

PFCs in Fish Tissue in the Delaware River



2009 National Forum on
Contaminants in Fish

Portland, OR
November 2009

Presentation Themes

- ✓ Background
 - Delaware River Basin
 - Program objectives
 - Why sample for PFCs?
- ✓ Program Details
 - Sampling Design
 - Analytical Methods
 - 2004-2007 Results
 - Background levels
- ✓ Summary



Basin Facts

- Largest un-dammed river east of the Mississippi – 330 miles
- 13,539 square mile drainage
- 17 million water users
- 216 tributaries
- Three reaches included in National Wild and Scenic River System
- One of the world's largest freshwater tidal estuaries
- Delaware Bay- 782 sq. miles

Background

□ Issues:

1. Why monitor fish?
 - Interstate waters
 - Funding for programs
 - Coordination w/ State partners.
2. Design considerations:
 - Locations – tidal vs. nontidal?
 - Species – resident or migratory?
 - Analytical parameters
3. Why monitor for PFCs?

Sampling Design

- ❑ Historically, water quality near the urban areas surrounding Philadelphia was severely degraded with dissolved oxygen conditions near 0 mg/l.
- ❑ When conditions improved in the 1980s, fish returned to this area, but were contaminated with several chemicals including PCBs.
- ❑ Fish contaminant monitoring was initiated in tidal waters in the 1990s with PCBs and chlorinated pesticides the target contaminants.
- ❑ In 2000, monitoring was extended to non-tidal areas.
- ❑ In 1994, PFCs, PBDEs and dioxin/furans were added as target contaminants.

Sampling Design

- ❑ Fish samples were collected from 8 stations in both the tidal and non-tidal portion of the Delaware River.
- ❑ Two species of fish are collected at each site representing resident benthic and pelagic trophic levels.
 - Tidal species: white perch, channel catfish
 - Non-tidal species: smallmouth bass, white sucker
- ❑ Samples are collected by electrofishing or hook & line, and consist of 4 to 5 fish of similar size and weight.

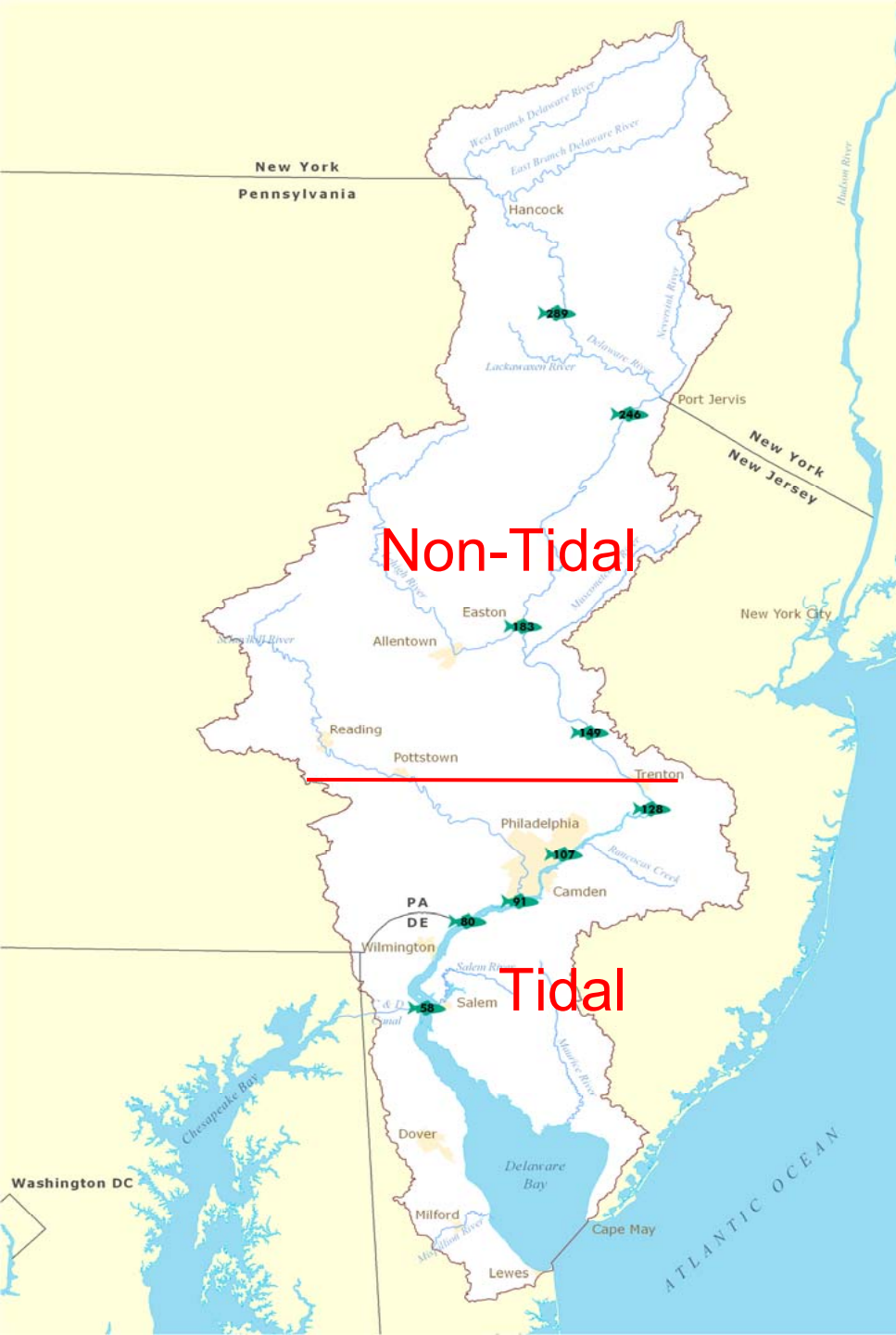
Sampling Locations 2004 - 2006

Non-Tidal Locations

| | |
|------------------|--------|
| Narrowsburg, NY | RM 290 |
| Milford, PA | RM 246 |
| Easton, PA | RM 183 |
| Lambertville, NJ | RM 149 |

Tidal Locations

| | |
|--------------------|--------|
| Crosswicks Creek | RM 128 |
| Tacony-Palymra Br. | RM 107 |
| Woodbury Creek | RM 91 |
| Raccoon Creek | RM 80 |
| Salem River | RM 58 |



Analytical Methods

- ❑ Samples are composites of standard fillets.
- ❑ Analytical Parameters & Methods:
 - 13 compounds using LC/MS/MS Method

Sulfonates

- 4 Perfluorobutanesulfonate (PFBS)
- 6 Perfluorohexanesulfonate (PFHxS)
- 8 Perfluorooctanesulfonate (PFOS)
- 8 Perfluorooctane sulfonamide (PFOSA)

**# of fluorinated
carbons**

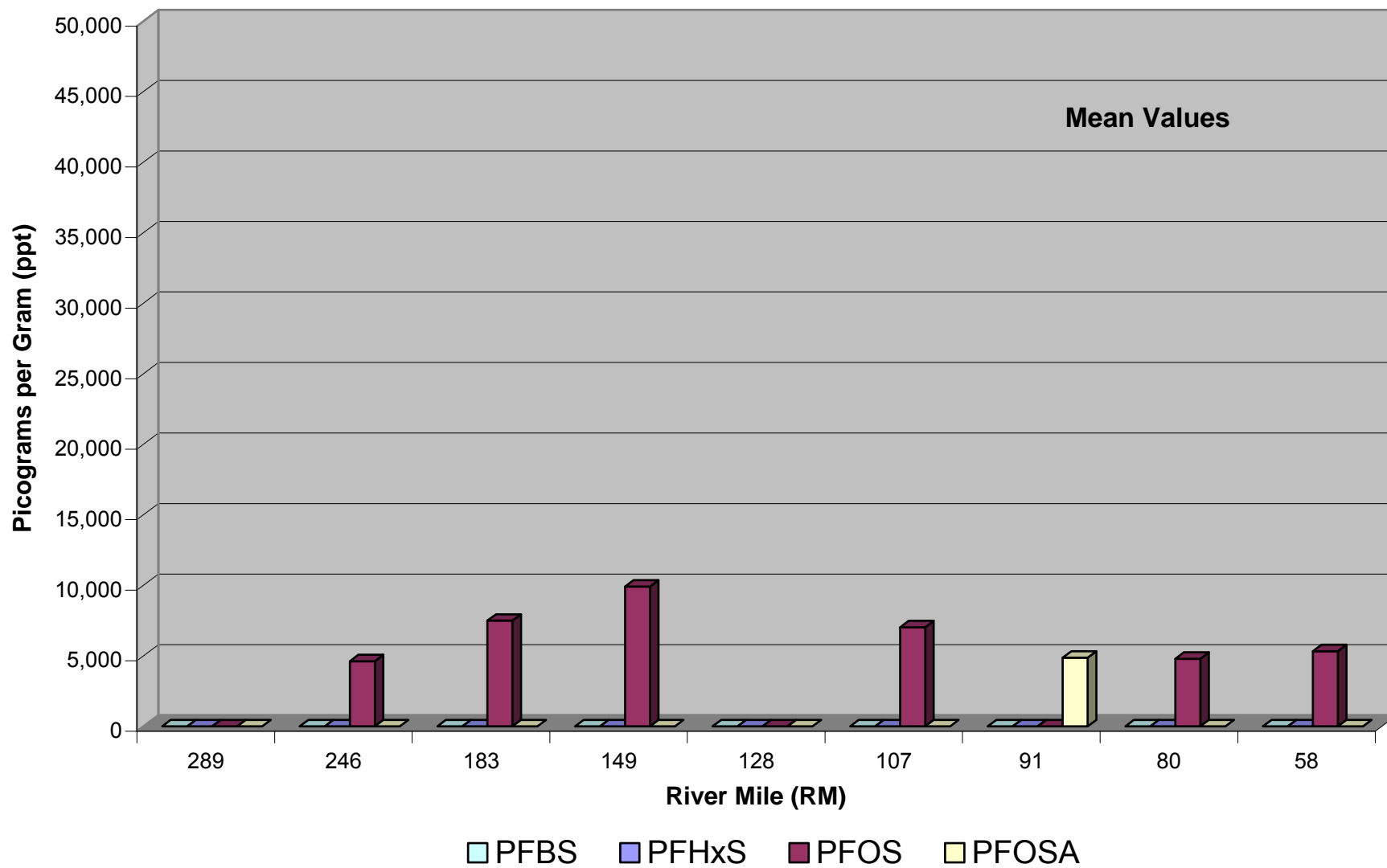


Carboxylates

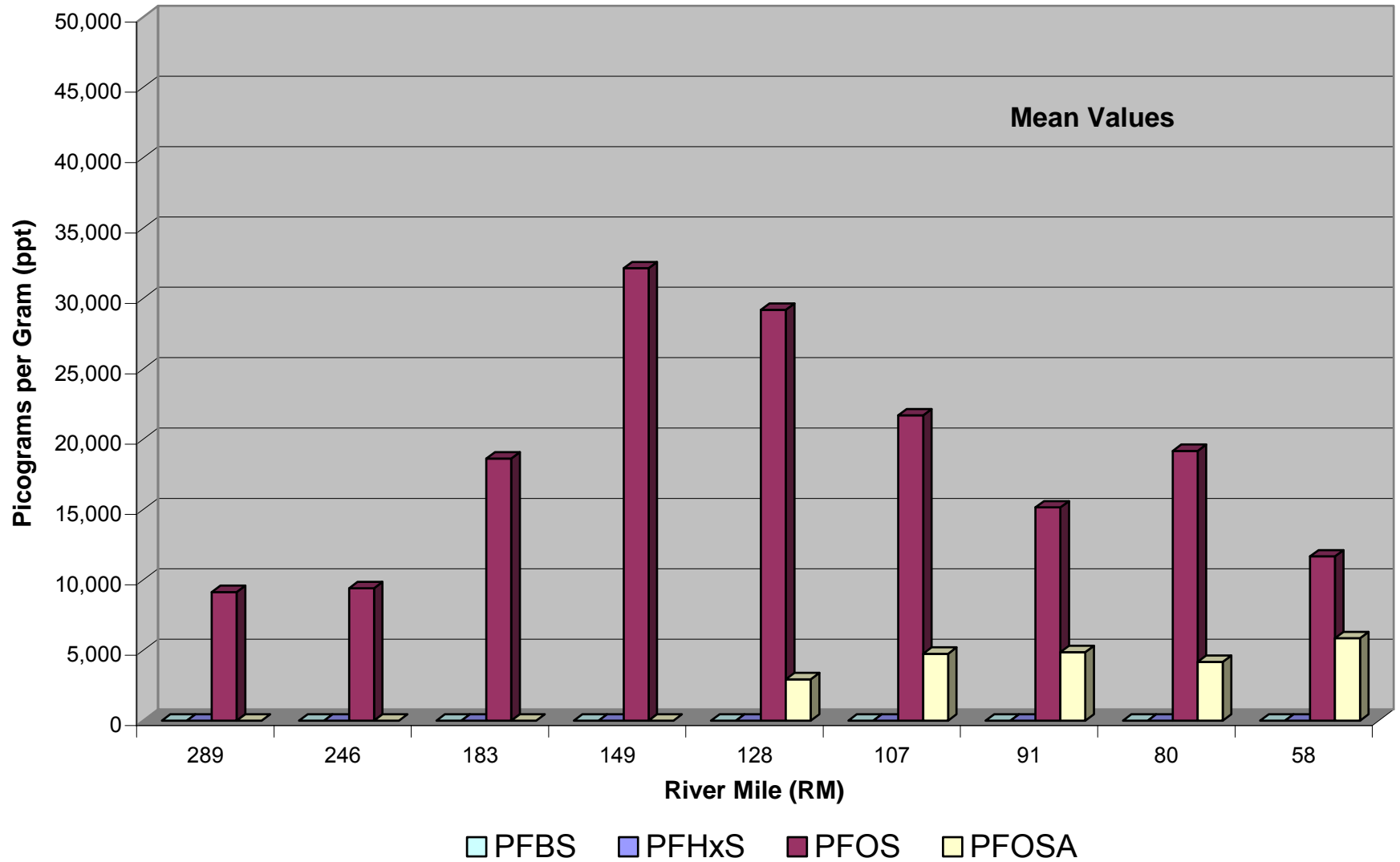
- 3 Perfluorobutanoate (PFBA)
- 4 Perfluoropentanoate (PFPeA)
- 5 Perfluorohexanoate (PFHxA)
- 6 Perfluoroheptanoate (PFHpA)
- 7 Perfluorooctanoate (PFOA)
- 8 Perfluorononanoate (PFNA)
- 9 Perfluorodecanoate (PFDA)
- 10 Perfluoroundecanoate (PFUnA)
- 11 Perfluorododecanoate (PFDoA)

- ❑ Analysis by Axys Analytical LTD

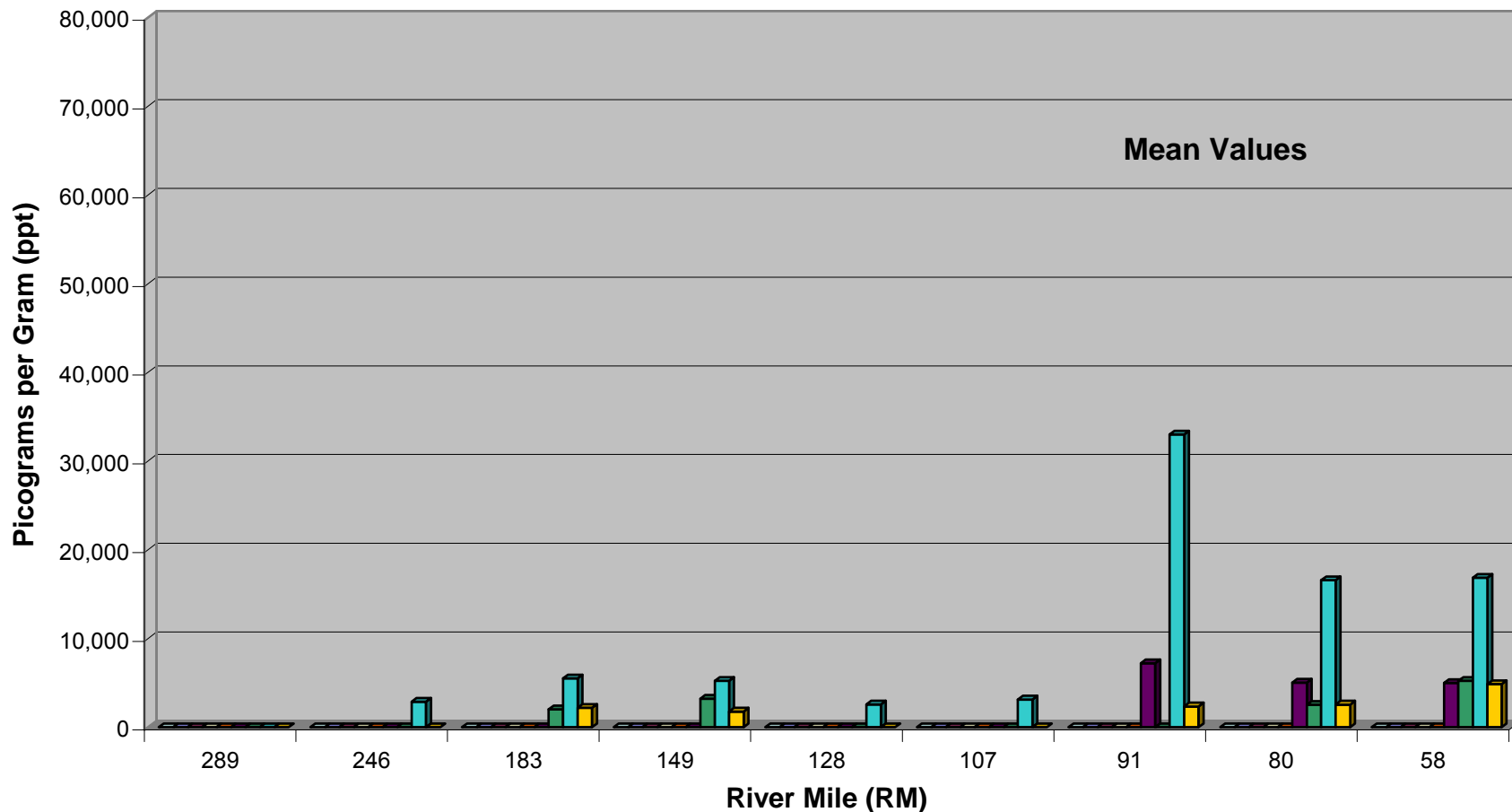
Perfluorinated Alkyl Sulfonate Results for Benthic Species Delaware River - 2004 - 2007



Perfluorinated Alkyl Sulfonate Results for Pelagic Species Delaware River - 2004 - 2007



Perfluorinated Carboxylate Results for Benthic Species Delaware River - 2004 - 2007



PBA

PFPeA

PFHxA

PFHpA

PFOA

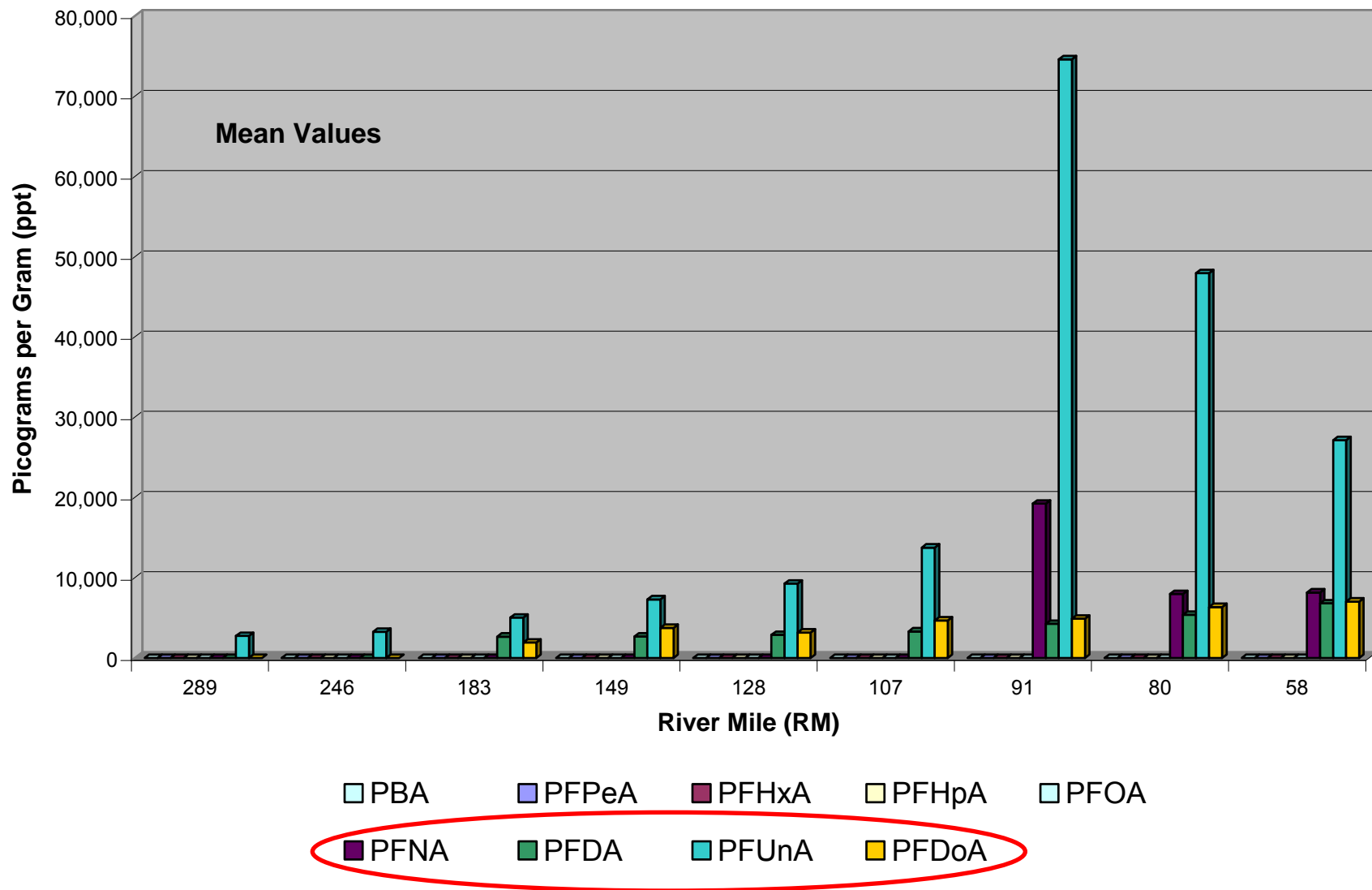
PFNA

PFDA

PFUnA

PFDoA

Perfluorinated Carboxylate Results for Pelagic Species Delaware River - 2004 - 2007



Background Concentrations

- ◆ The northernmost sampling locations should reflect background concentrations since they are located within National Park Service units.

| Type | Parameter | Mean (ppb) | Std Dev (ppb) |
|-------|-----------|------------|---------------|
| PFASs | PFOS | 9.4 | 3.4 |
| | PFOSA | U | - |
| PFCAs | PFNA | U | - |
| | PFDA | U | - |
| | PFUnA | 3.1 | 0.7 |
| | PFDoA | U | - |

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| | <i>PFUnA</i> | <i>3.1</i> | 0.7 |
| | PFDoA | U | - |

Summary

- ◆ DRBC conducted analysis of fish tissue samples from 9 locations for PFCs in the Delaware River Basin from 2004-2007.
- ◆ PFC concentrations were higher in pelagic compared to benthic species tested.
- ◆ Results indicated higher concentrations of PFOS/PFOSA (up to 35 ppb) in pelagic species near urban areas.
- ◆ Results indicated detectable concentrations of PFCAs with 8 fluorinated carbons or more (PFNA, PFDA, PFUnA and PFDoA).

Summary

- ◆ Highest tissue concentrations (~75 ppb) were observed for PFUnA in a pelagic species near the Philadelphia urban area.
 - ◆ DRBC also conducted ambient water surveys in the tidal portion of the Delaware River from 2007 to 2009 to provide data for bioaccumulation and impairment assessments.
 - ◆ Additional fish tissue sampling for PFCs is planned in 2010 as part of the DRBC's routine surveys.
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- A stylized silhouette of a mountain range in a teal color, located in the bottom right corner of the slide.