PCBs in Stormwater and Sediments in the Middle Rio Grande

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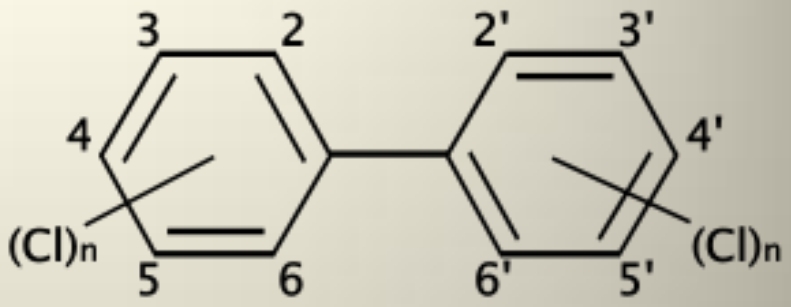
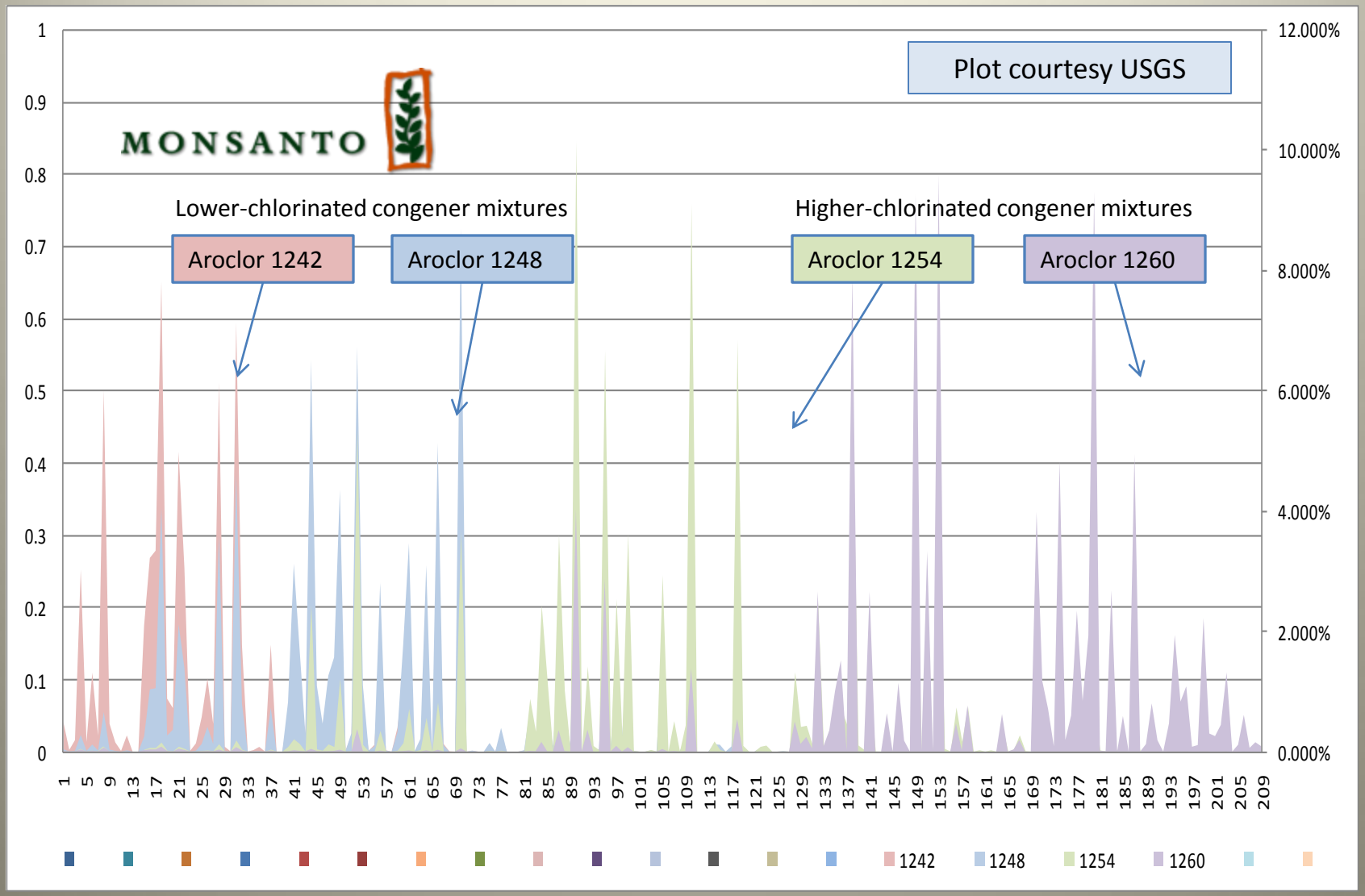


BACKGROUND

PCB Basics

- **Polychlorinated Biphenyls**
  - Production began in 1929, banned in 1979
  - 209 possible congeners, based on the number and location of chlorine atoms attached to carbon atoms in the benzene rings
  - Toxicity (e.g. skin lesions) and probable carcinogenicity known since 1937 (Harvard School of Public Health conference)
- **Aroclors**
  - Monsanto brand-name mixtures of PCB congeners (1930-1977)
  - Numbering convention (e.g. 1254, 1260)
    - First two digits = Number of carbon atoms in structure (12)
    - Second two digits = Percentage of weight attributable to chlorine (54%, 60%)
  - 1254 & 1260 used pre-1950; 1242 used 1950-1971
- **PCBs occur in the water environment primarily attached to suspended organic sediments (USGS studies)**

Aroclor Spectral Signatures



Historical PCB Uses

Aroclor	Common Uses (IARC 1979)
1242 (Post-1950)	Transformers, hydraulic fluids, plasticizers, adhesives
1248	Hydraulic fluids, lubricants, plasticizers, adhesives
1254 (Pre-1950)	Capacitors, transformers, hydraulic fluids, lubricants, plasticizers, adhesives, wax extenders, de-dusting agents, inks, cutting oils, pesticide extenders, sealants and caulking compounds
1260 (Pre-1950)	Transformers, hydraulic fluids, synthetic resins, de-dusting agents
1268	Plasticizers, wax extenders

2010-2011 BERNCO STUDY

BernCo Stormwater Sediments Survey

- Objectives
  - Assess historical discharges of PCBs from County stormwater facilities by examining sediment-bound PCBs
  - Evaluate efficacy of Sanchez Farm stormwater BMP treatment train for reducing PCB concentrations
- Approach
  - USGS collected sediment samples June 2010 and April 2011
    - Embudo Canyon basin (control location – no urban runoff) (2010)
    - Four County stormwater pump station outflow channels/areas (2010)
    - Sanchez Farms inlet structure and wetlands (2010 & 2011)
    - Field blank – “PCB-free” laboratory-created sand sample
  - TestAmerica, Inc. analyzed sediments for PCB (using EPA Method 1668A) and for total organic carbon

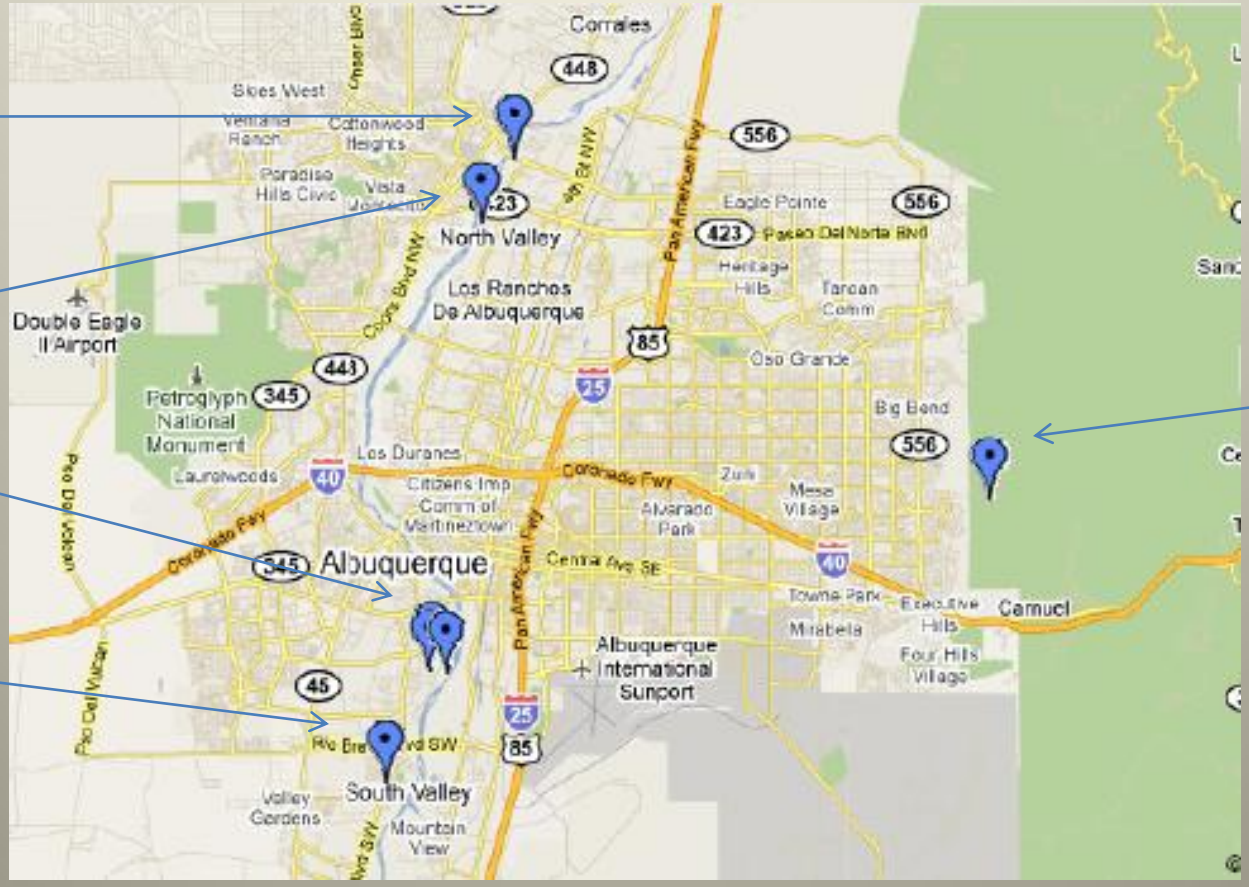
BernCo Sample Locations

Alameda Pump Station Outflow

Paseo del Norte Pump Station Outflow

Sanchez Farms Treatment Facility (Three samples)

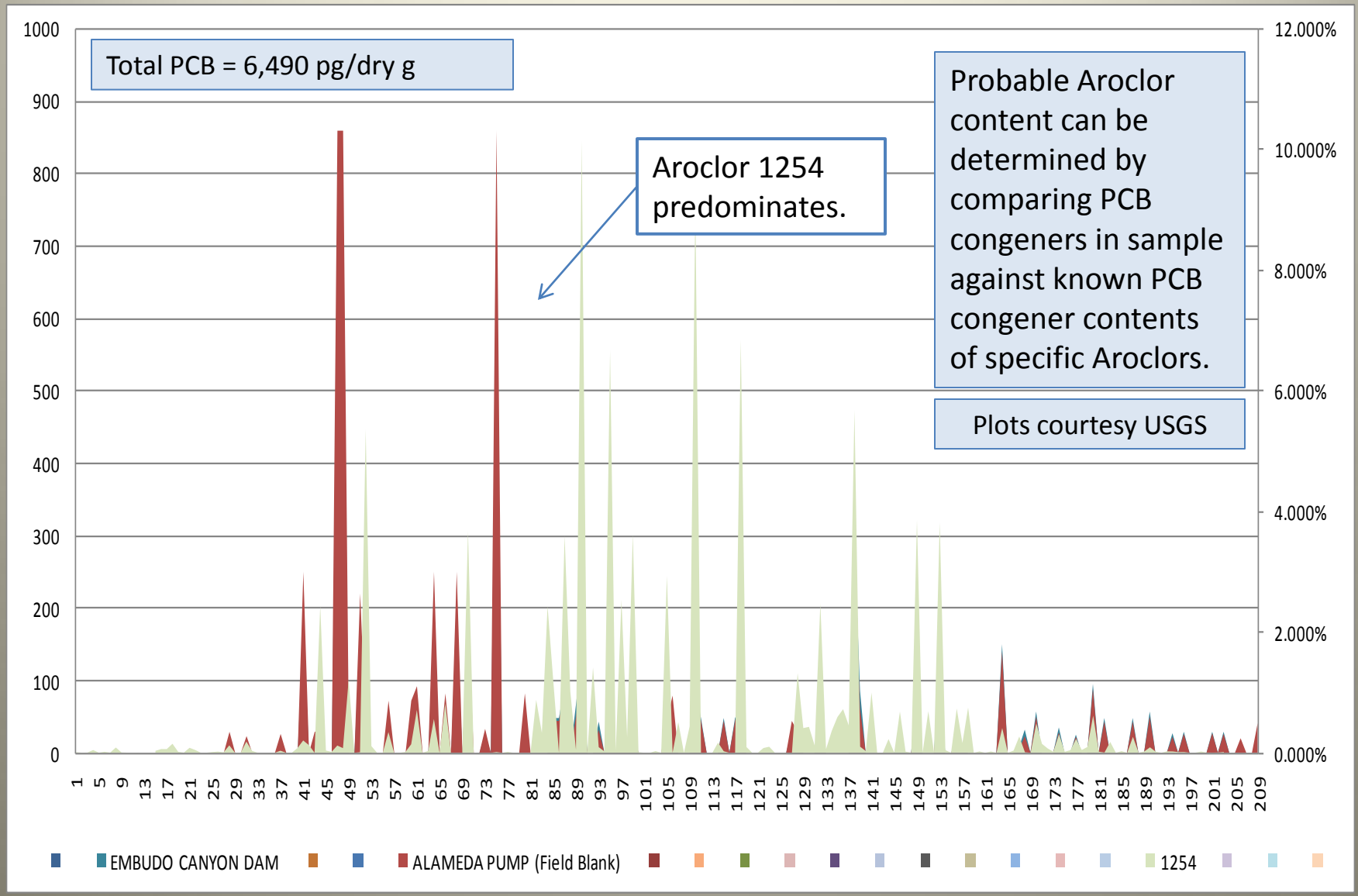
Adobe Acres Pump Station Inlet



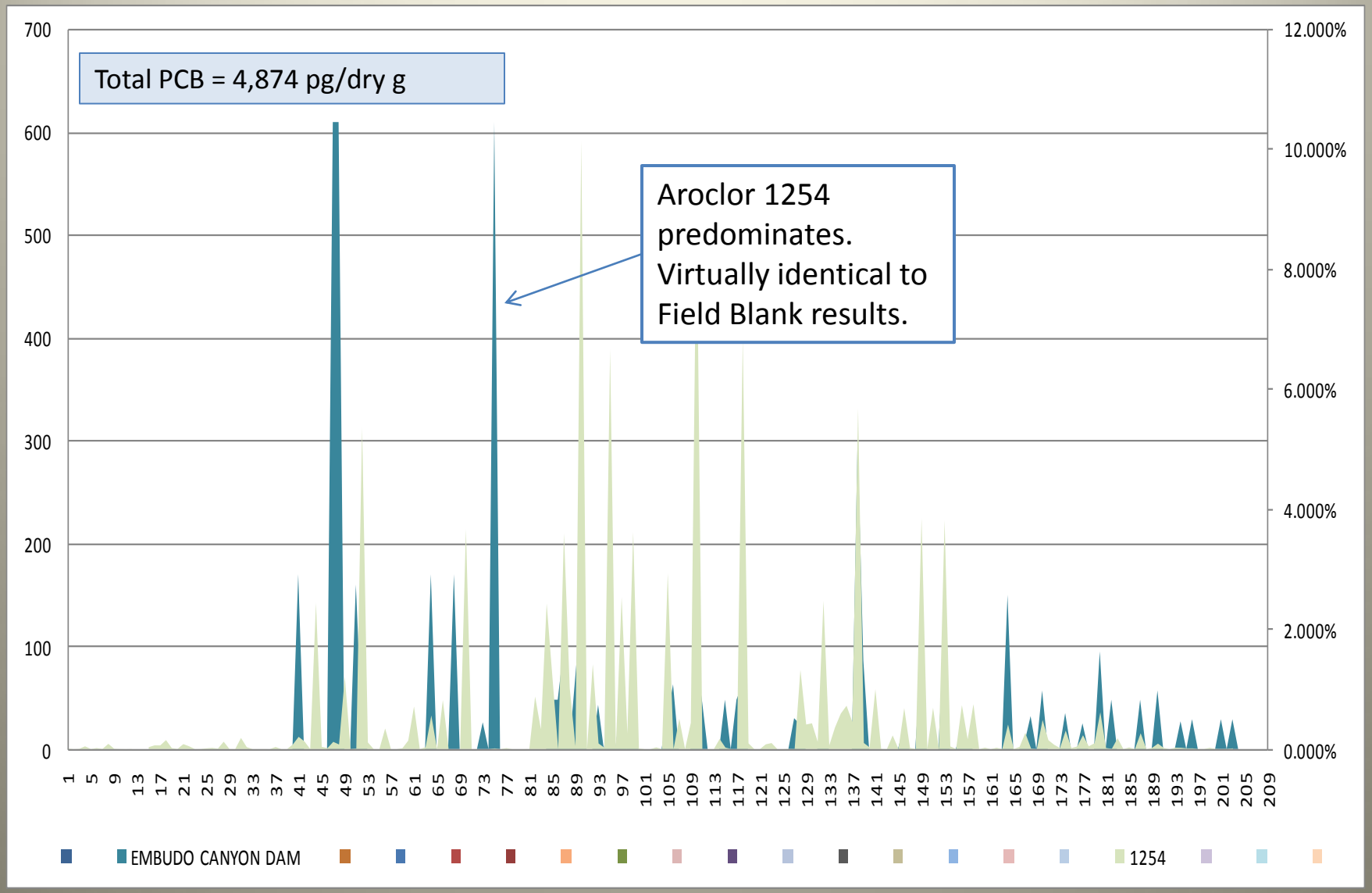
Embudo Canyon (Control Location)

BACKGROUND RESULTS

Field Blank


Total PCB = 6,490 pg/dry g
Aroclor 1254 predominates.
Probable Aroclor content can be determined by comparing PCB congeners in sample against known PCB congener contents of specific Aroclors.
Plots courtesy USGS
1000
900
800
700
600
500
400
300
200
100
0
12.000%
10.000%
8.000%
6.000%
4.000%
2.000%
0.000%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97 101 105 109 113 117 121 125 129 133 137 141 145 149 153 157 161 165 169 173 177 181 185 189 193 197 201 205 209
EMBUDO CANYON DAM
ALAMEDA PUMP (Field Blank)
1254

Embudo Canyon Control

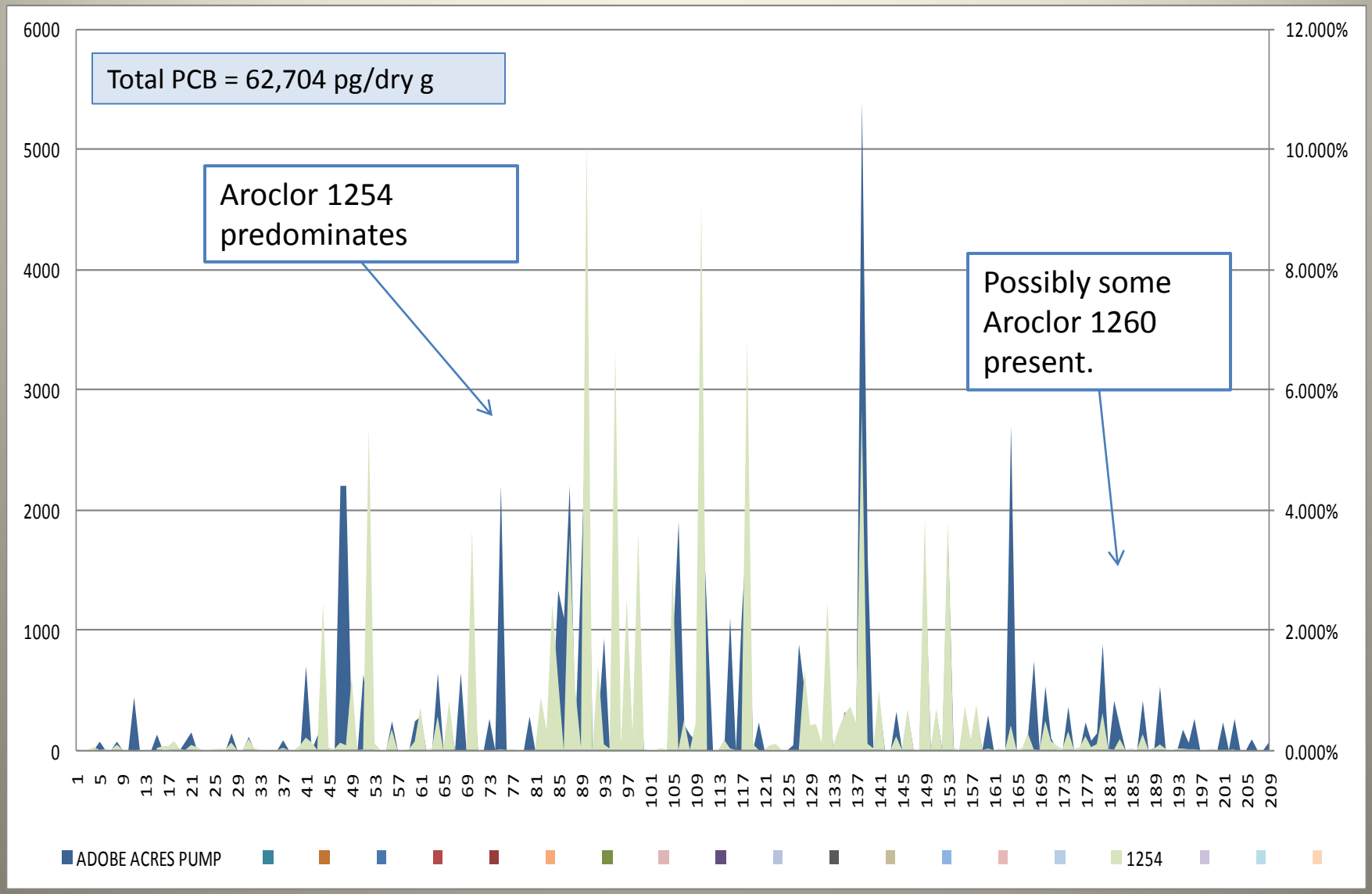


Field Blank and Control

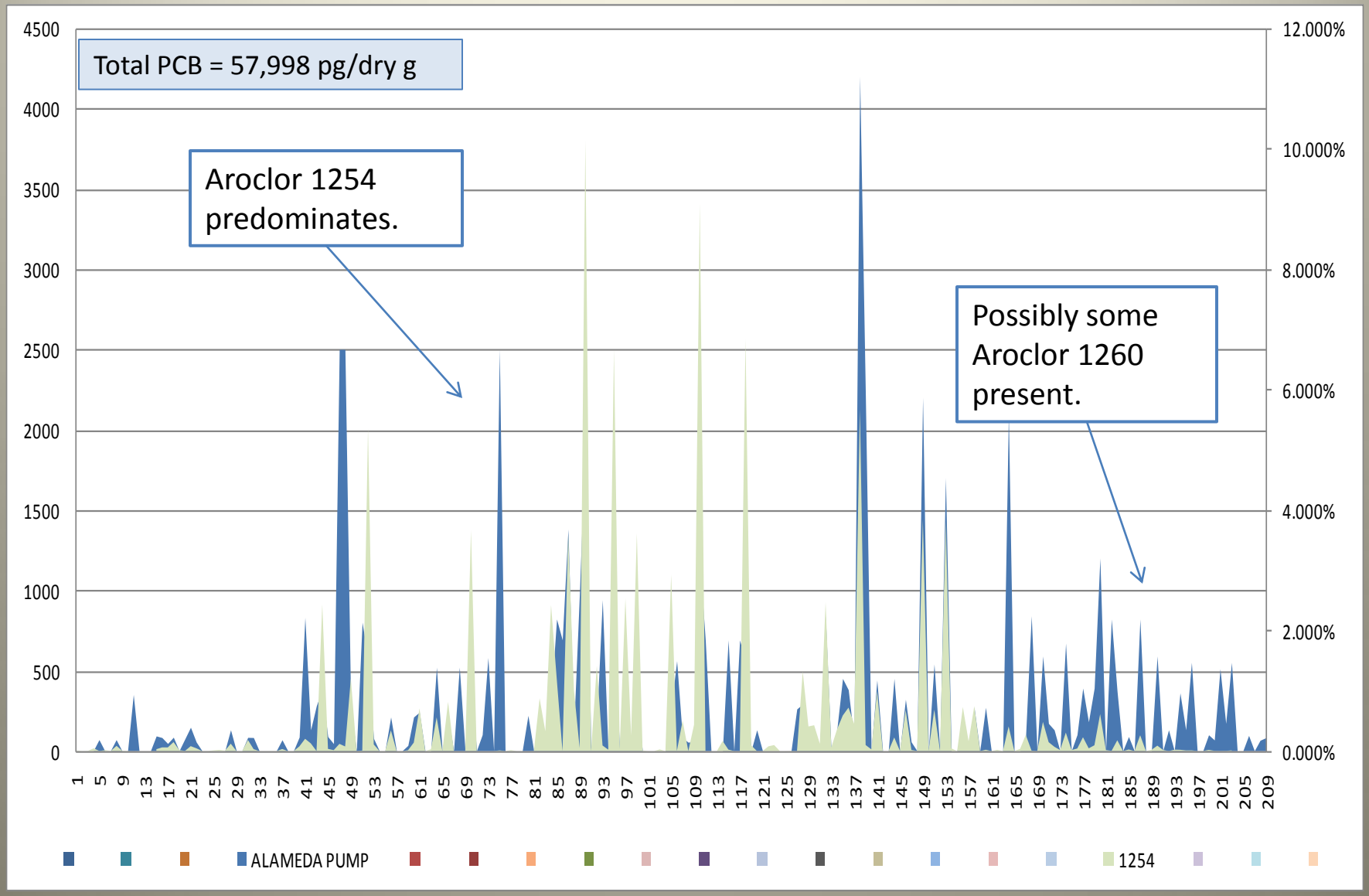
- Field blanks were “PCB-free” soil obtained from laboratories using lower-sensitivity Aroclor method
- USGS sampling trowel preparation
  - 2010: Alconox wash, distilled water rinse
  - 2011: Added final field rinse with hexane
- Field blank/background results
  - 2010: 6,490 pg/g (blank); 4,874 pg/g (background)
  - 2011: No PCBs detected in field blank (DL = ~20 pg/g)
- 2010: PCBs observed in field blank and control soil may have been sampling-related contaminants
  - Concentrations were small relative to levels in sediments
  - Blank and background PCBs appeared to be Aroclor 1254

OUTFALL RESULTS (2010)

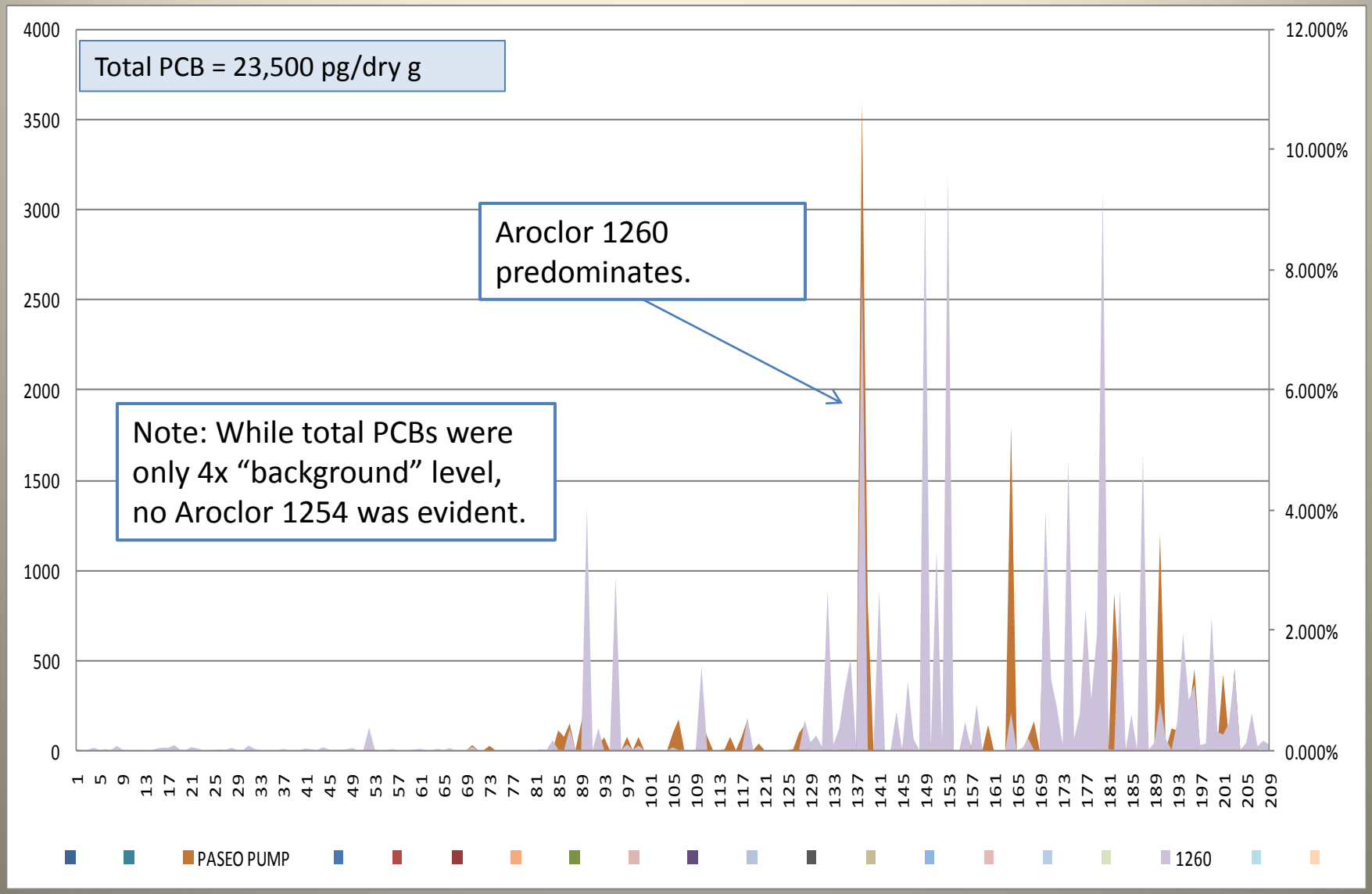
Adobe Acres (2010)



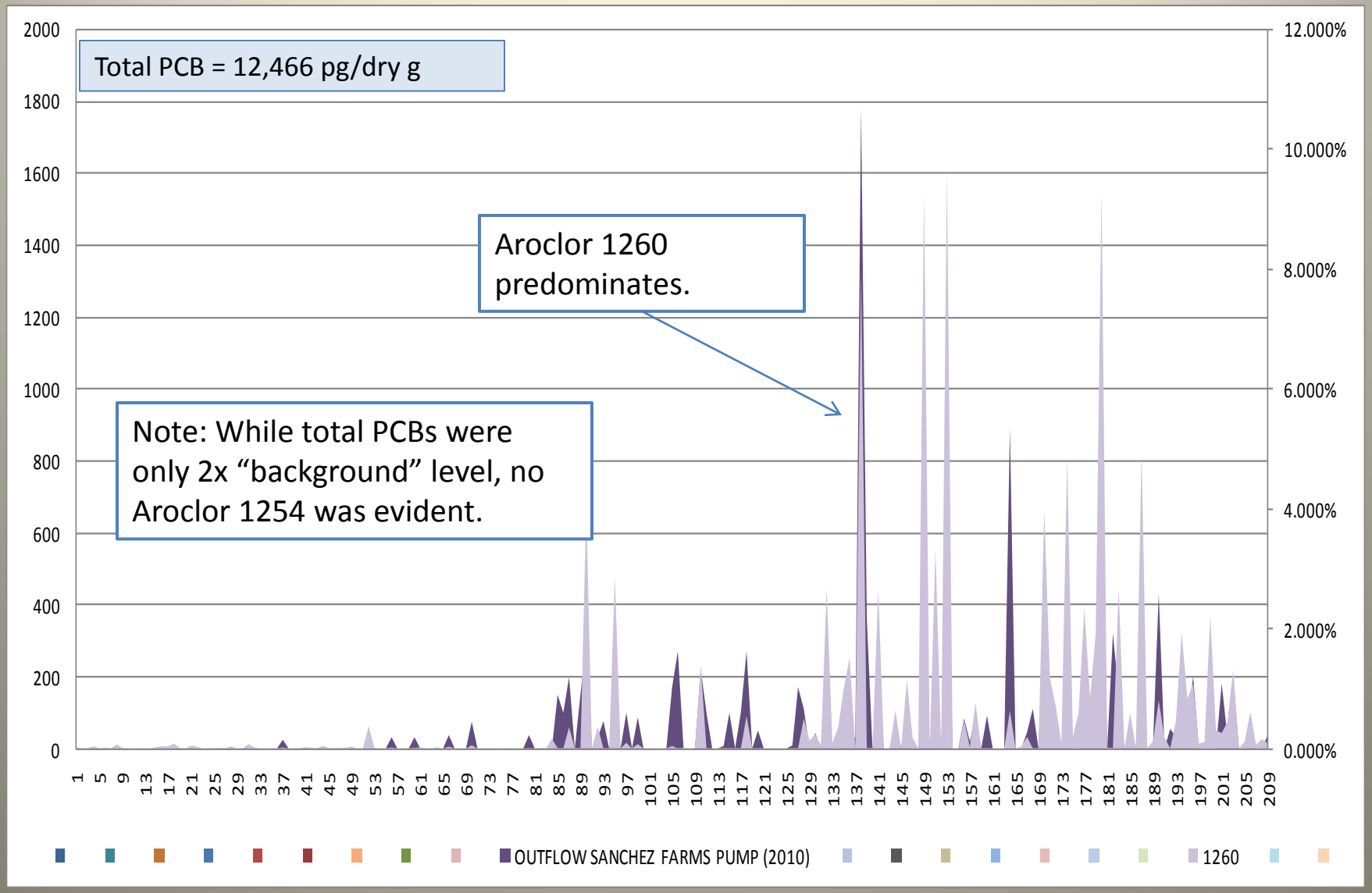
Alameda (2010)



Paseo del Norte (2010)



Sanchez Farm (2010)



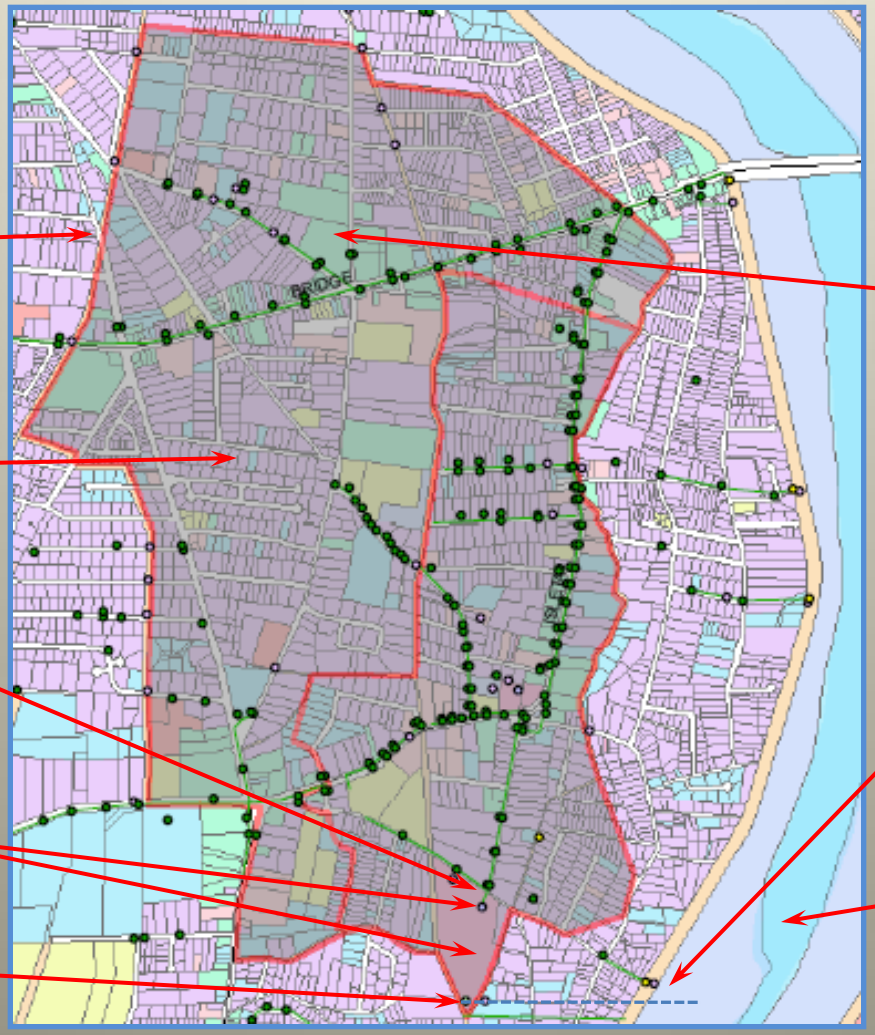
PCBs in Sediment at Bernalillo County Stormwater Outflows (2010)

Sample Location	Sediment Moisture (%)	Total Organic Carbon (mg/dry g)	Total PCBs (pg/dry g)	Predominant Aroclors*
Field Blank	0.28	2.7	6,490	1254
Embudo Canyon	0.75	11	4,874	1254
Adobe Acres Inlet	58	131	62,704	1254
Alameda Outflow	30	101	57,998	1254
Paseo del Norte Outflow	11	21	23,500	1260
Sanchez Farms Outflow	19	14	12,466	1260

* Aroclors are specific combinations of PCB congeners produced and distributed by Monsanto Company

SANCHEZ FARM FACILITY RESULTS

Sanchez Farm Drainage: 695 acres



Drainage Boundary

Residential Property

Drainage Outfall

Basin and Wetlands

Pump Station

Commercial Property

Discharge Line

Rio Grande

Sanchez Farms Sample Locations

Sanchez Farm Inlet (trash/sediment removal structure)

Sanchez Farms Wetlands

Sanchez Farms Outflow

PCBs in Sediment at Bernalillo County at Sanchez Farms Facility (2010 & 2011)

Location		Sediment Moisture (%)	Total PCBs in Sediment (pg/dry g)	Predominant Aroclor
Inlet Structure/ Collector Line	2010	36	591,846	1254
	2011	3	1,128,256	
	Average	*20*	*860,051*	
Wetlands	2010	17	11,212	1254
	2011	21	24,640	
	Average	*19*	*17,926*	
Outflow	2010	19	12,466	1260
	2011	2	9,639	
	Average	*10*	*11,052*	

99% removal

Possible sampling-related contamination during 2010 appeared to have little discernible effect when 2010 and 2011 results are compared.

Trash/sediment removal structure and constructed wetlands apparently remove 99% of sediment-bound PCBs from Sanchez Farm stormwater flows.

PCB VS. TOC

Total PCB vs. TOC in Stormwater Sediments

Year	Location	TOC (mg/kg)*	PCB (pg/dry g)	µgPCB/gOC†
2010	Adobe Acres	53	62,704	1.2
2010	Paseo del Norte	18	23,500	1.3
2010	Alameda	71	57,998	0.8
2010	Sanchez Farm Inlet	53	597,846	11.3
2010	Sanchez Farm Wetland	8	11,212	1.4
2010	Sanchez Farm Outflow	11	12,466	1.1
2011	Sanchez Farm Collector	32	1,128,256	35.3
2011	Sanchez Farm Wetland	8	24,640	3.1
2011	Sanchez Farm Outflow	7	9,639	1.4

* **Sediments were air-dried before TOC analysis, so results are approximately mg/dry kg**

† **NY Dept of Envtl Conservation guidance suggests <0.88 µgPCB/gOC to ensure water column concentration of 640 pg/L (R. Ford-Schmidt, NMED, Pers. Comm. 2011)**

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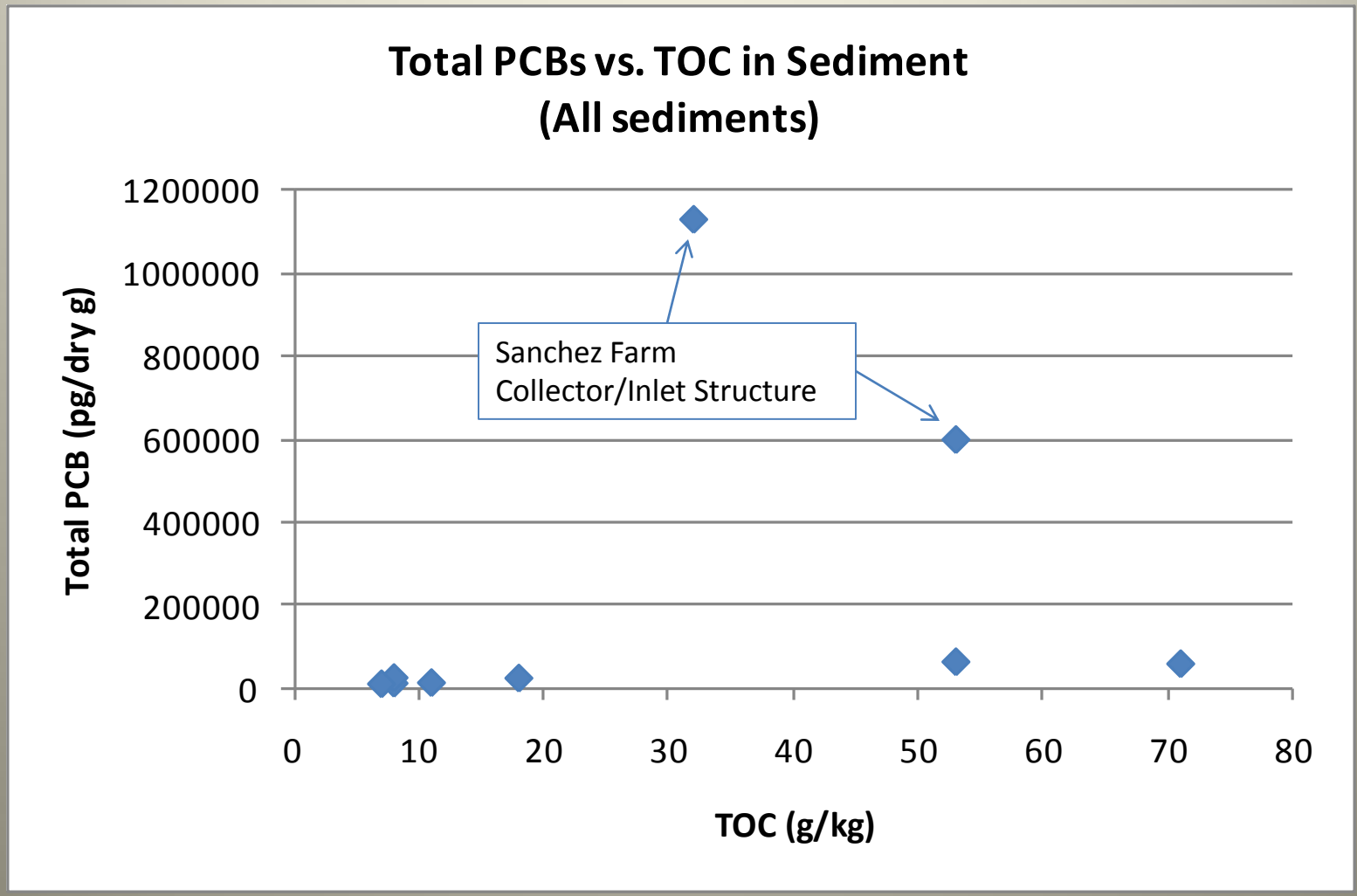
Relationship of PCB to TOC



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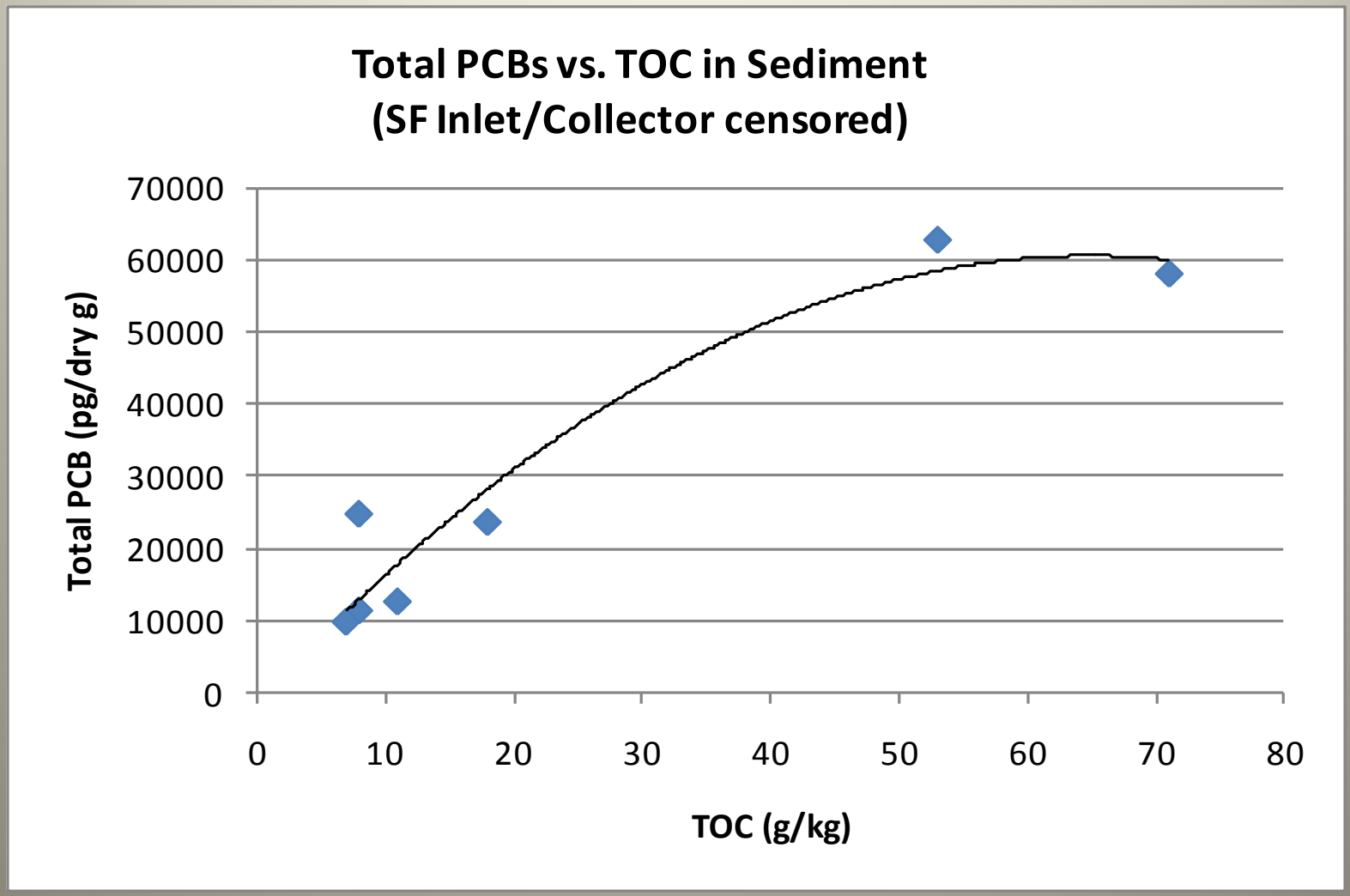


SUMMARY

NMED vs. BC: Stormwater PCB Discharges

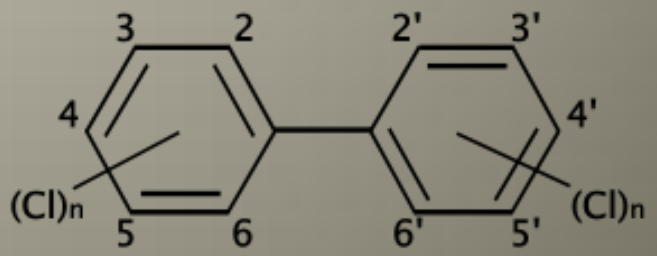
Sample Location	PCB in Sediment (pg/dry g)	Average SSC (mg/L)	PCB in Water (pg/L)
NMED: Rio Grande below east ABQ outfall	93,184*	1,361	142,695
BC: Adobe Acres Inflow	62,704	740‡	46,401†
BC: Alameda Outflow	57,998	558‡	32,363†
BC: Paseo del Norte Outflow	23,500	730‡	17,155†
BC: Sanchez Farms Outflow☺	11,052	146‡	1,614†

* PCB concentration in sediment was computed from PCB in water and SSC (NMED)
‡ Average SSC for outflows was determined from 2004-2009 sampling history (County)
† PCB concentration in water was computed from PCB in sediment and average SSC (County)
☺ Sanchez Farms outflow follows treatment by sedimentation and wetlands

NMWQCC Human Health Criterion for PCB in Water = 640 pg/L
NMWQCC Aquatic Life Criterion for PCB in Water = 14,000 pg/L
USEPA Human Health Criterion for PCBs in Solids = 50,000,000 pg/g

Conclusions

- PCBs in untreated Bernalillo County stormwater may exceed water quality criteria by 3x to 72x
- PCBs in raw sediment (Sanchez Farm) pose little human health hazard to County workers
- Legacy (pre-1950) PCB sources in the Albuquerque-area watershed are likely ubiquitous so that sediment control offers best option for control
- Stormwater sediment-removal BMPs can effectively reduce PCB discharges



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