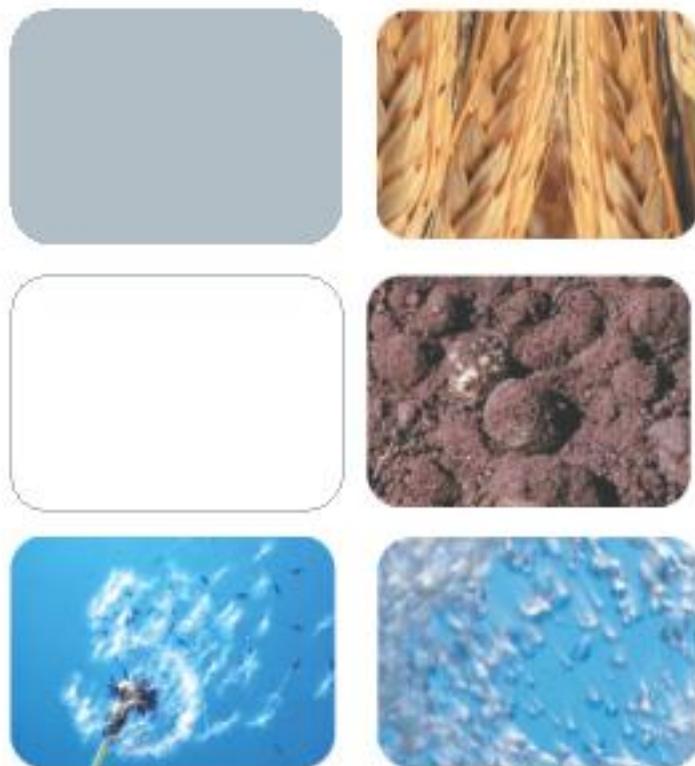
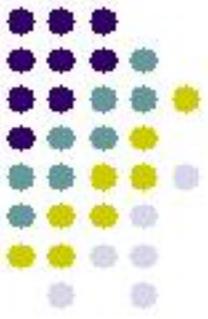




Leaders in Environmental Testing



High Performance  
Sampling and Analysis  
of Persistent Organic  
Pollutants in the Newark  
Bay Estuary



# Newark Bay Estuary Participants

- **United States Geological Survey (USGS-NJ)**
- **New Jersey Department of Environmental Protection (NJDEP)**
- **Stevens Institute - Rutgers University**
- **Severn Trent Laboratories**
- **Battelle Environmental Divisions**

# New Jersey Toxic Sediment Reduction Program

- Determine sources and concentrations of organic contaminants in the Newark Bay and Hudson River Estuary system.
- Detect as many target compound as possible.
- Obtain samples with target compounds in a range of magnitudes above field blanks and lab blanks.
  - >> High-volume multi-stage sampling train. Toxic Organics Platform Sampler (TOPS).

# Persistent Organic Pollutants (POPs) Studied

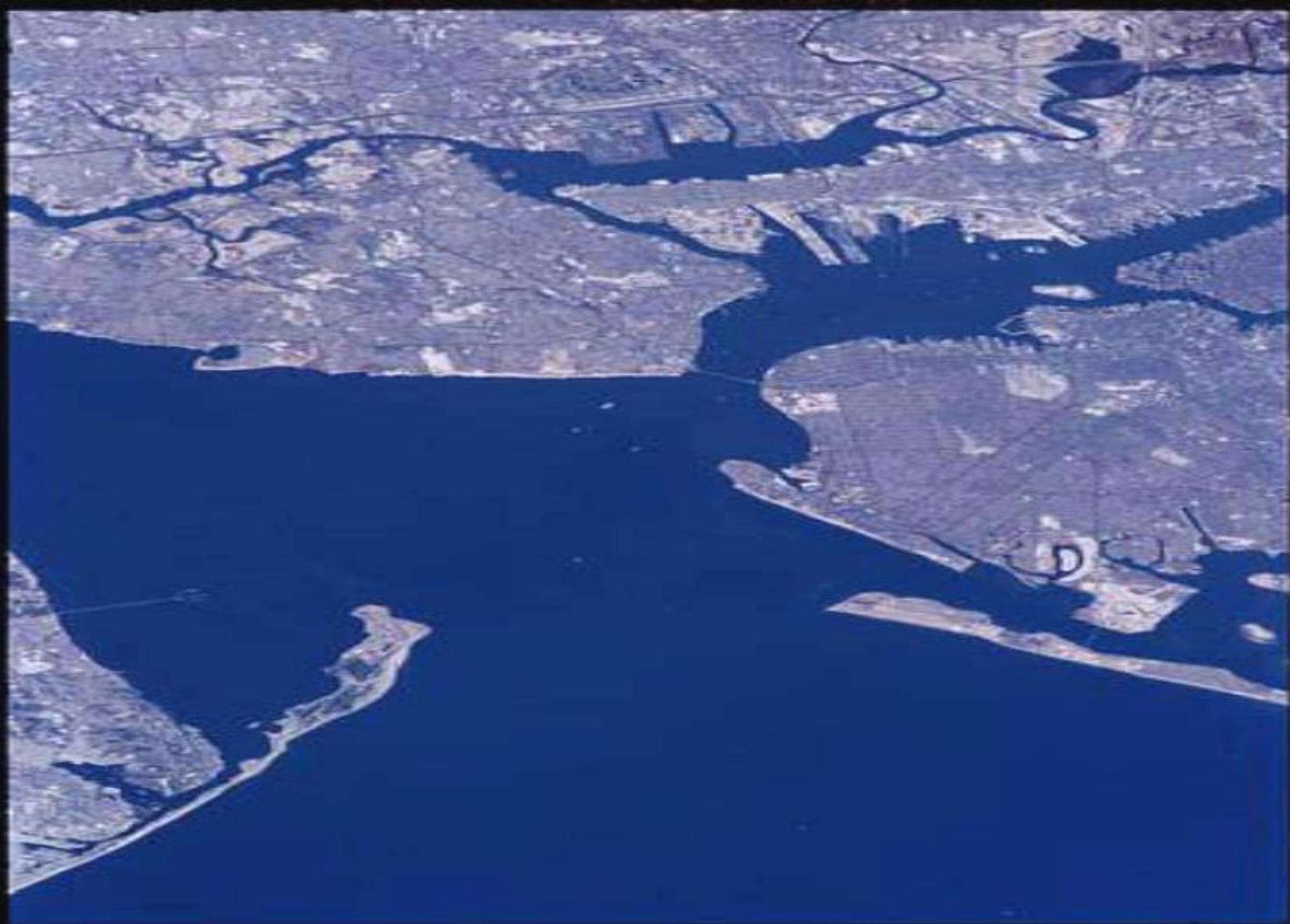
- Polychlorinated Dioxins and Furans (PCDDs/PCDFs) (17 analytes)
- Polychlorinated Biphenyls (PCBs) (113 analytes)
- Organochlorine Pesticides (OCPs) (24 analytes)
- Polynuclear Aromatic Hydrocarbons (PAHs) (27 analytes)

# New York / New Jersey Harbor Estuary

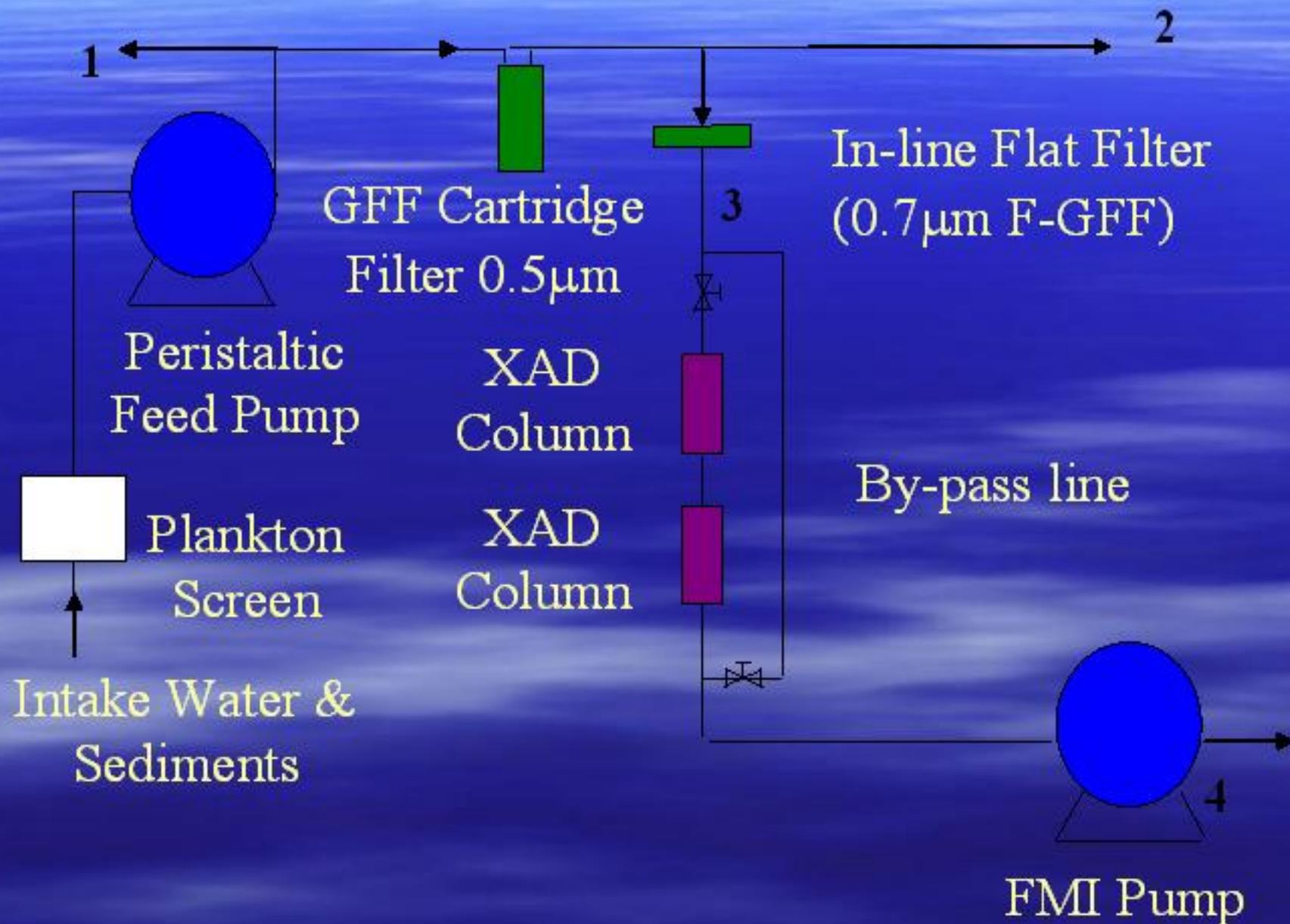
## Sampling locations:

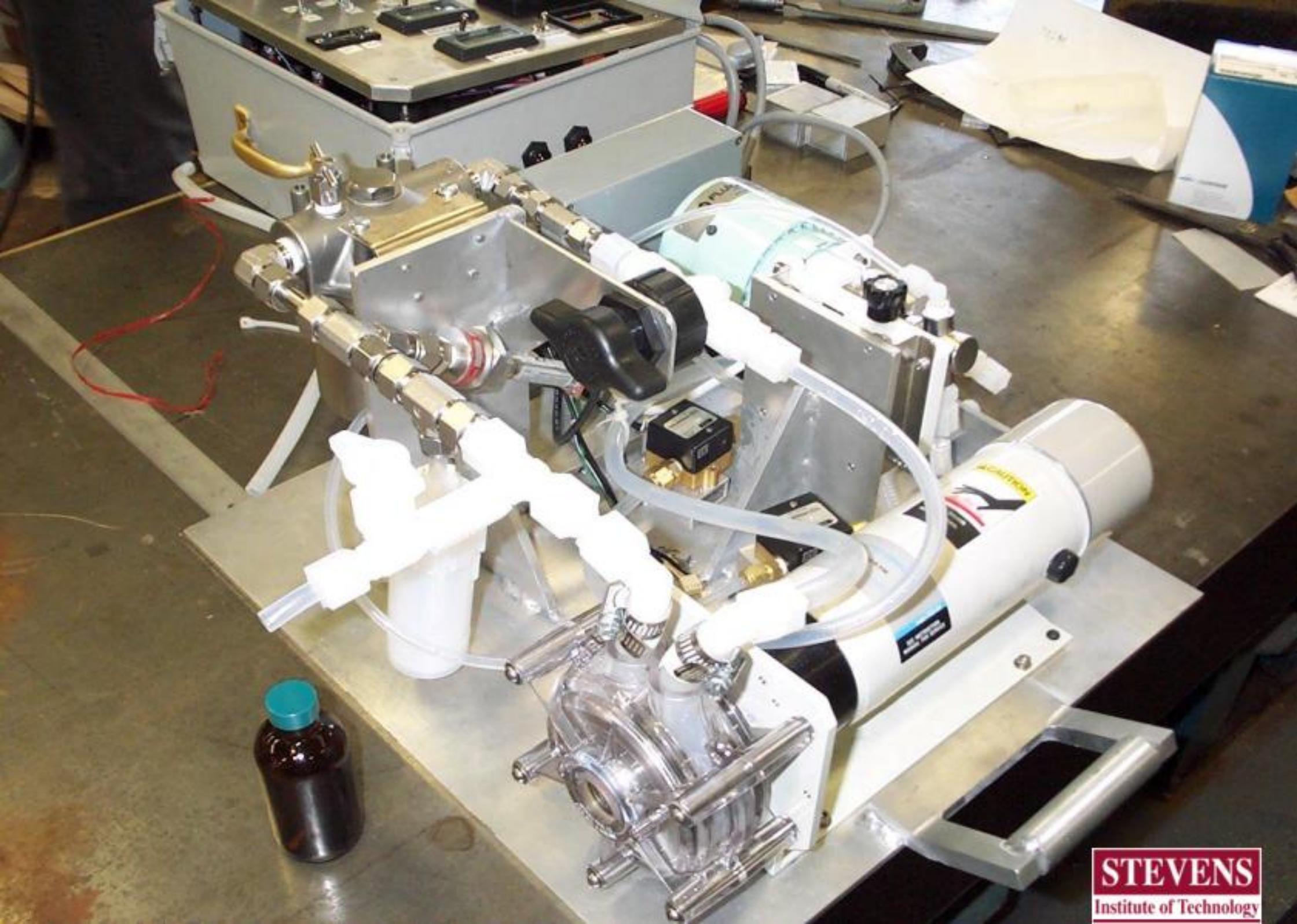
- heads of tide,
- combined sewer outfalls
- mixed pools.



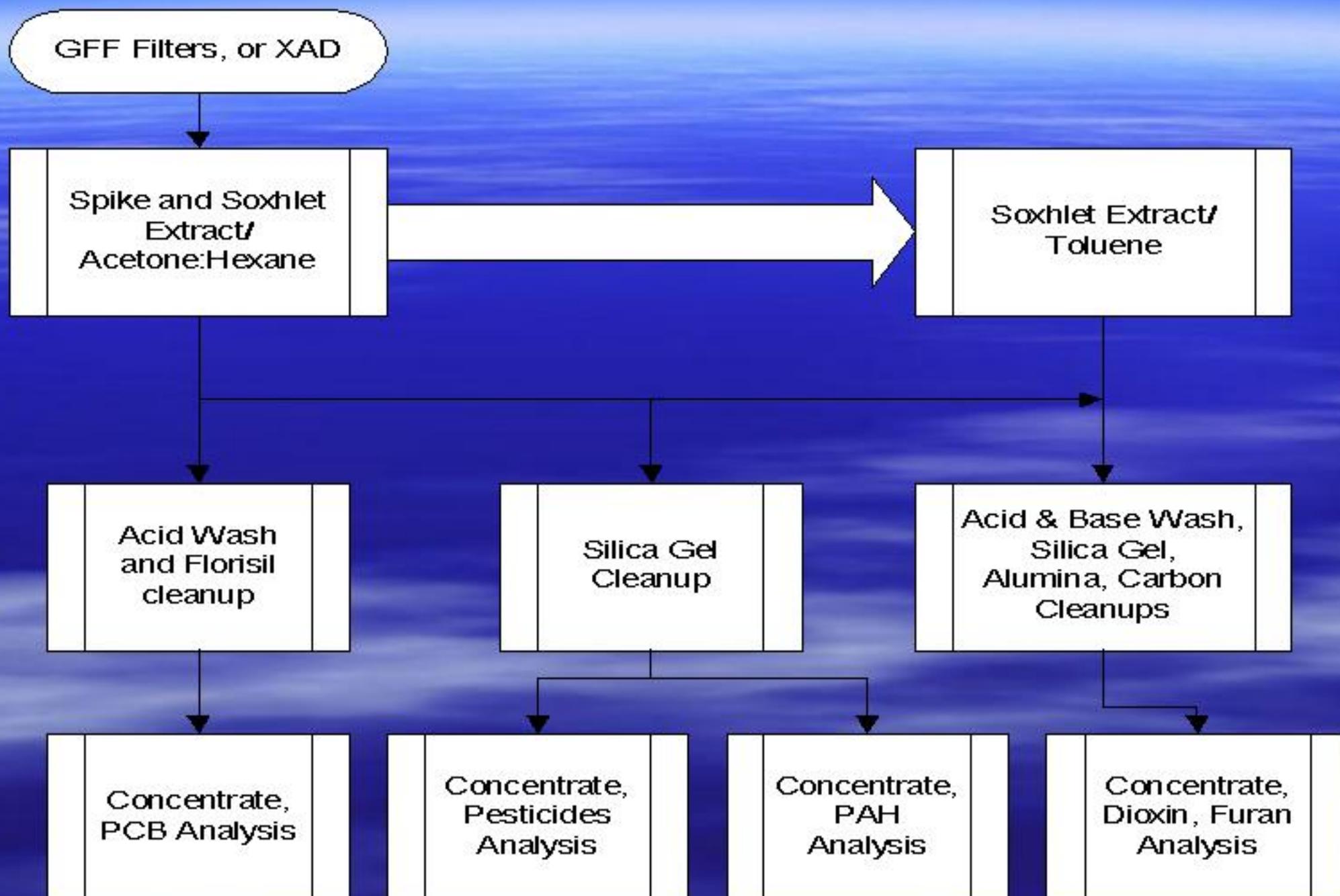


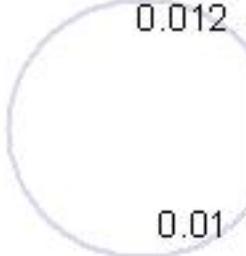
# Modified TOPS Sampler



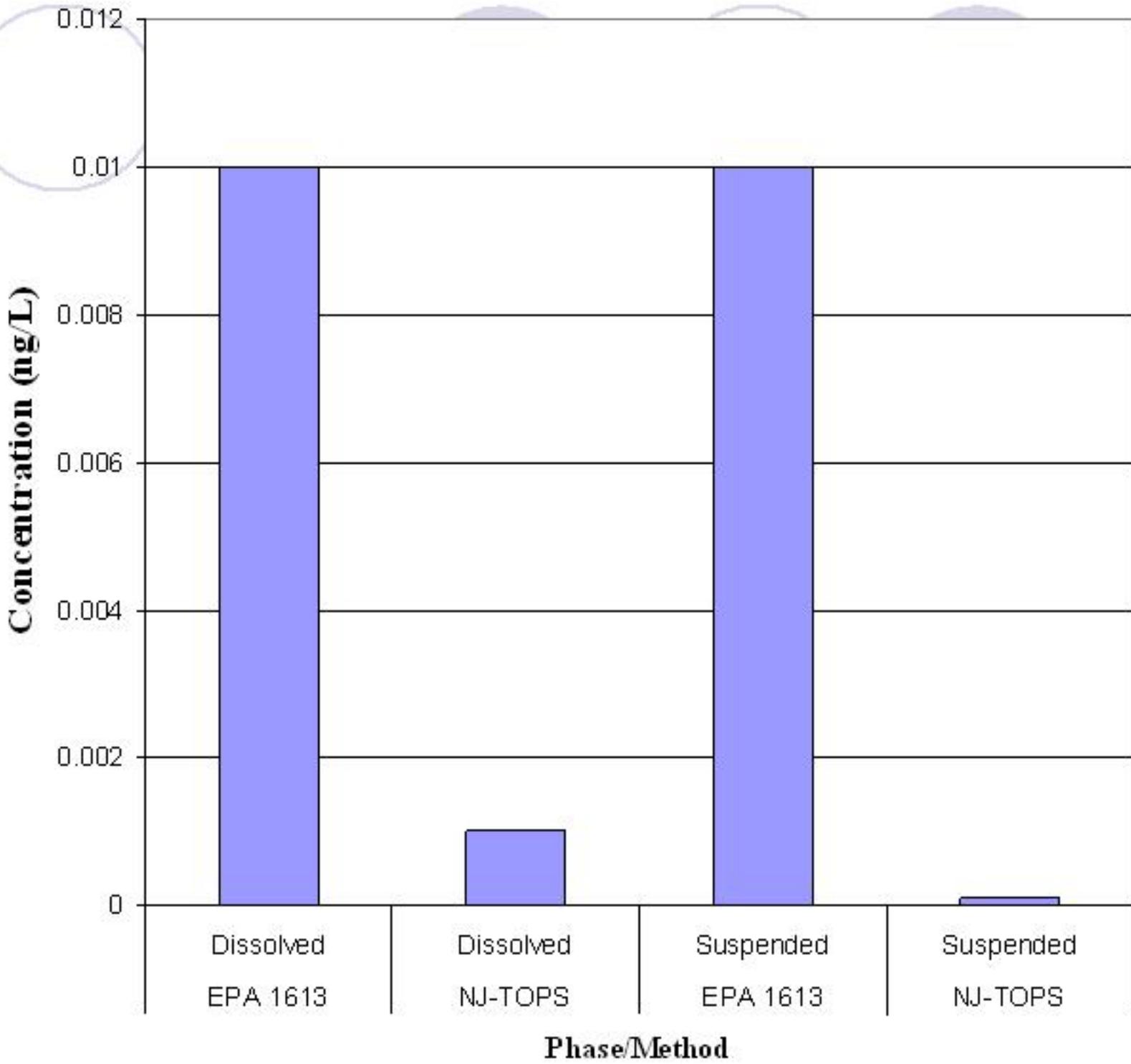


# Laboratory Analysis – Extraction, Cleanup, Concentration, GC/MS



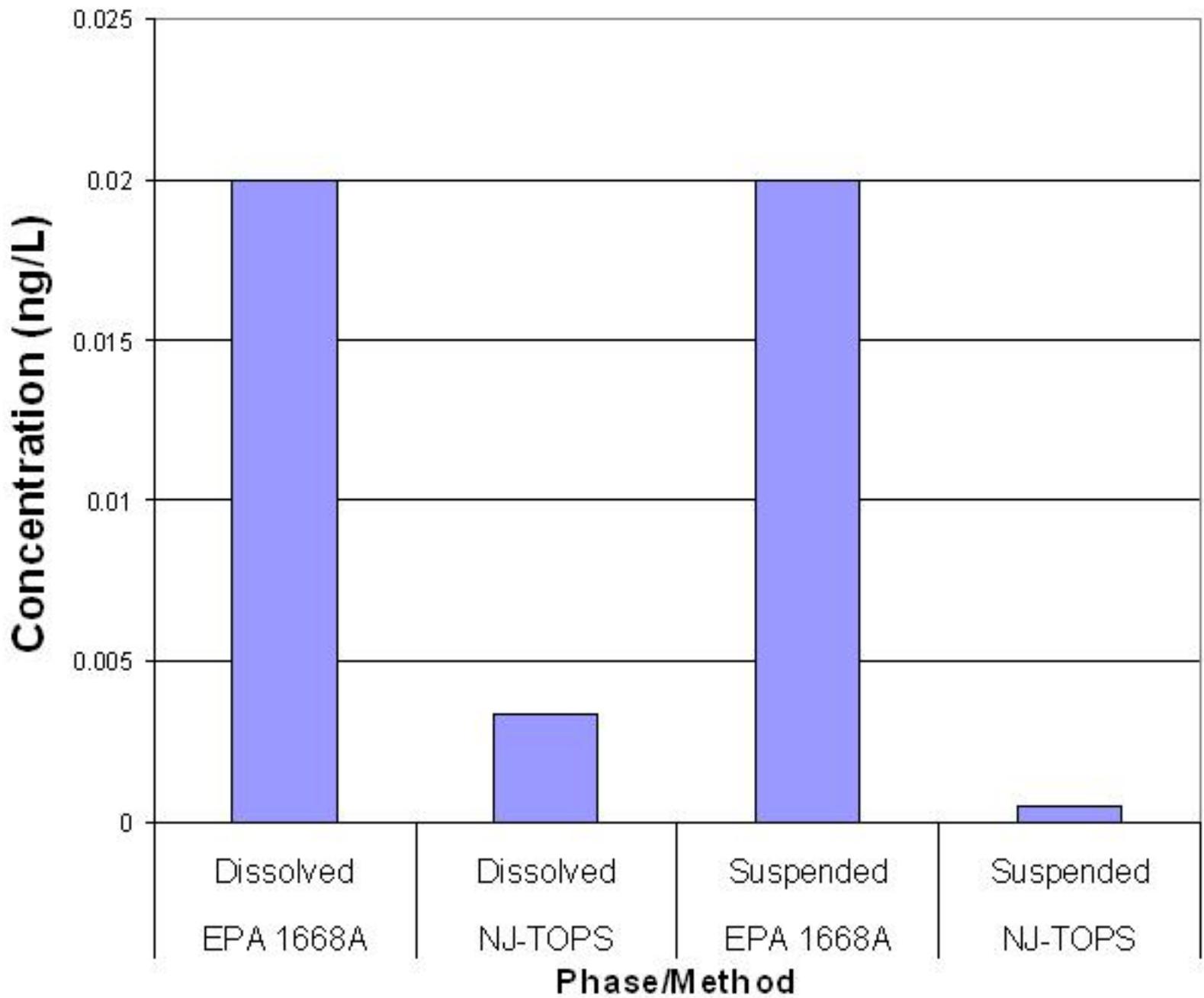


Low  
Calibration  
Level (LCL)  
for TOPS  
versus  
Traditional 1 L  
Grab Sample  
  
Dioxins &  
Furans



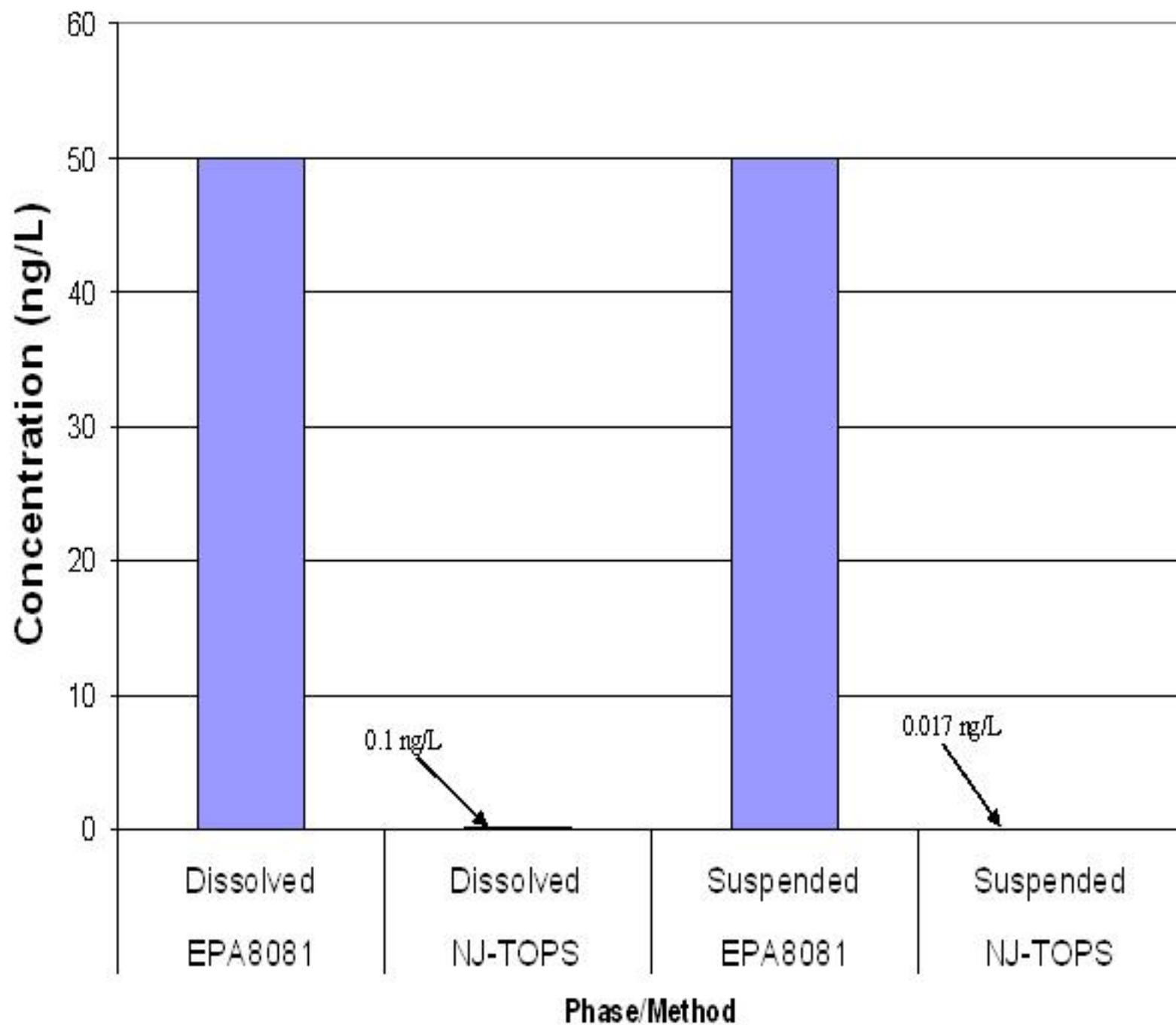
# PCB Congeners

LCL for  
TOPS  
versus 1L  
Grab  
Sample

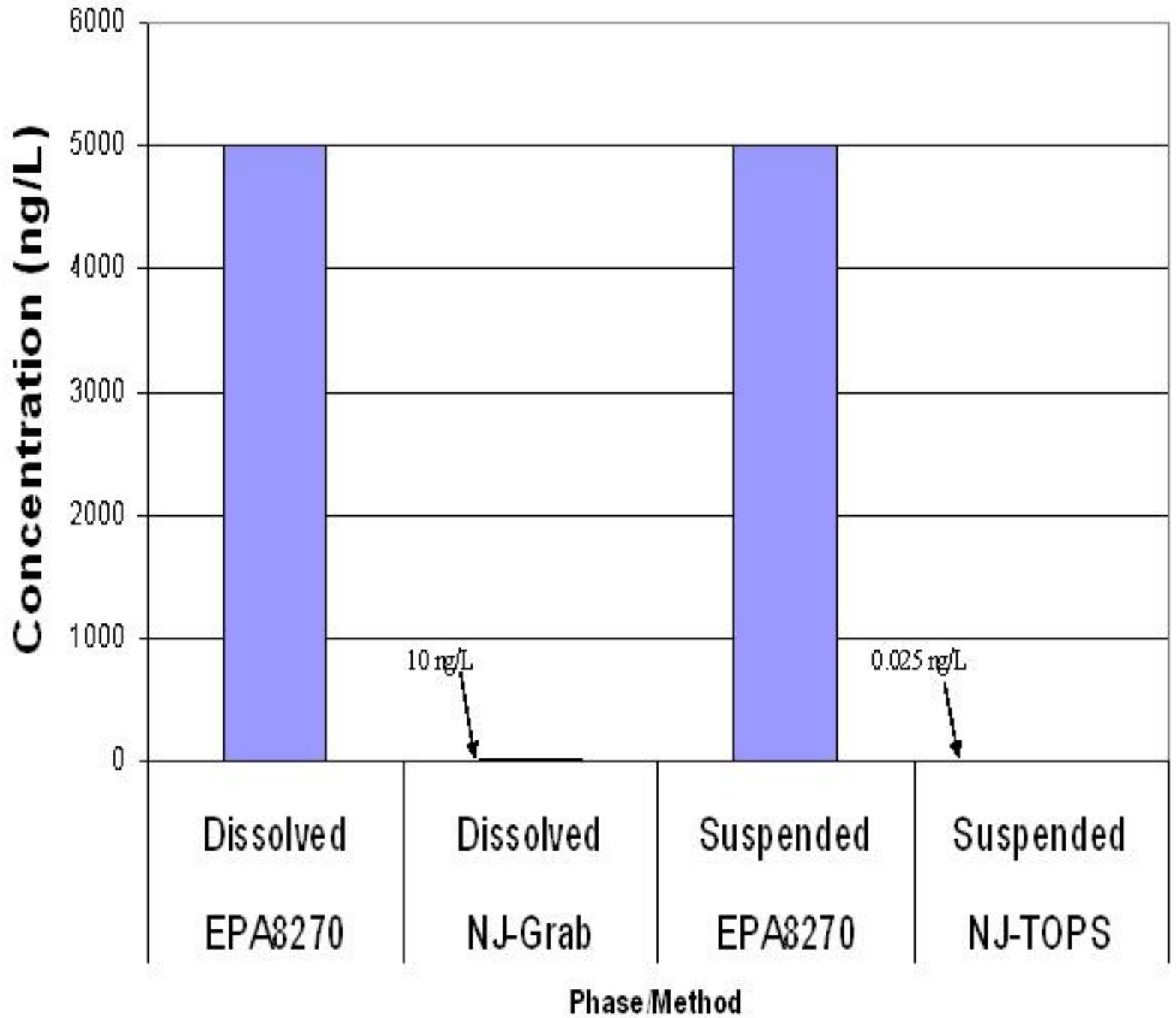


# OC Pesticides

LCL for  
TOPS-HRMS  
versus 1L  
Grab Sample-  
8081



PAHs  
LCL for  
NY/NJ  
Protocol 1L  
Grab  
versus 8270  
(Dissolved)  
& 1L vs  
TOPS  
(Suspended)



# Recovery of NIST SRM 2262 from XAD resin

Mass injected = 10, 20, or 50 ng

Typical time before analysis = 7 to 30 days

BZ # and Homolog Group	1SRM1LPCB (20ng) % recovery	1SRM2LPCB (10ng) % recovery	3SRM1LPCB (50ng) %recovery
8 Di	103	100	99
18 Tri	167	90	153
44 to 77 Tetra	91	89	89
87 to 126 Penta	118	93	115
128 to 153 Hexa	92	98	91
170 to 188 Hepta	105	94	104
195 to 201 Octa	117	110	116
206 Nona	83	98	82
209 Deca	91	95	89
<b>Average Recovery</b>	<b>106</b>	<b>95</b>	<b>104</b>

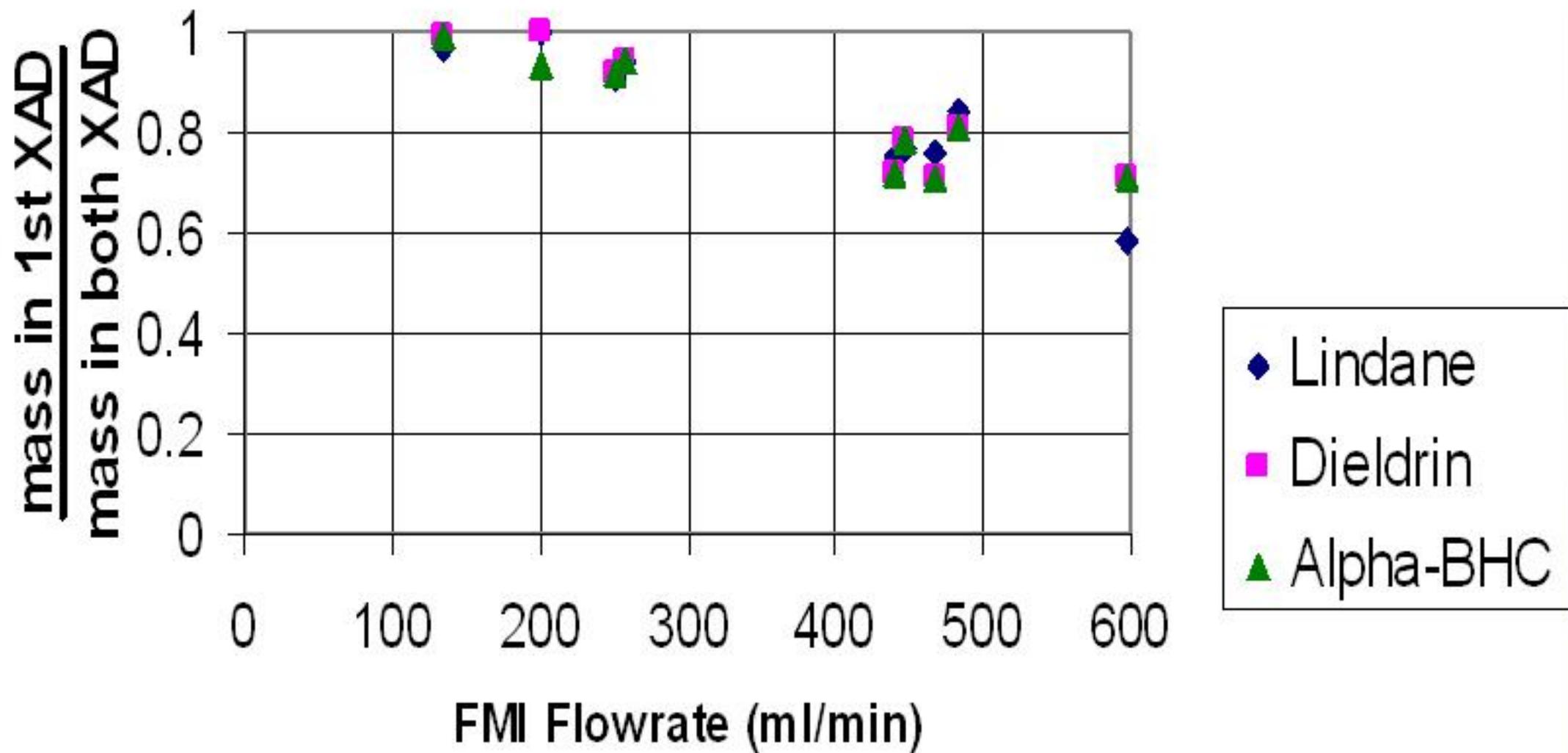
## SRM Recoveries – Pesticides Spiked in XAD

Compound	SRM 2261 NIST Concentration ug/mL	Spiked Mass (pg/sample)	Mass Recovered (pg/sample)	Percent Recovered
gamma-BHC	2.00	1000	700	70
alpha-chlordane	2.00	1000	760	76
2,4' DDD	2.00	1000	770	77
4,4' DDD	2.00	1000	660	66
2,4' DDE	2.00	1000	610	61
4,4' DDE	2.00	1000	1100	110
2,4' DDT	2.00	1000	940	94
4,4' DDT	2.00	1000	940	94
Heptachlor	2.00	1000	1300	130
Hexachlorobenzene	2.00	1000	1000	100
Mirex	2.00	1000	810	81
trans-Nonachlor	2.00	1000	980	98
Dieldrin	2.00	1000	1000	100
Heptachlor epoxide	2.00	1000	800	80

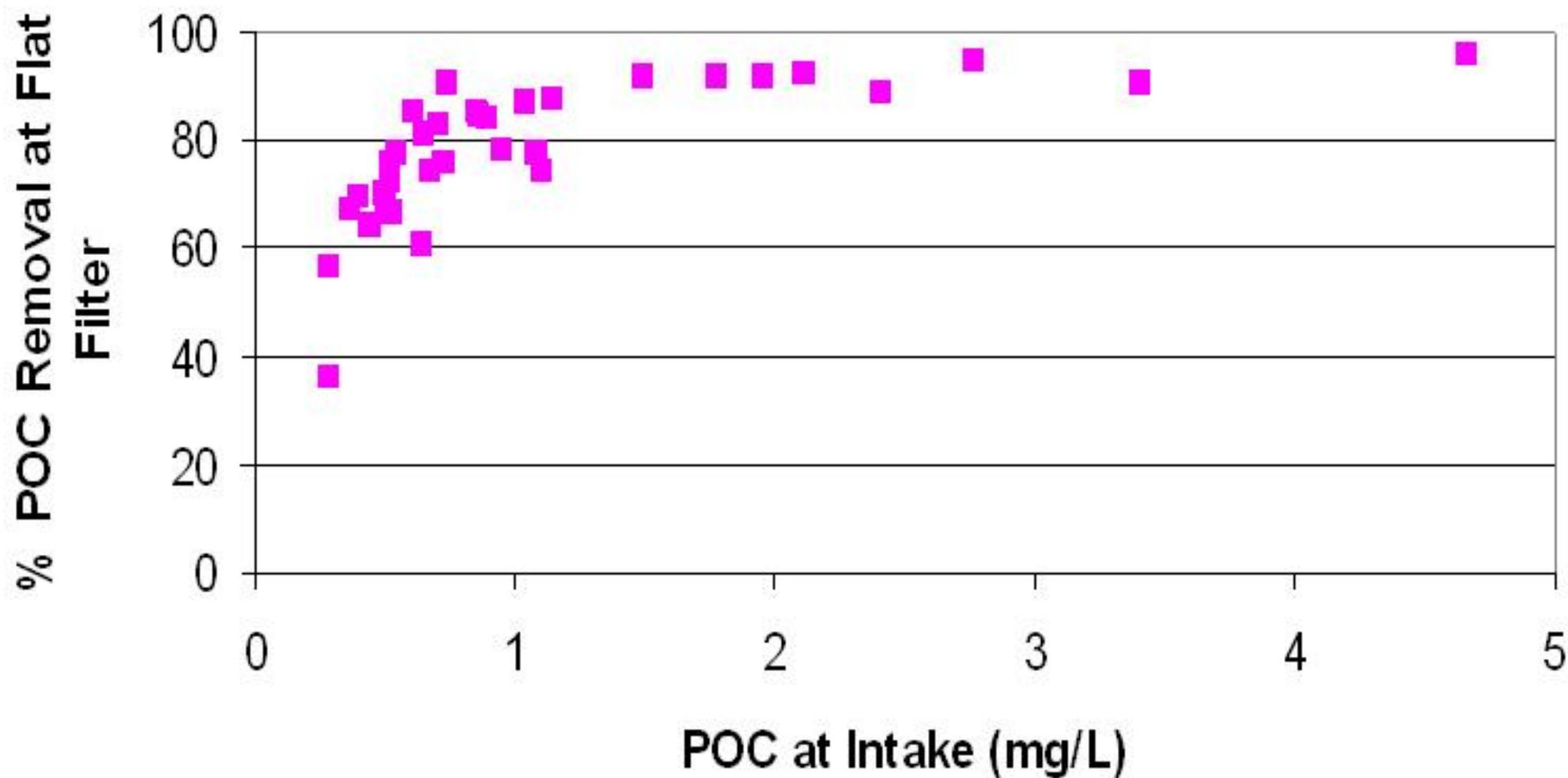
## SRM Recoveries – PAHs Spiked in Water

- Spiked @ 100-500 ng/L in water.
- Applied NYDEC/NJDEP Protocol
- 22 certified analytes determined.
- Recoveries: 82 – 133%

## Pesticide Data FMI flowrate vs. Breakthrough



## POC Removal at Flat Filter



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## *How low can we measure? – Using PCB Congeners as an Example*

EDL – Concentration associated with a peak at 2.5 X noise, during analysis.

Often higher in field and equipment blanks than field samples.

Range of values in this work:

Dissolved (XAD) = 15 to 450 pg (**0.3 to 9 pg/L** for 50 L sample)

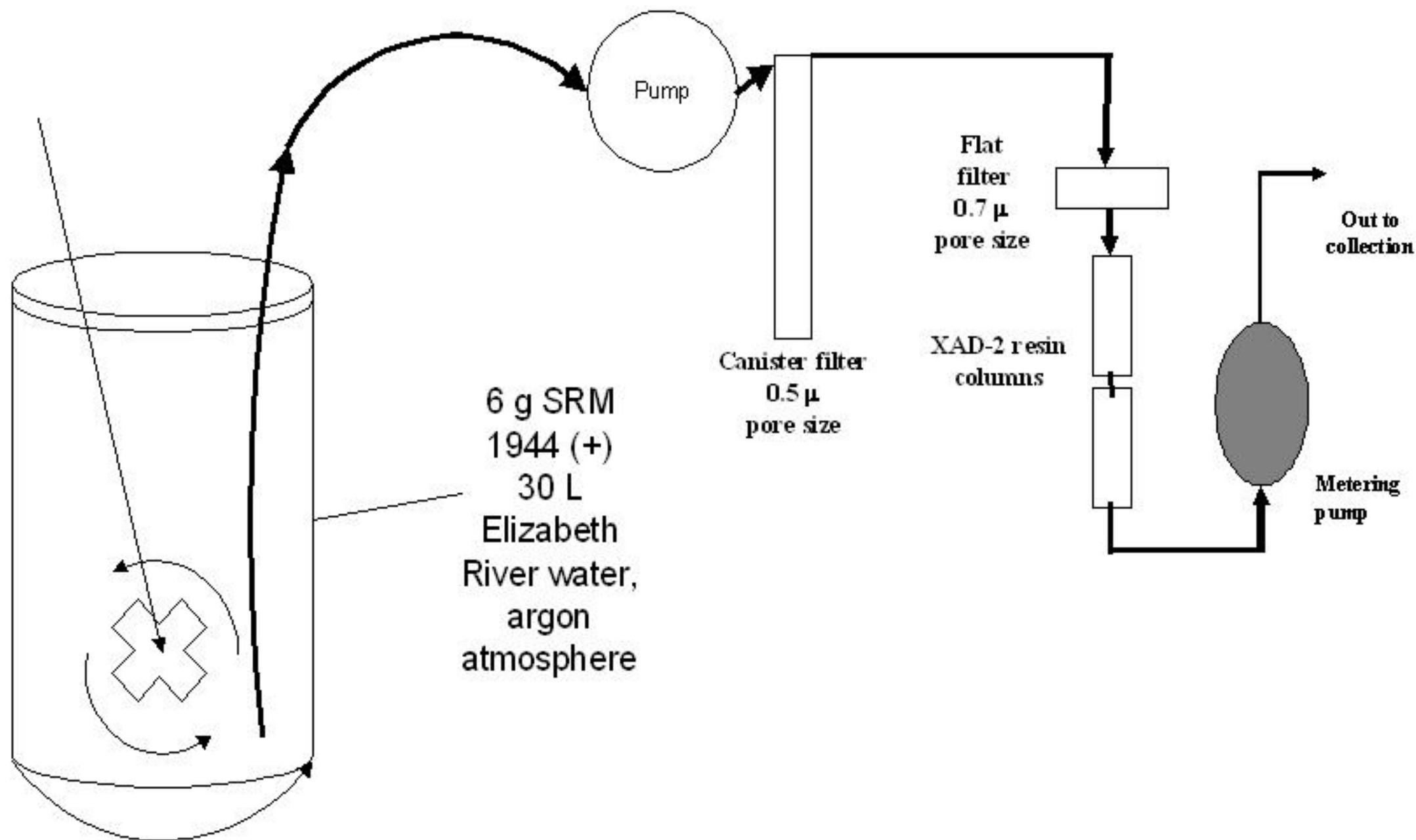
Filters = 25 to 550 pg (8 to 180 pg/g for 3 gram sample)

**For a 500 L sample at 6 mg/L, 0.016 to 0.36 pg/L**

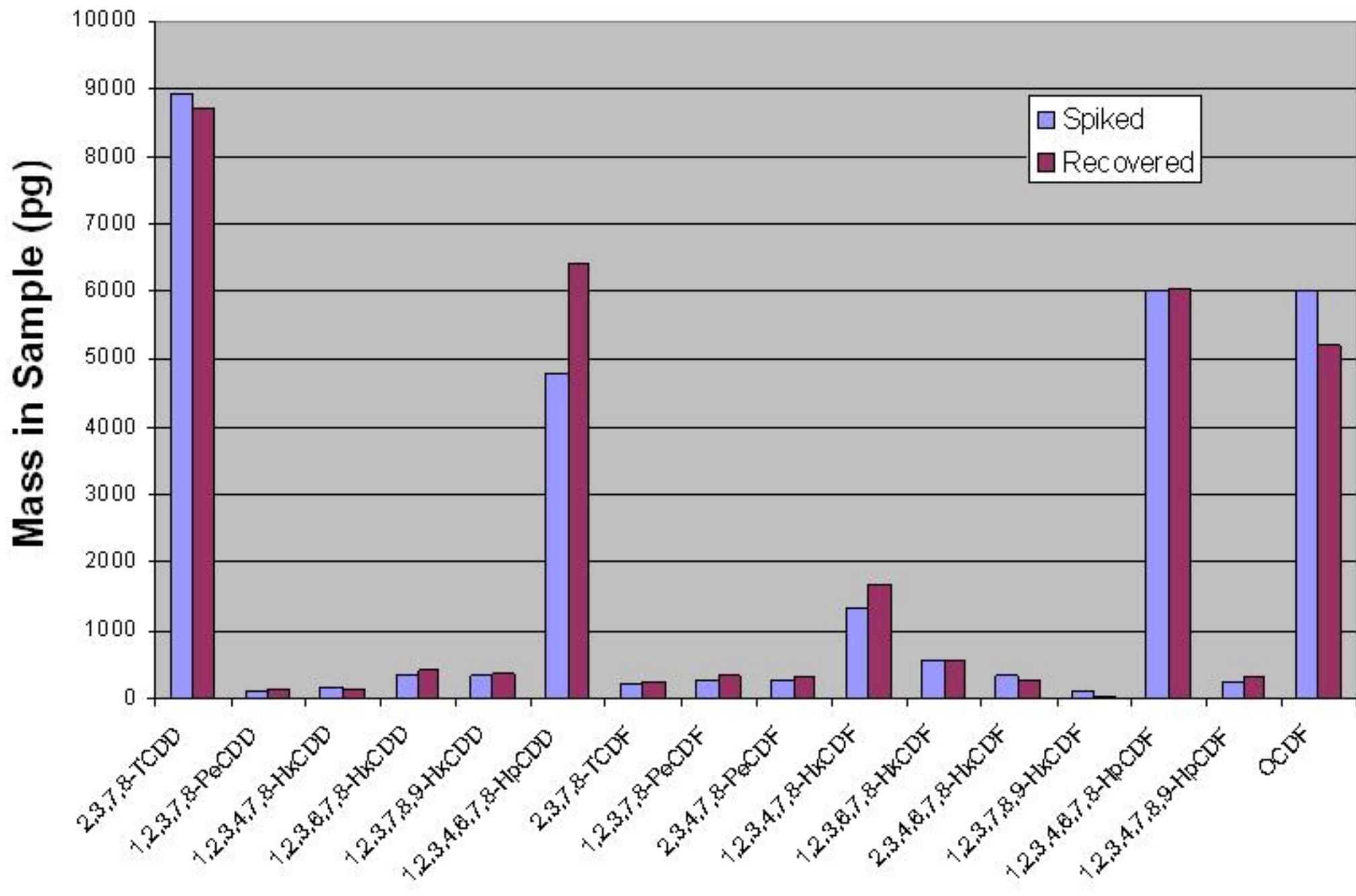
**This assumes that 100% of contaminants entering the sampler are trapped by the filters and XAD, AND recovered through analysis.**

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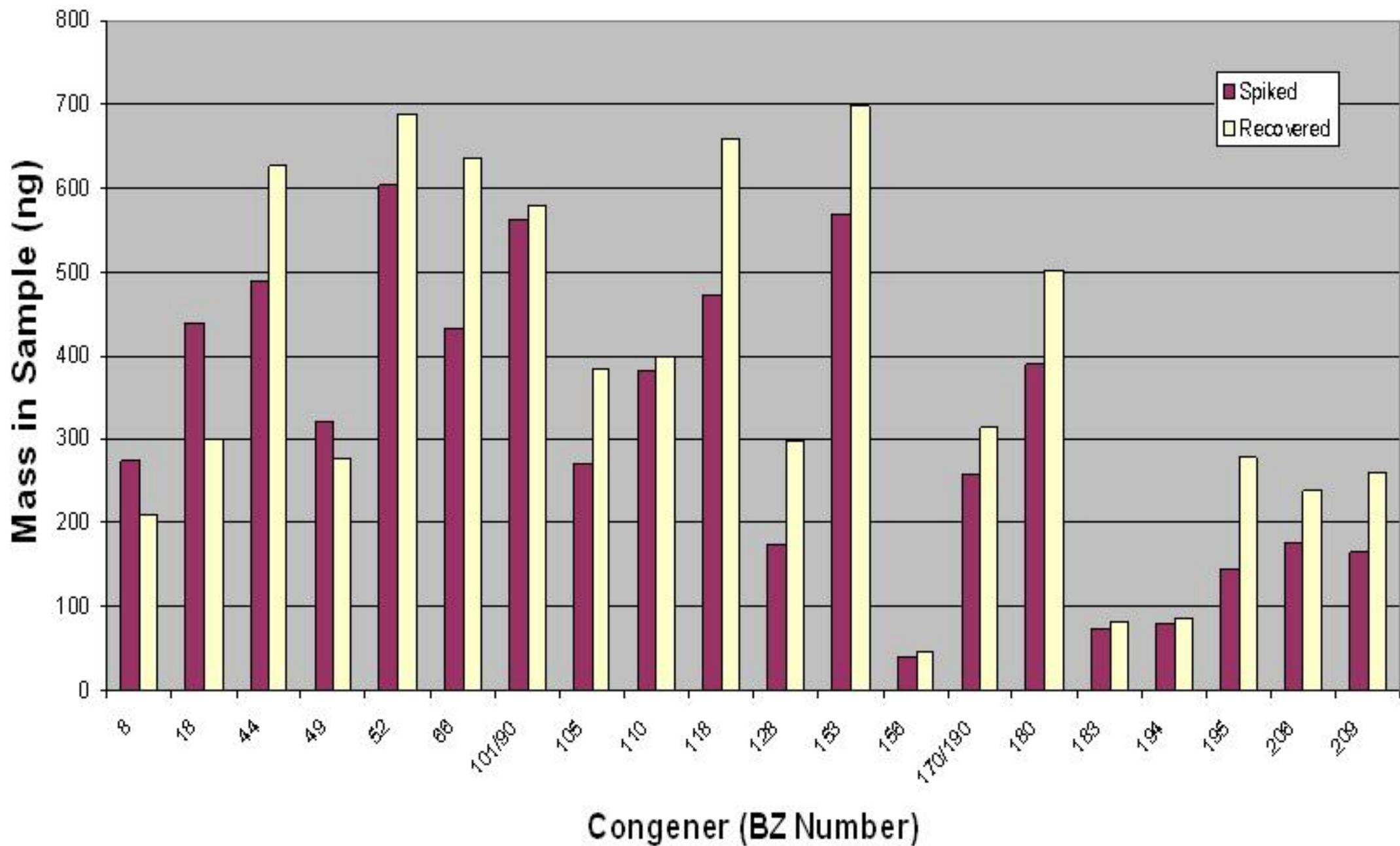
# Vat River, New Jersey



# Sampling & Analysis Validation - Dioxins & Furans



# Sampling & Analysis Validation PCBs



**Leaders in Environmental Testing**

- Operating limits were determined for flow rate, filter configuration, minimum POC, XAD bed volume.
- Calibration range for all compound classes were reduced by 1-4 orders of magnitude below EPA Methods.
- Measured detection limits (EDLs) have been demonstrated at ppq and sub-ppq levels for POPs.
- Laboratory analysis precision and recovery have been demonstrated by SRM analysis. (PAHs, PCBs, OCPs, TCDD).
- Sampling and analysis accuracy has been demonstrated by SRM analysis (PCDD/Fs, PCBs). PAH data is in progress.
- Evaluation of possible positive bias for PCBs is in progress.
- TOPs met program goals for PCDD/F, PCB, PAH (sediments). OCP data not yet evaluated.



- **Timothy Wilson, Jennifer Bonin– USGS, Trenton, NJ**
- **David McNeil, Snell Mills – STL Knoxville**
- **Joel Pecchioli – New Jersey DEP, Trenton, NJ**
- **Tsian Liang Su - Stevens Institute – Rutgers University**
- **Simon Litten, Larry Bailey - New York DEC, Albany NY**



more information...

➤ [dthal@stl-inc.com](mailto:dthal@stl-inc.com)

➤ [tpwilson@usgs.gov](mailto:tpwilson@usgs.gov)