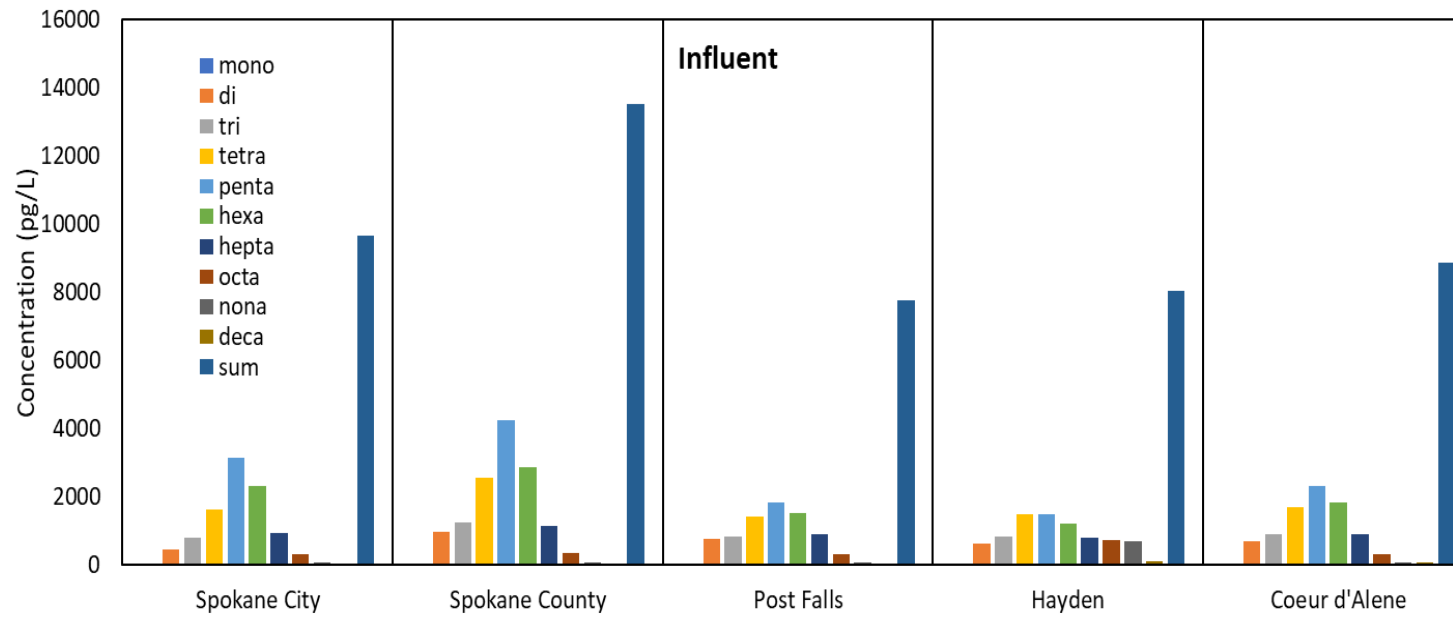


- No visible difference between SCRWRF and HARSB blanks.
- Silicone might be a real contributor to PCBs at HARSB
- Did HARSB use silicone tubing?

# Where does PCB 11 in effluent come from?

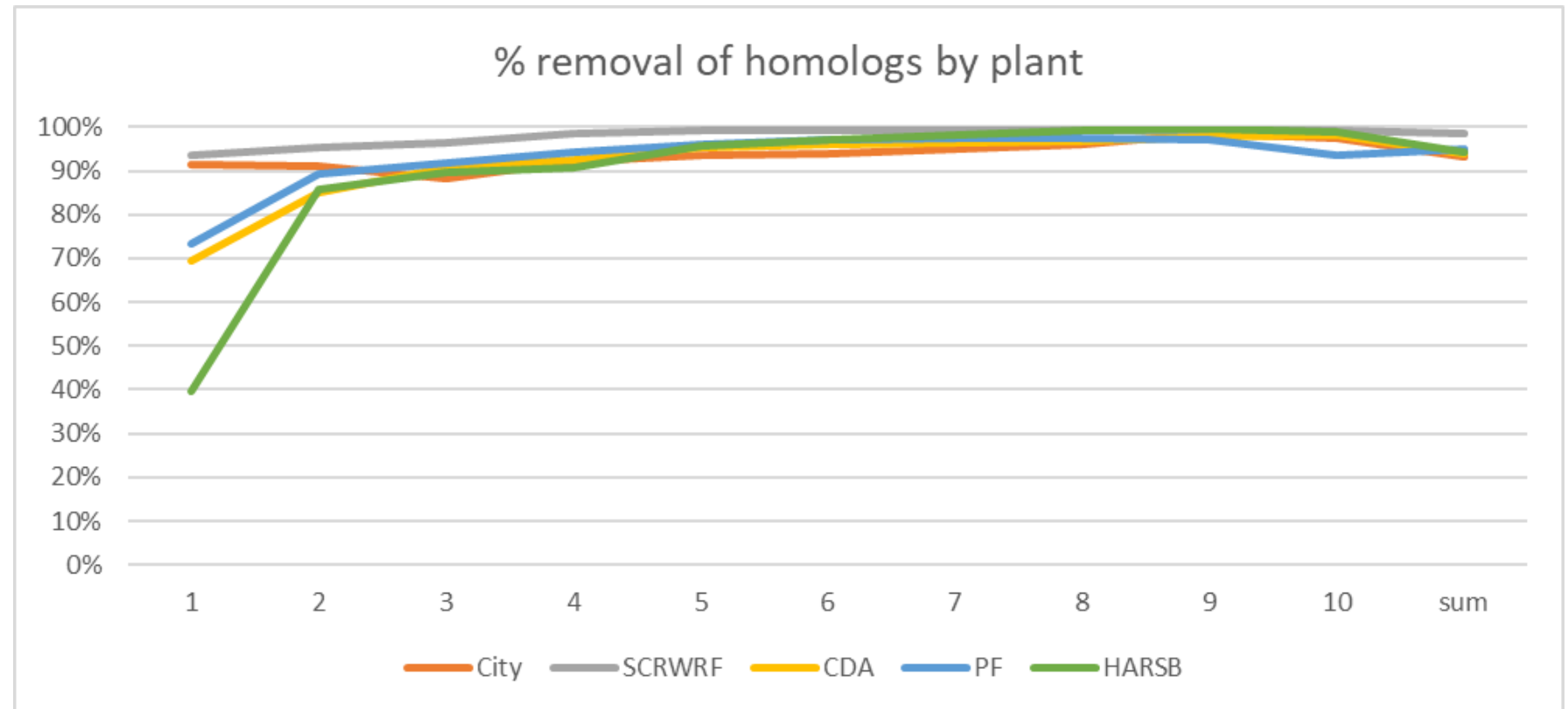
Amount of PCB 11 and total PCBs in effluent that is due to blank contamination, based on PMF results and assuming that Eff2 is blank contamination (?)

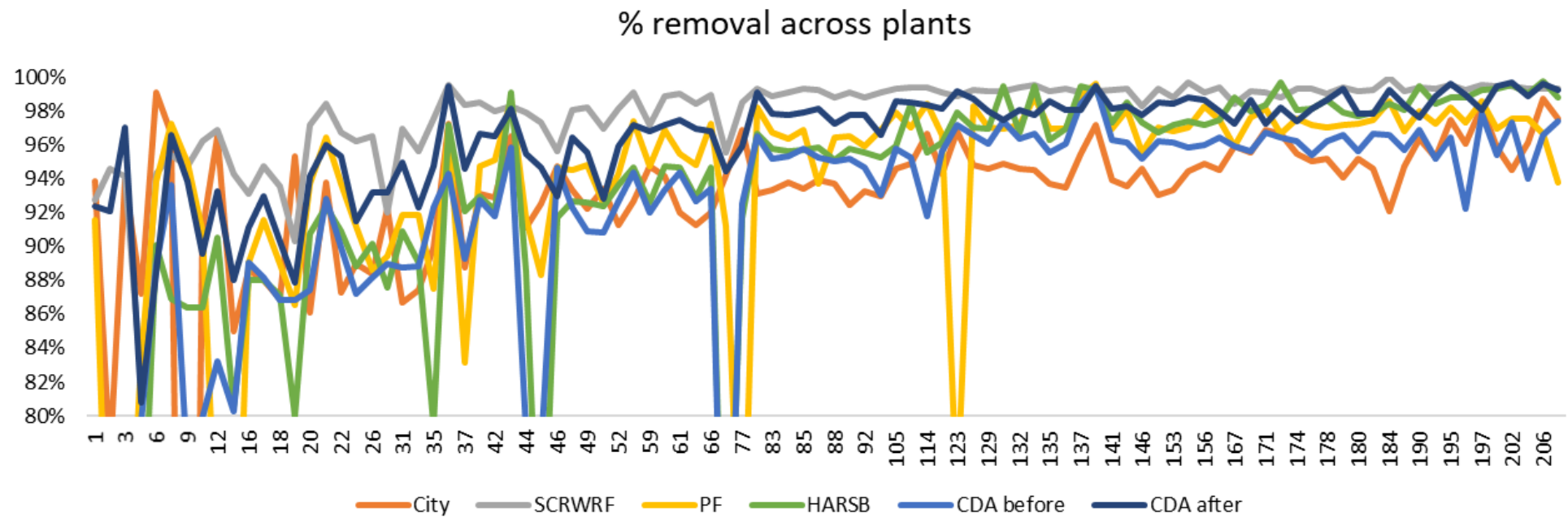
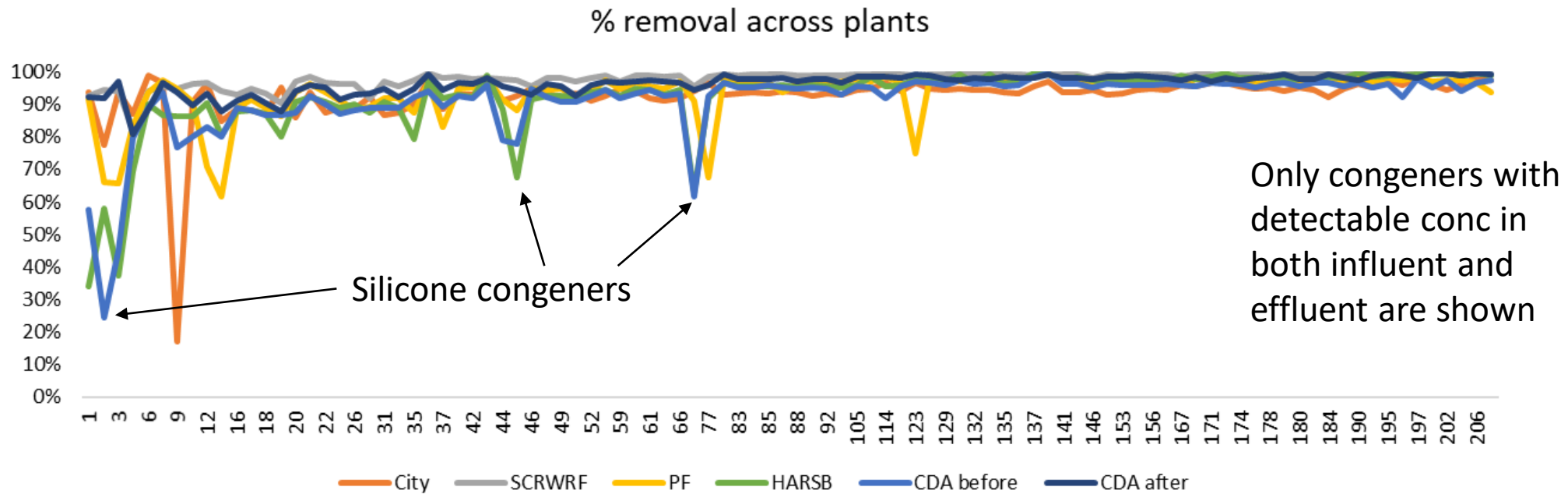
	PCB 11			Total PCBs		
	Measured	"Real"	% from blank	Measured	"Real"	% from blank
CDA	53	42	14%	499	435	13%
PF	43	35	17%	361	311	14%
HARSB	59	36	39%	435	295	32%
City	46	44	5%	645	631	2%
SCRWRF	27	26	6%	188	179	5%
CDA						
before	61	46	17%	545	454	17%
after	33	30	9%	256	238	7%
SEPS	80	74	9%	665	624	6%
TMF	42	26	21%	312	212	32%



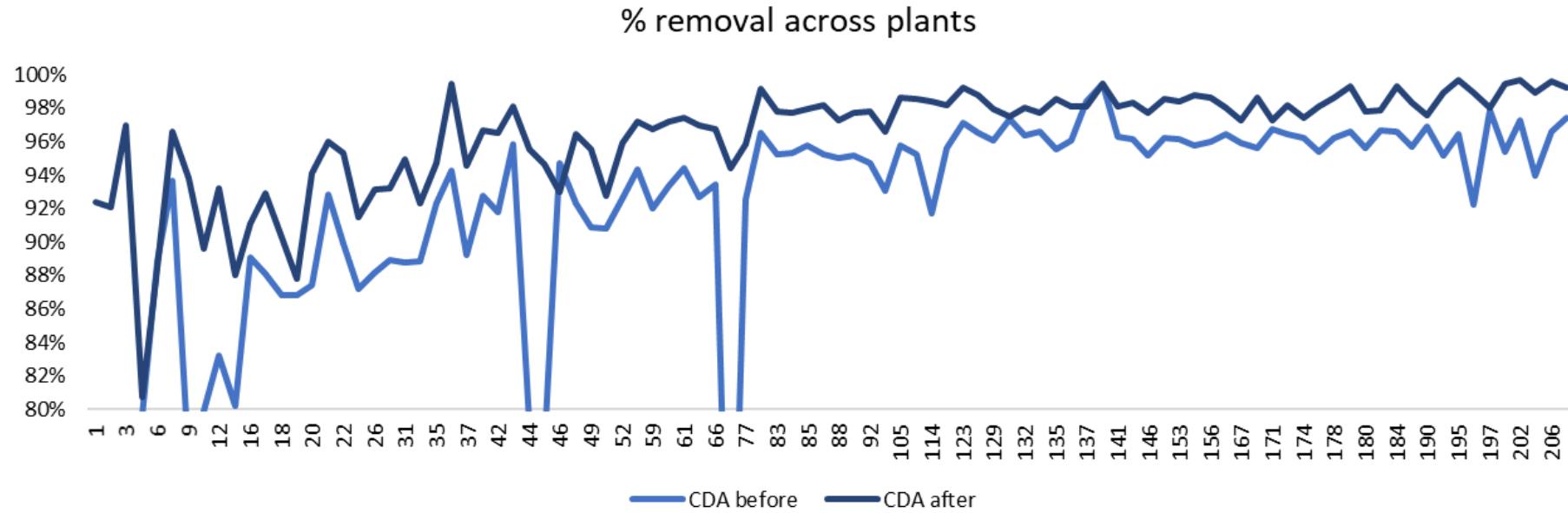
# Percent removal

- Removal calculated from raw blank corrected data, not PMF results





# Removal at CDA– before and after upgrade





# IEP influent

- Influent more variable than at the municipal plants, ranging from 30 ng/L to 4,000 ng/L with a relative standard deviation (RSD) of 132%.
- PCB 11 accounted for 0.3% to 8.3% of Sum209PCBs in the IEP influent
- IEP influent very similar to Aroclor 1242: when PCB 11 is removed from the correlation, the similarity ( $R^2$ ) ranged from 0.87 to 0.98.

# IEP effluent

- averaged 2,400 pg/L after secondary treatment and 1,600 after tertiary (membrane filtration) treatment – 33% improvement
- PCB 11 concentrations were statistically identical in the secondary and tertiary effluent, averaging ( $\pm$  standard deviation)  $131 \pm 23$  pg/L and  $141 \pm 67$  pg/L respectively
- Effluent still resembles Aroclor 1242

# Liberty Lake

- Influent Avg  $3,927 \pm 1,759$  pg/L (about half of other plants)
- Effluent: 8 peaks detected in more than half of all samples
  - SCRWRF: 100 peaks detected more in more than half of all samples
- Effluent concentrations (ND = 0):
  - Before upgrade: 1048 pg/L (73% removal)
  - After upgrade: 177 pg/L (95% removal)

# Removal by homolog at LL

