United States Environmental Protection Agency
Office of Water 4305T
EPA-820-F-13-003 September 2013

Contaminants of Emerging Concern (CECs) in Fish:

Polybrominated Diphenyl Ethers (PBDEs)

About PBDEs

Polybrominated diphenyl ethers (PBDEs), commonly referred to as brominated flame retardants, are a group of chemical compounds that include 209 congeners in ten bromination levels (mono through deca). They are widely used as flame retardants in the manufacture of a number of products, including textiles, polyurethane upholstery foams, and plastic components of electronic equipment. Commercial production of PBDEs began in the 1970s and researchers first reported their presence in the environment in the 1980s. Recent studies indicate that PBDEs are transported worldwide passively by air and actively through water sources, and they can occur in locations as remote as the arctic environment. Monitoring studies to date document their presence in air, water, soil, sediment, and biota (including humans). About 30 congeners are commonly detected in environmental samples.

Why Is Studying PBDEs in Fish Important?

In the past decade, PBDEs have emerged as contaminants of concern because they are widely distributed and persistent in the environment. A number of studies conducted in the U.S. and Europe since 2000 confirm that PBDEs biomagnify in the food chain and accumulate in fish and human tissue. PBDEs have been associated primarily with endocrine disruption and neurodevelopmental toxicity.

How Is EPA Responding?

Most of the early studies of PBDEs in U.S. fish focused on a particular waterbody or on the occurrence of a particular group of PBDE congeners. In 2003, the EPA identified the need for a more comprehensive characterization of PBDE contamination in U.S. fish and conducted a series of national- and regional-scale studies to evaluate the extent of PBDE contamination in freshwater fish. The purpose of the studies was to develop national or regional estimates of the median concentrations of PBDEs in fish from various surface waters, including lakes, reservoirs, and rivers. The statistical design of the studies also allowed for estimation of the percentage of lakes and reservoirs or river miles with fish tissue concentrations above a specified human health threshold. EPA established partnerships to conduct the following studies:

- The National Study of Chemical Residues in Lake Fish Tissue (1998–2009)
- National Rivers and Streams Assessment (2008–2014)
- National Coastal Condition Assessment, Great Lakes Human Health Fish Tissue Study (2010–2014)

The National Study of Chemical Residues in Lake Fish Tissue
(National Lake Fish Tissue Study)

First statistically based national assessment of contaminants in fish from U.S. lakes and reservoirs

National Lake Fish Tissue Study Design

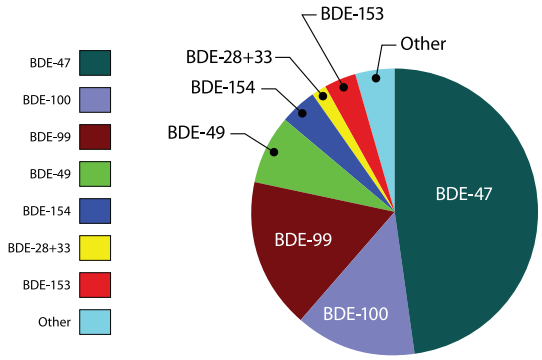
Design Elements	PBDEs		Other Chemicals	
	Predators	Bottom Dwellers	Predators	Bottom Dwellers
Number of Sites	166	166	500	500
Sampling Period	2003	2003	2000–2003	2000–2003
Fish Samples/Site	1	1	1	1
Fish Tissue Sample	Fillets	Whole bodies	Fillets	Whole bodies
Chemical Analysis	46 congeners	46 congeners	Various*	Various*
Total Samples Analyzed	160	131	486	395

* Additional Chemicals: Hg, As, PCBs (209 congeners), dioxins/furans (17), pesticides (46), and semi-volatile organic compounds (40)

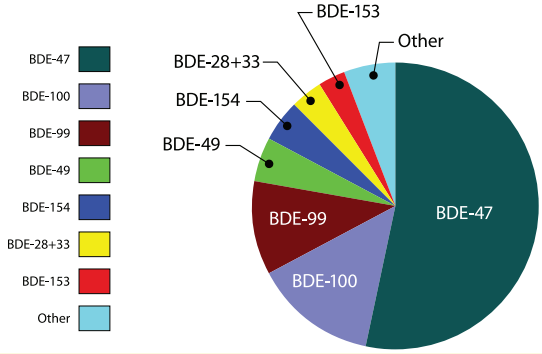
PBDE Results

- The three most prevalent PBDE congeners in both predator fillet and bottom-dweller whole-body samples are BDE-47, BDE-99, and BDE-100.
- Due to higher lipid content, measured concentrations of individual PBDE congeners are consistently higher in whole-body samples than in fillet samples; the maximum measured concentration for fillet samples is 38 ppb and 125 ppb for whole-body samples.

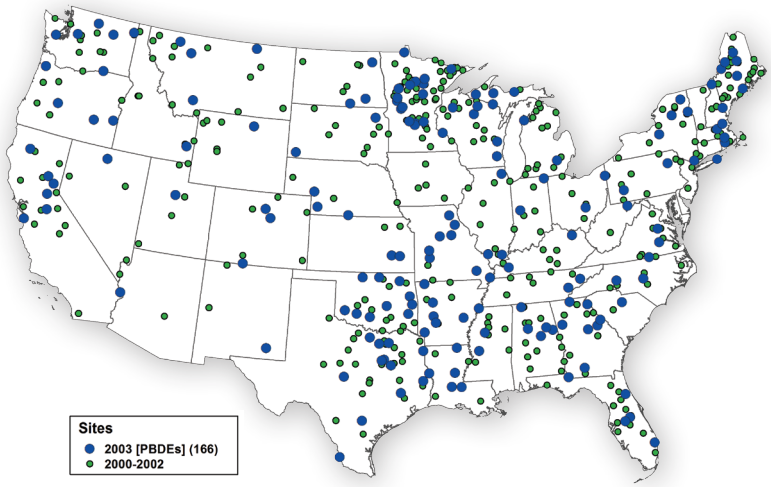
Contributions of Individual PBDEs to Total PBDE Concentrations in Fish Fillet Samples



Contributions of Individual PBDEs to Total PBDE Concentrations in Whole-Body Fish Samples



NLFTS Fish Sampling Locations (500)



Publications

- **PBDE Results Article** (in press; Environmental Monitoring and Assessment Journal; projected publication in 2013)
- **National Lake Fish Tissue Study Final Report** (September 2009)
- **Study Design and Legacy Contaminant Results Articles** (Environmental Monitoring and Assessment Journal, 2009)

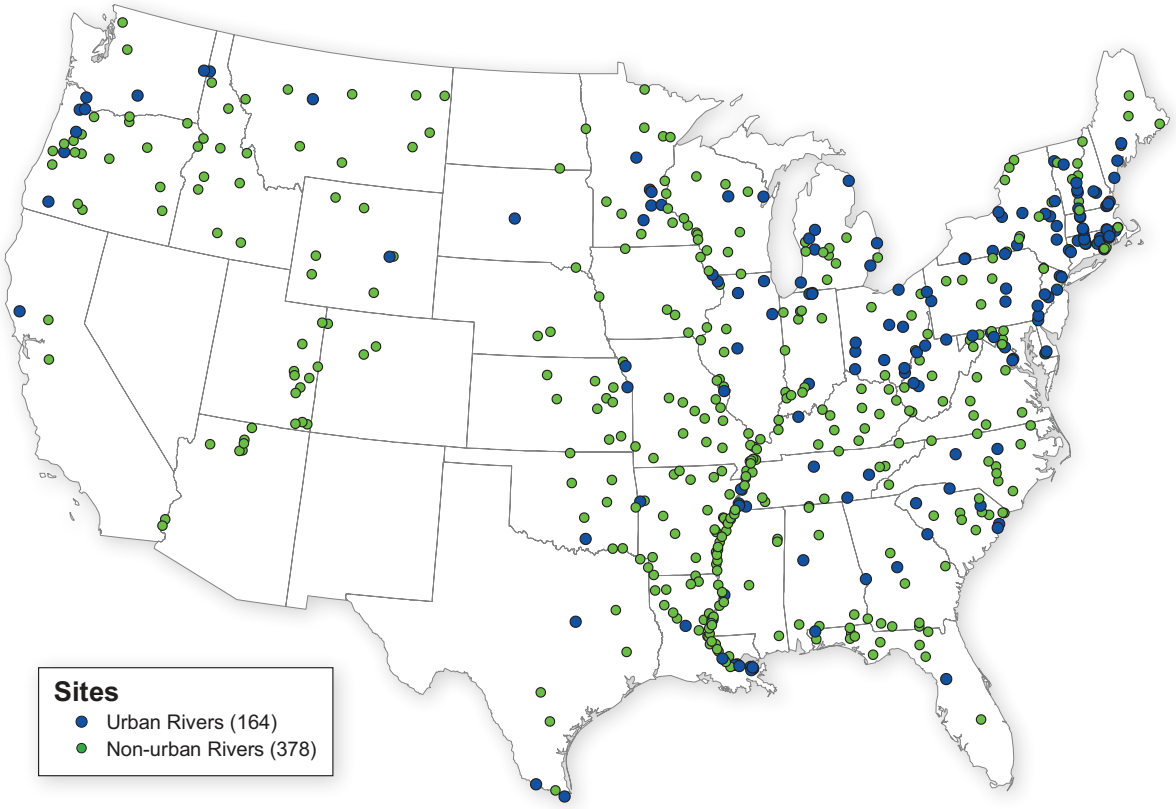
Collaborators with EPA

- 52 state agencies
- 3 tribal agencies
- 2 other federal agencies

National Rivers and Streams Assessment (NRSA)
CEC and Legacy Fish Tissue Contamination Studies

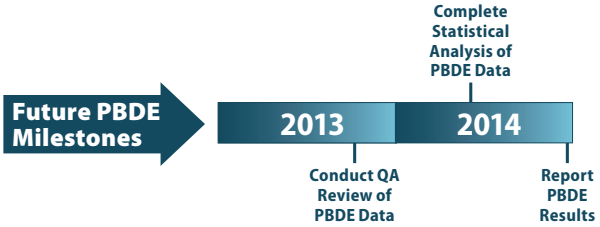
First statistically based national assessment of contaminants in fish from U.S. rivers

NRSA Fish Sampling Locations (542)



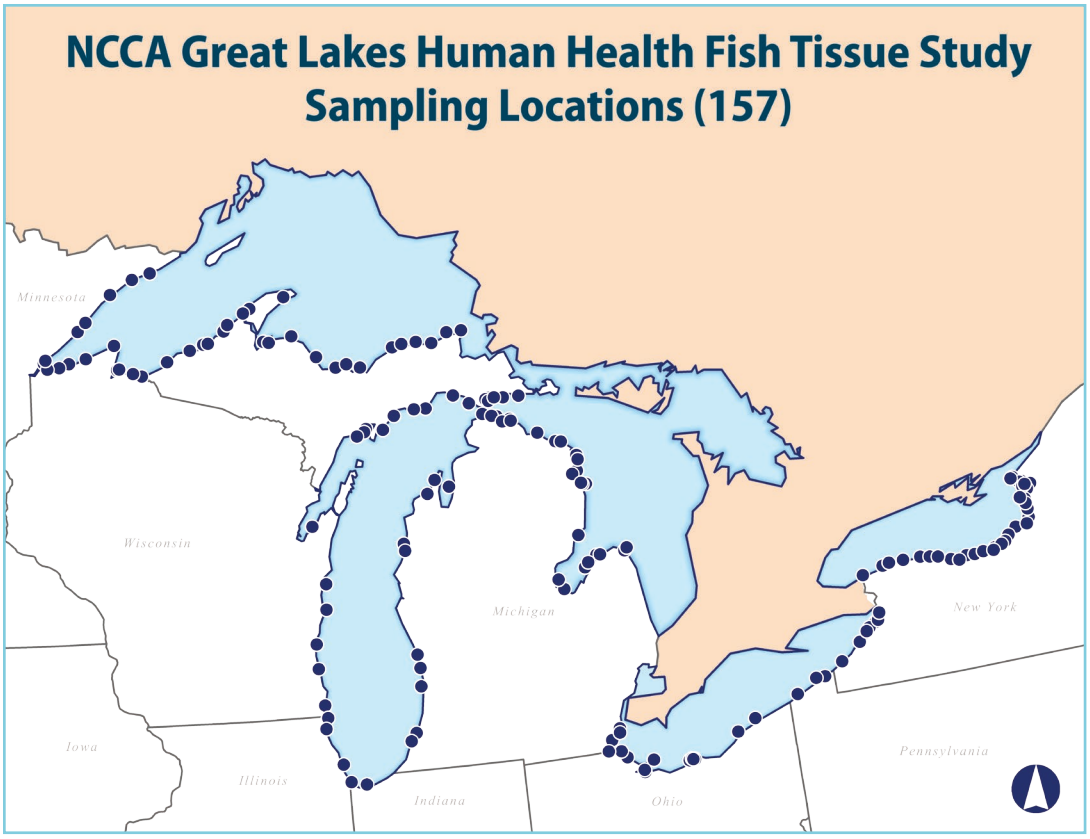
Study Design

- 542 randomly selected river segments sampled in the lower 48 states during 2008 and 2009
- Five fish collected per site to form one composite sample for fillet analysis because people typically consume fillets
- Fillets analyzed for 8 PBDE congeners
- Fillet results for other CECs (PFCs and PPCPs) from 164 urban river sites
- Additional fillet results for legacy contaminants (mercury, selenium, PCBs, and pesticides) from the full set of 542 river sites sampled for fish



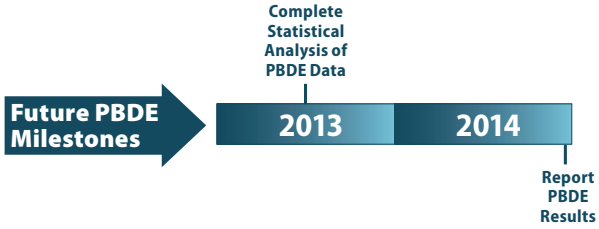
National Coastal Condition Assessment
Great Lakes Human Health Fish Tissue Study

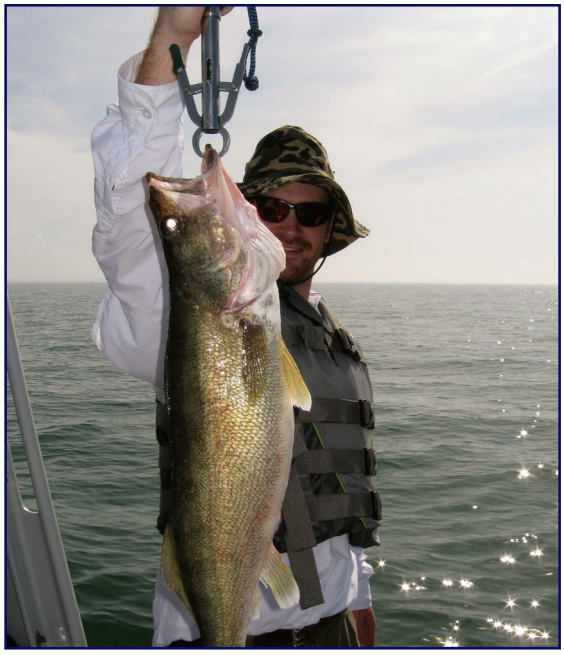
First statistically based assessment of chemicals in Great Lakes fish relevant to human health



Study Design

- 157 randomly selected nearshore sites sampled in the five Great Lakes (about 30 sites per lake) during 2010
- One fish sample collected per site for fillet analysis
- Fillets analyzed for 52 PBDE congeners
- Fillet results for other CECs (PFCs), mercury, and PCBs
- First broad assessment of fatty acids in Great Lakes fish





For additional information contact:

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or access *http://water.epa.gov/scitech/swguidance/fishstudies/*