

# Polybrominated Dioxins and Furans

TIER 2  
LOW  
CONCERN

DONALD YEE,  
San Francisco Estuary Institute  
(don@sfei.org)

## Quick Summary

Polybrominated dioxins and furans are brominated versions of the more commonly known chlorinated dioxins and furans. Polybrominated dioxins and furans are expected to accumulate in Bay sediments and biota, but have been found only at concentrations much lower than their chlorinated cousins. With the phase-out of PBDE flame retardants, polybrominated dioxins and furans from synthetic products will decrease, but some biologically produced forms will likely continue to be present.

In Bay samples, the most toxic polybrominated dioxin and furan compounds were not detected or found at very low concentrations

## What Are They?

- Synthetic or naturally occurring brominated chemicals similar in structure and toxicity to chlorinated dioxins and furans.
- Polybrominated dioxins and furans are formed as by-products of brominated organic chemicals such as PBDEs (PAGE 63).
- They are also formed by combustion and environmental reactions of brominated chemicals and their degradation products.
- Some forms are naturally produced by algae.

## What Are They Used For?

- The only deliberate uses for polybrominated dioxins and furans are in laboratory research.

## How Are They Getting Into the Bay?

- Pathways for polybrominated dioxin and furan entry to the Bay are unknown, but may mirror those for PBDEs and other synthetic brominated chemicals.
- Measured loads in the literature have focused on areas with brominated materials in manufacturing, recycling, or incineration, generally not prevalent in the Bay Area.
- Samples in New York after the burning of the World Trade Center (Litten et al. 2003) had high concentrations, likely from combustion of brominated materials (Buser 1986). Production of polybrominated dioxins and furans may also occur in smaller structure fires, but, except in major disasters, the amounts will usually be small and dispersed.

## What Happens to Them in the Bay?

- Polybrominated dioxins and furans are expected to bind to particles and settle into sediments, where they may be taken up by sediment-dwelling organisms and passed up the food chain.

- They are less persistent than the chlorinated dioxins and furans, with an estimated half-life in soil of three to six months (Melber and Kielhorn 1998).
- In Bay sediment and biota samples, the most toxic polybrominated dioxin and furan compounds were not detected or found at very low concentrations, much lower than those reported in the literature for areas with large expected sources.
- Some 1,3,7-tribromodibenzodioxin was found in the Bay, highest in South Bay and southern Central Bay. This is believed to be a degradation product of PBDEs (Steen et al. 2009, Arnoldsson et al. 2012).
- Polybrominated dioxins and furans in a sediment core from Osaka Bay in Japan decreased with depth, paralleling decreases in PBDEs in those cores and suggesting increasing concentrations over time (Takigami et al. 2005); concentrations in the Bay should show similar trends.

## Is There a Risk of Harm in the Bay?

- Polybrominated dioxins and furans have modes of action similar to polychlorinated dioxins and furans (Melber and Kielhorn 1998).
- Bay polybrominated dioxins and furans are nearly a factor of 10 or more less toxic than polychlorinated dioxins and furans, so their risks are proportionally smaller, likely accounting for only around 5% of total dioxin-like activity in Bay sediments.

## Management

- Polybrominated dioxins and furans should decrease with the phase-out of PBDEs, unless PBDEs are replaced with other brominated flame retardants.