

What are brominated flame retardants?

**What is the status regarding international
MRL's?**

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23.04.2015

1. Why we need BFRs?

2. What exactly are BFRs?

3. How are BFRs regulated?

To inhibit fire you need at least one of the following characteristics:

- Gas phase radical quenching (BFRs)
- Endothermic degradation
- Thermal shielding
- Dilution of gas phase



Made to save life!

One thing all BFR have in common: Bromine

“classical BFRs”

Poly brominated diphenylethers → PBDE

Poly brominated biphenyls → PBB

Tetrabromobisphenol-A → TBBPA

Hexabromocyclododecane → HBCDD

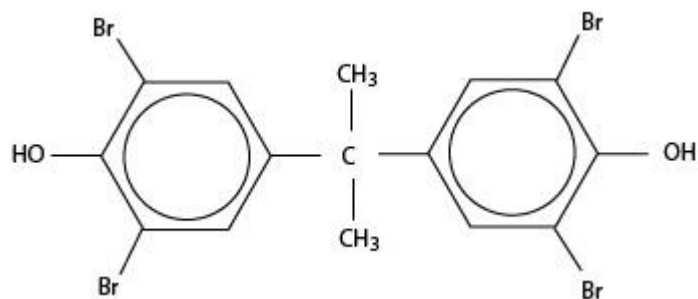
“NBFRs” n= novel

2-ethylhexyl-2,3,4,5-tetrabromobenzoate → TBB

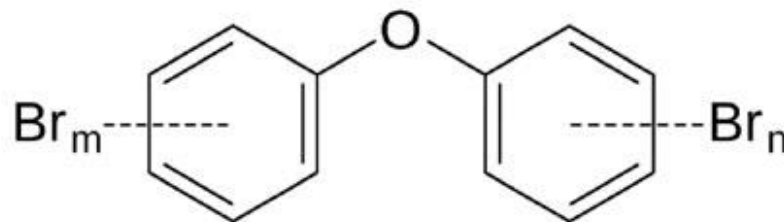
bis(2-ethylhexyl)-tetrabromophthalate → TBPH

And many more ...

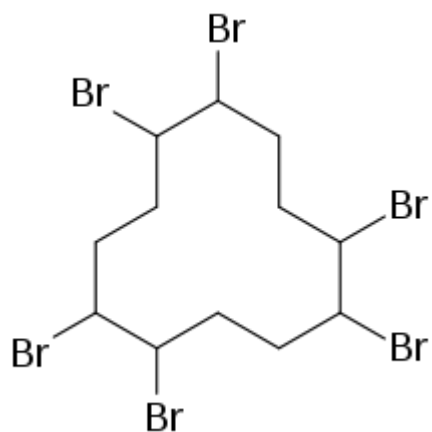
Some BRFs / “classic BFRs”



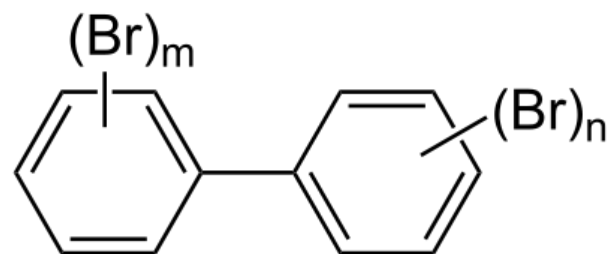
TBBPA



PBDE

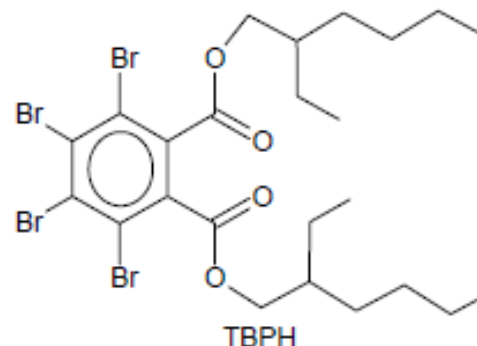
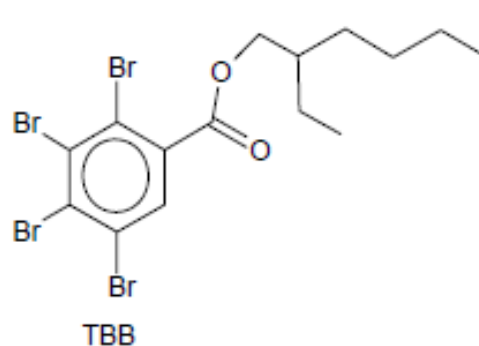
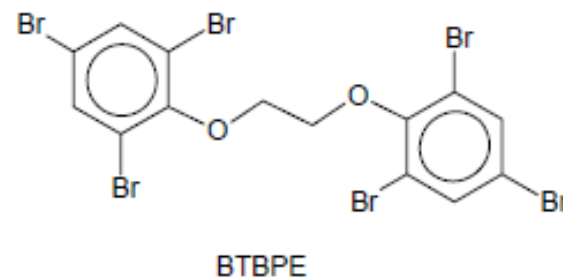
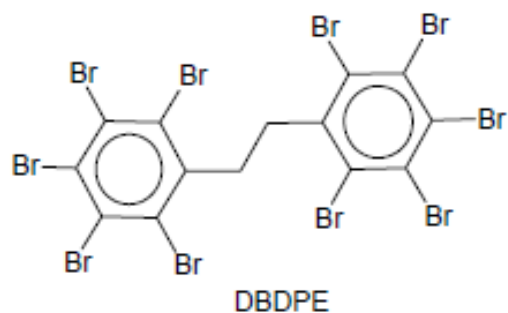
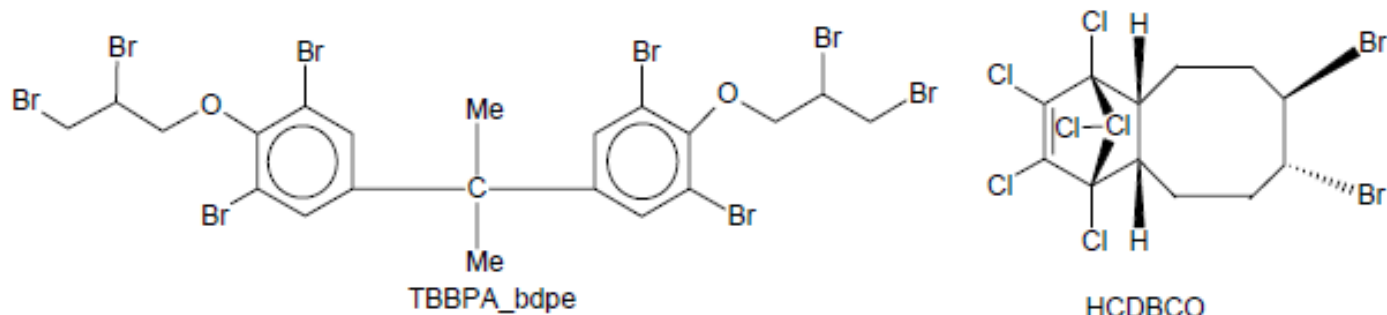


HBCDD



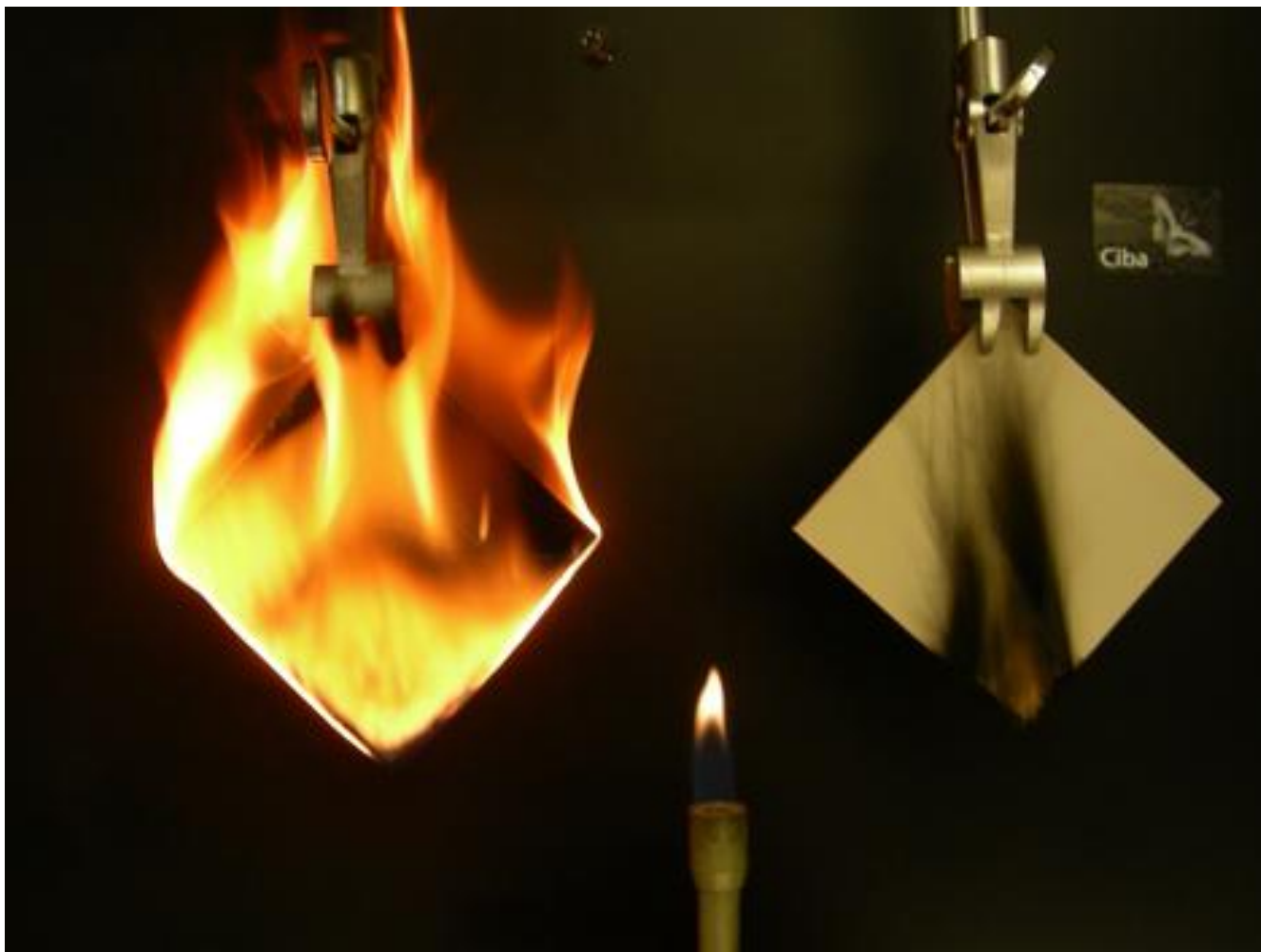
PBB

Some BRFs / "novel BFRs"



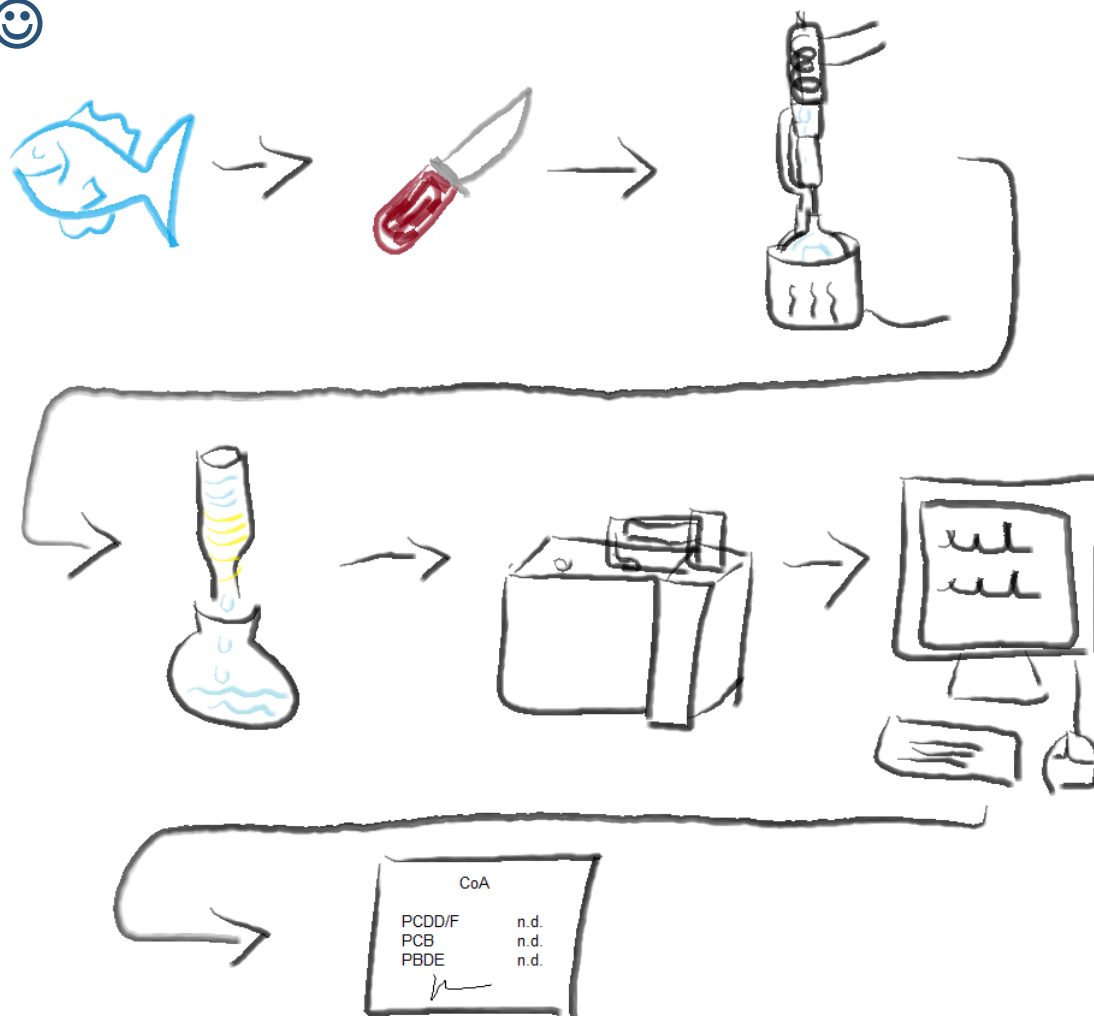
Use of BFRs





Effectiveness check ☺

1. Sample
2. Preparation
3. Extraction
4. Cleanup
5. Measurement
6. Calculation
7. Report



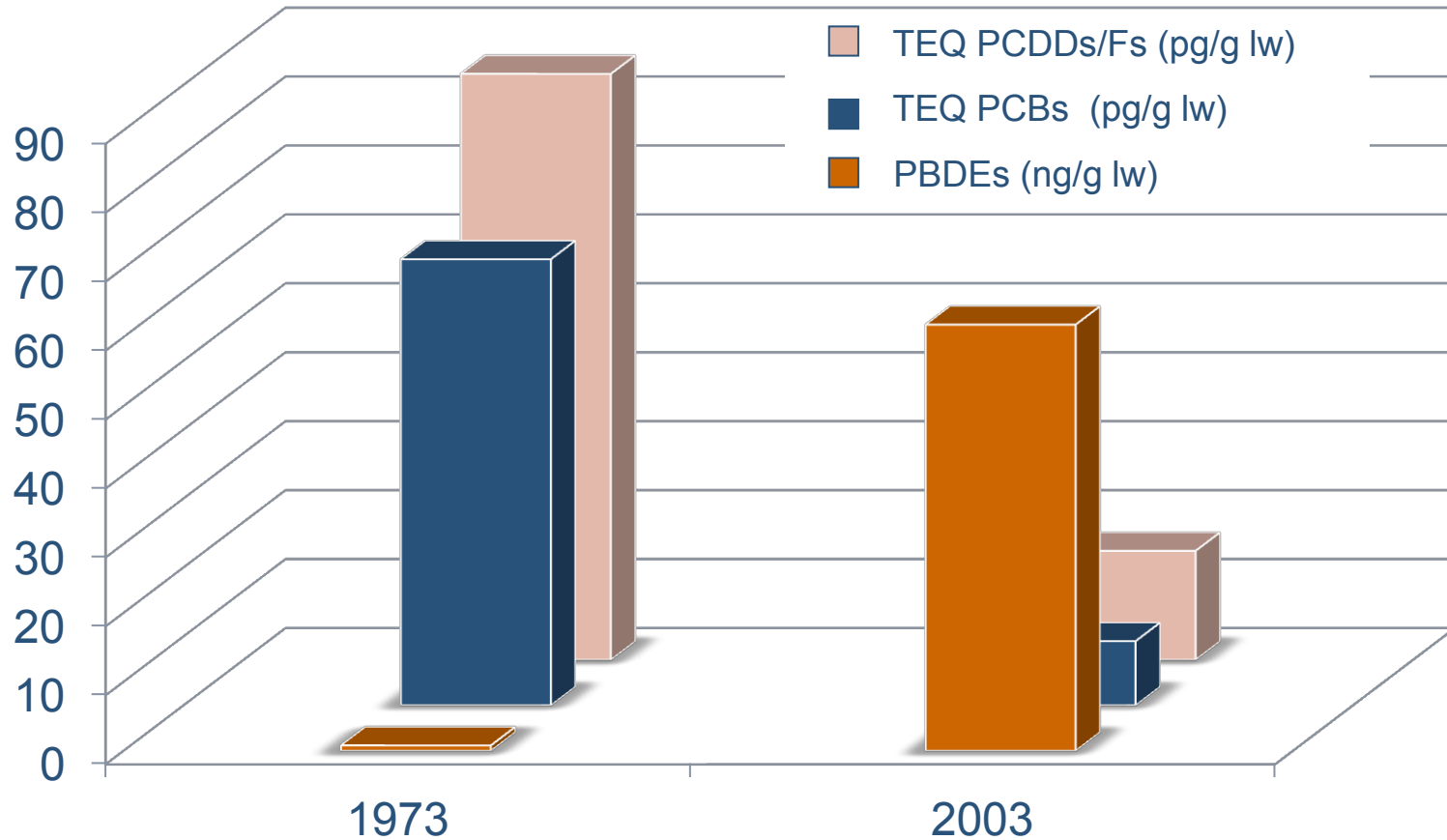
- 1. Reaction during use in case of fire → optimal requirements for creation of PBDD/F and PCDD/F → toxic even in low concentrations (more or less for all BFRs)**
- 2. Leach out of the products over life time and accumulation in environment especially Biota**
- 3. NBFRs → behaviour mostly unknown**

Example PBDE:

- **Rapidly accumulating in humans and animals**
- **Hormonal disruption**
 - Effects on thyroid, oestrogen and testosterone
- **Developmental effects**
 - Irreversible learning/behavioral effects in young animals
 - Decreased ovarian follicles, sperm counts
- **Cancer?**
 - Structures similar to known carcinogens (PCBs, PBBs)
 - Environmental conversion to known carcinogens (dioxins and furans)

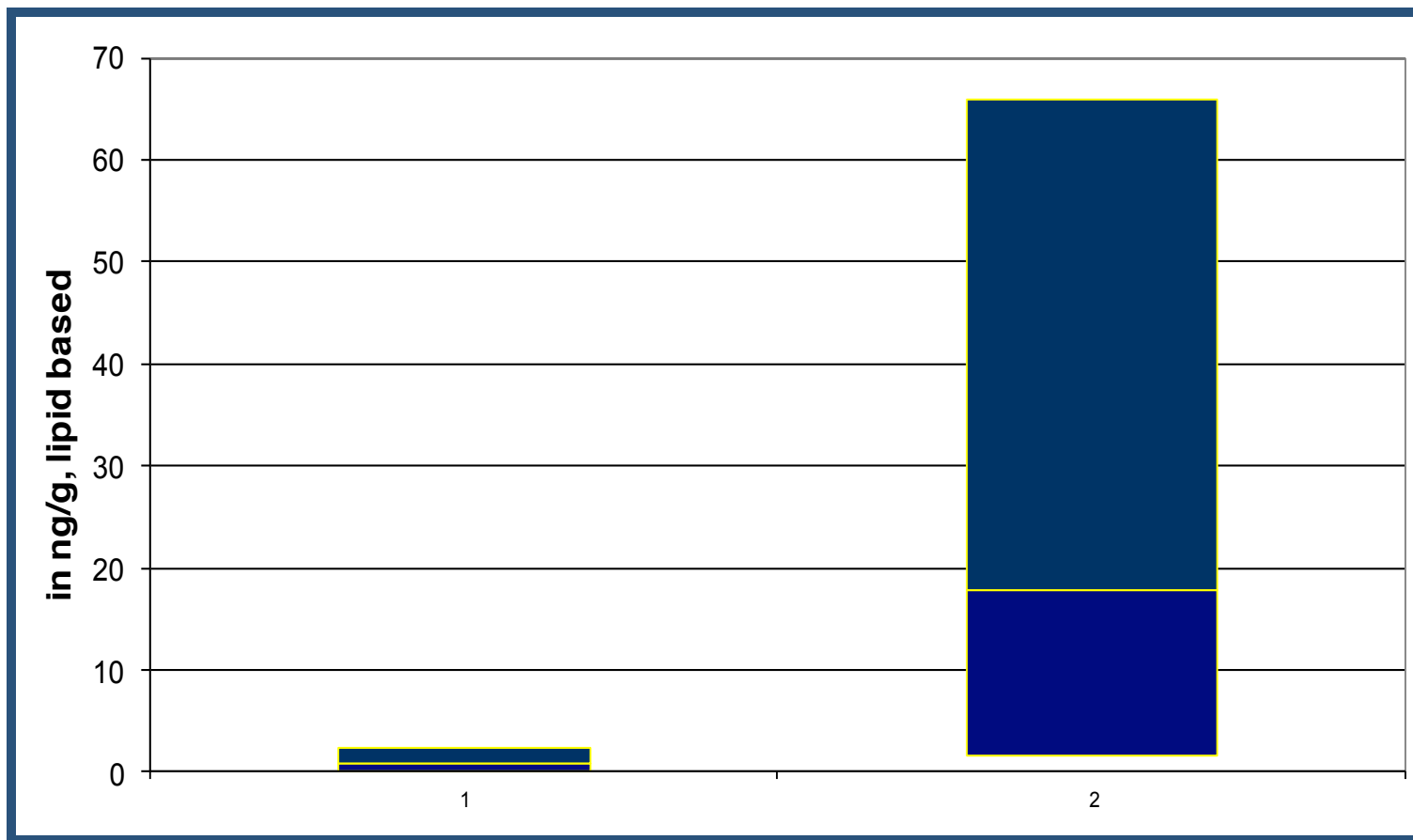
Stapleton H. M., 2010

PCDD/F, PCB and PBDE in blood; time trend



Schechter & Paepke, BFR 2004

Total PBDEs in Fish Oil Samples



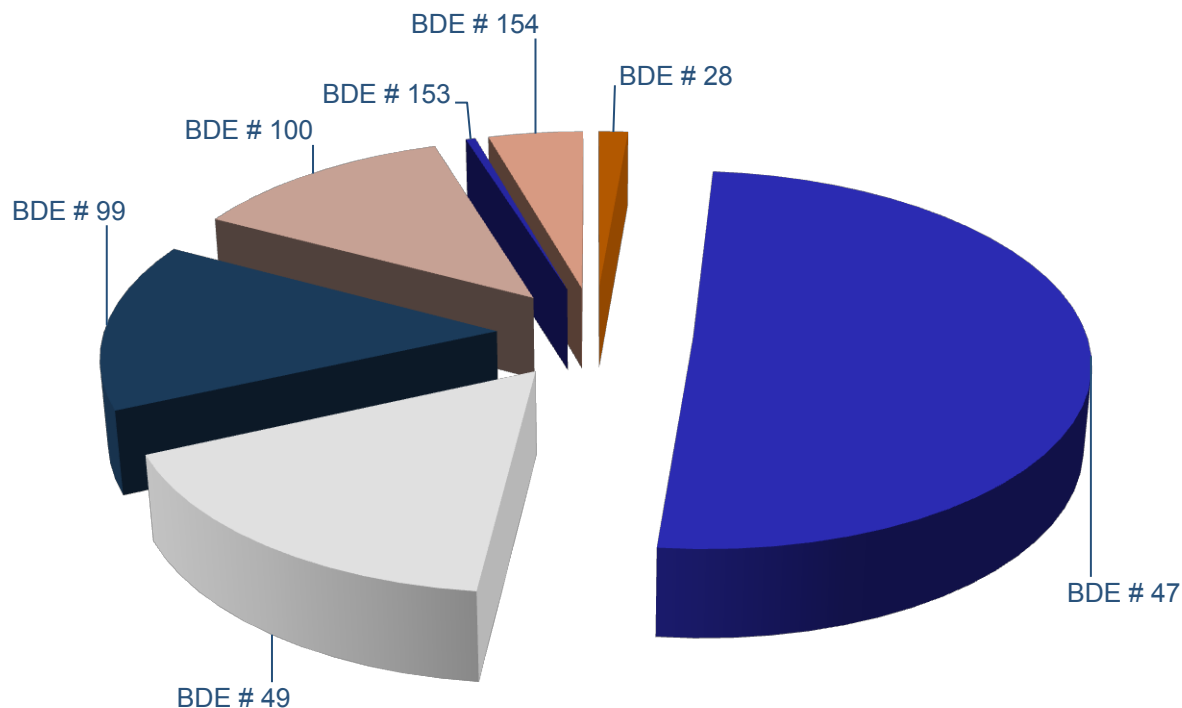
Pacific Area

European Area

Paepke, 2004

Typical pattern for sum of seven PBDE (Omega-3 acid ethyl esters):

- BDE # 28**
- BDE # 47**
- BDE # 49**
- BDE # 99**
- BDE # 100**
- BDE # 153**
- BDE # 154**



European Union

- **Penta- and OctaBDE Banned in 2006**
- **DecaBDE Banned in Sweden- January 2007**
- **DecaBDE Banned in EU – July 2008**



United States

- **Voluntary phase out of PentaBDE, OctaBDE by chemical companies in 2013 also DecaBDE**
- **Bans passed in Maine and Washington (DecaBDE) already in 2007**
- **Proposed bans in other states are pending**



Maximum residue levels (MRL) :

In EU Nr. 757/2010 for products → max. 10mg/kg

No limits for food/feed

No specific limits for Food and Feed

For pharmaceutical some Omega-3 acid ethyl ester products limits for sum of seven PBDEs (e.g. US FDA)

Questions?

Thanks for your kind attention 😊

Enjoy the coffee break!