Pentachlorophenol Pilot Study

RMP Emerging Contaminants WG

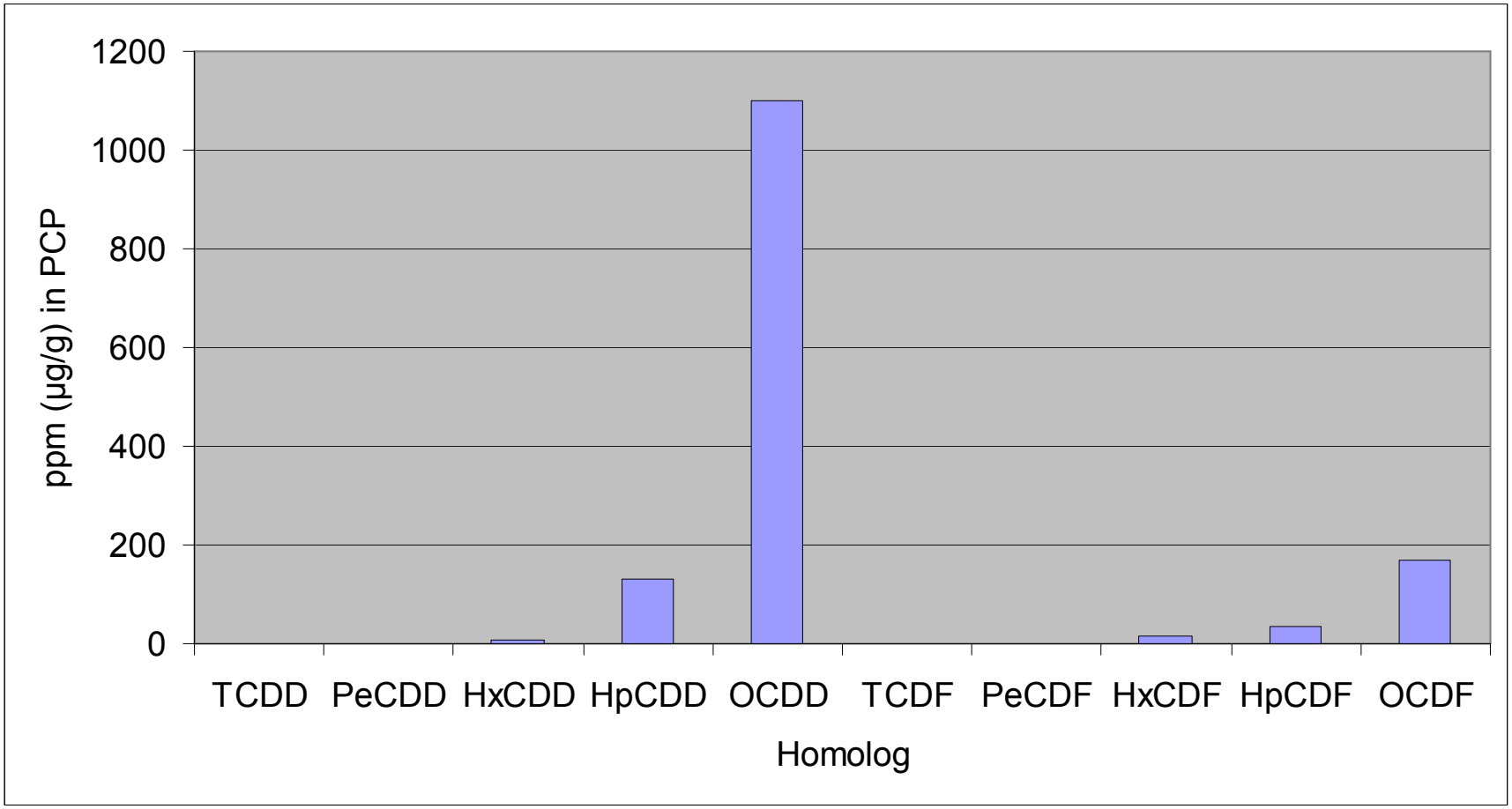
April 2009

Pentachlorophenol (PCP)

- Currently used as wood preservative
- PCP Mixture typically contains PCDD/Fs
  - Mostly HpCDD and OCDD
  - OCDD formation from PCP in environment (Gu 2008, Holt 2008)
- Detected 80% of samples in urban watershed (Seattle WA) ~5-80ng/L
- Previous RMP screening = ND (<1000ng/L)
  - CTR chronic limit ~7900ng/L (280 if used for domestic water supply)

PCDD/Fs in PCP

Harrad et al 1991



PCDD/Fs in SF Bay

(Axys 100L Samples) HpCDD/OCDD ~10% of TEQs

PARAMETER	Sacramento River	Yerba Buena Island	Dumbarton Bridge	Blank	LAB MDL	3x max(blank or MDL)	avg % of TEQ
2003-08	pg/L	pg/L	pg/L	pg/L			
2,3,7,8-TCDD	<	e 0.008	e 0.005	<	0.005	0.005	16%
1,2,3,7,8-PeCDD	e 0.008	0.011	e 0.008	<	0.005	0.005	21%
1,2,3,4,7,8-HxCDD	0.009	0.011	0.008	<	0.005	0.005	2%
1,2,3,6,7,8-HxCDD	0.029	0.04	e 0.025	<	0.005	0.005	7%
1,2,3,7,8,9-HxCDD	0.024	0.035	0.022	0.0050	0.005	0.01509	6%
1,2,3,4,6,7,8-HpCDD	b 0.410	b 0.500	b 0.281	e 0.012	0.005	0.0348	9%
OCDD	b 3.050	b 2.850	b 2.110	0.035	0.006	0.105	2%
2,3,7,8-TCDF	0.032	0.054	0.046	<	0.005	0.005	11%
1,2,3,7,8-PeCDF	0.006	e 0.016	0.009	<	0.005	0.005	1%
2,3,4,7,8-PeCDF	0.011	0.023	0.021	0.0055	0.005	0.01641	13%
1,2,3,4,7,8-HxCDF	0.014	0.017	e 0.011	<	0.005	0.005	3%
1,2,3,6,7,8-HxCDF	0.009	0.014	0.009	<	0.005	0.005	3%
1,2,3,7,8,9-HxCDF	<	<	<	<	0.005	0.005	0%
2,3,4,6,7,8-HxCDF	0.007	0.013	0.01	<	0.005	0.005	2%
1,2,3,4,6,7,8-HpCDF	b 0.090	b,e 0.139	b 0.076	0.0071	0.005	0.02127	2%
1,2,3,4,7,8,9-HpCDF	B, e	B	B, e	0.0070	0.005	0.02109	0%
OCDF	b 0.165	b 0.205	b 0.106	0.018	0.005	0.0528	0%

Questions

- What are concentrations of PCP in Bay?
  - Unlikely > currently known chronic thresholds
- How much does PCP contribute to PCDD/Fs in SF Bay?
  - Exact quantitation difficult due to different partitioning & degradation (faster for PCP)
  - May estimate bounds (max or min contributions)

Tributary Samples (~16/yr)

- Least environmental processing (nearest to source profile)
  - Provides (upper) ballpark estimate of PCDD/Fs from PCP
  - May give hints of emission processes (leaching/evasion/erosion off wood)
  - If PCDD/Fs different from expected PCP ratio
    - May indicate other sources (w/ HpCDD/OCDD)

Bay Sediments (~47/yr)

- Measure of exposure facing Bay biota
  - Remaining PCP in sediment gives lower bound of PCDD/F contribution
    - since PCP losses likely faster
  - Indicates losses from watershed to Bay or within Bay
    - and/or unaccounted sources, e.g. air deposition, which can be modeled

Analysis Costs

- Water
  - GC/HRMS- variant on OCP method
    - DL ~0.1ng/L?
    - $825 alone (Axys) or +$150 on PCB/OCP analysis
  - Likely sufficient for tributary water
    - (5ng/L in Seattle)
- Sediment
  - Add on to GC/HRMS OCP or PCB method
    - +$0/sample? (EBMUD)

Estimated PCP in Water

- If all OCDD came from PCP
  - OCDD in PCP 1100 ppm
  - OCDD in Bay water ~10 pg/L
  - PCP in Bay ~ 9,100 pg/L (9 ng/L)
    - Near LRMS MDL
  - Tributaries likely higher by 10x-100x?
- If not all OCDD from PCP
  - PCP result would provide estimate of OCDD (and other PCDD/F) contribution

Estimated PCP in Sediment

- If all OCDD came from PCP
  - OCDD in PCP 1100 ppm
  - OCDD in sediment ~100-1000 ng/kg
  - PCP in Bay sediment ~ 91,000 ng/kg
    - 91 ng/g well above MDL for 10 g sample
- If not all OCDD from PCP
  - Bay PCP likely lower than original
  - PCP degradation > OCDD (1% vs .01%/day)

Study Options

- Tributary waters only (~$7200)
  - 16 samples, likely to require HRMS method
  - if combined w/ PCB/OCP +$150/sample ($825 alone)
- Gives upper limit on
  - possible PCP originated PCDD/Fs
  - PCP exposure to biota

Study Options

- Add Bay sediments (+$10650)
  - 47 samples
  - if combined w/ PCB/OCP HRMS +$0(?)/sample (by EBMUD, no method yet)
- Gives lower limit on PCDD/Fs from PCP
  - ambient PCP likely small fraction of original load