PFAS in Surface Water, Sediment and Fish from the Delaware River

Ron MacGillivray, Ph.D.
Senior Environmental Toxicologist
ron.macgillivray@drbc.gov

HDC-SETAC Spring Meeting
April, 2019

www.itrcweb.org
Why was the DRBC created in 1961?

- Water supply shortages and disputes over the apportionment of the basin’s waters;
- Severe pollution in the Delaware River and its major tributaries;
- Serious flooding

Five Equal Members:
Delaware
New Jersey
Pennsylvania
New York
Federal Government
Contaminants
DRBC 2004 to 2018

- Pharmaceuticals and Personal Care Products (PPCP)
- Hormones
- Stain repellants/non-stick surfaces/fire fighting foams [PFAS]
- Flame Retardants [PBDE]
- Detergents [NP]
- Plasticizers [bis-phenol A]
- Surveys in surface water, fish and sediment
What are the occurrences and sources of CEC in the Delaware River and Bay?

What are the risks to designated uses in Delaware River and Bay from CEC?

What actions can be identified to minimize CEC impacts in the Delaware River and Bay?
Why are Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) of Concern?

- Properties
- Uses
- Sources
- Stewardship
- Alternatives
- Discharges
- Persistence
- Toxicity
- Bioaccumulation

https://journals.plos.org/plosbiology/article/figure?id=10.1371/journal.pbio.2002855.g001
Association with liver damage, increased cholesterol, thyroid disease, decreased response to vaccines, asthma, decreased fertility and birth weight, pregnancy–induced hypertension

**EPA HA PFOS & PFOA 70 ng/L, NJDEP MCL PFNA 13 ng/L**
Ecological Effects

- National WQC for aquatic life not derived
- Long chain PFAS bioaccumulate
- Many PFAS are persistent (short and long chain)
- Moderately acute and slightly chronically toxic to aquatic organisms (survival, growth and reproduction)
  - PNEC for PFOS 0.6 to 6.6 ug/L (Qi et al. 2011)
  - PNEC for PFOA 1,250 ug/L (Hoke et al. 2015)
  - PNEC for PFHxA (C6) 199 ug/L (Hoke et al. 2015)
- Sublethal effects observed (e.g., histopathology, neurological and immune effects) non-standard tests
Water grab samples in HDPE bottles
Fish samples are composites of five standard fillets.
Sediment surficial grab with Ponar.
Analytical Parameters & Methods: 13 compounds using LC/MS/MS Method
Analysis by SGS-Axys Analytical LTD

**Sulfonates and Sulfonamide**

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

**Carboxylates**

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

# of carbons
Surface water
Six tidal sites in 2007, 2008, 2009
Fifteen tidal sites in 2015
Four non-tidal sites in 2016

Fish

Sediment
Fifteen tidal sites in 2016
PFAS (ng/L) decreases in surface water vary by compound.
PFAS in sediment 2016
low concentrations similar to other urban areas

Sediment surficial grab with Ponar.
PFAS (ng/g) in fish fillet vary by species, location and year.
Statistically significant decreases for PFNA and PFUnA concentrations in fish
PFOS bioaccumulation in fish with limited declines in concentrations

**PFOS (C8) in Smallmouth Bass from Delaware River**
- EDL < 5.0 ng/g in 2004 to 2010
- EDL < 1.0 ng/g in 2012 to 2018

**PFOS (C8) in White Perch from Delaware Estuary**
- EDL < 5.0 ng/g in 2004 to 2010
- EDL < 1.0 ng/g in 2012 to 2018

Sampling years: 2004 to 2018

Sampling locations:
- RM 149
- RM 183
- RM 246
- RM 289
- RM 58
- RM 80
- RM 91
- RM 107
- RM 128

RM 289 not sampled
PFAS have been detected in surface water, sediment and fish from the main stem Delaware River

Data needs:

- for fish consumption advisories (more main stem data and advisory triggers)
- for source water protection (occurrence of other PFAS, precursors and alternative cpds e.g., GenX and Solvay replacement product)
- for protection of aquatic life (measured environmental concentrations and predicted no effect concentrations, bioaccumulation factors (BAF)
Questions

Ron MacGillivray, Ph.D
Senior Environmental Toxicologist
ron.macgillivray@drbc.gov
DRBC Contaminants of Emerging Concern
https://www.state.nj.us/drbc/quality/reports/cecs.html