

Different indoor air and dust sampling methods for BFRs and emerging contaminants: How comparable are they?

Cynthia de Wit

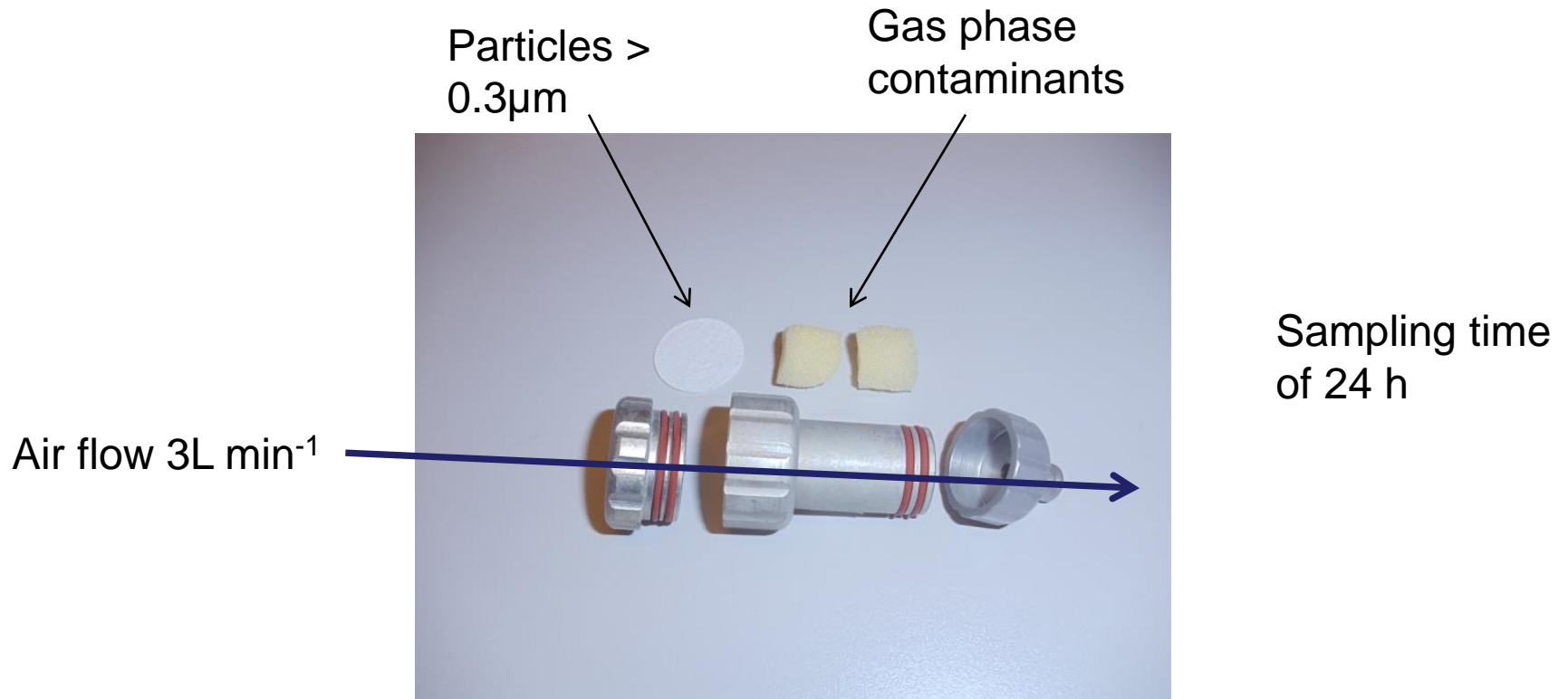
Department of Environmental Science and Analytical
Chemistry (ACES), Stockholm University

Overview

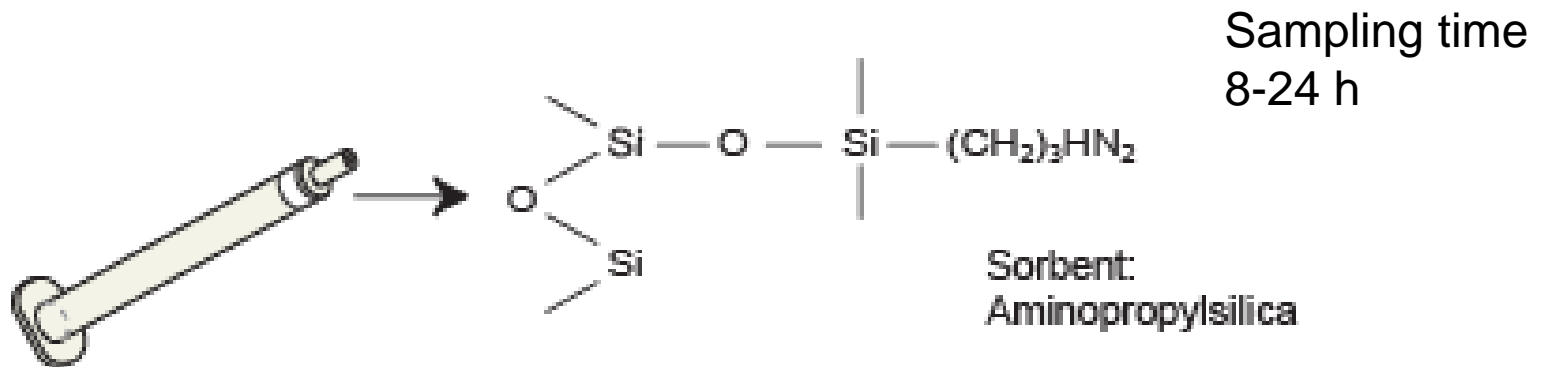
- **Indoor air sampling methods**
 - Active
 - Passive
- **Dust sampling methods**
 - Researcher collected
 - Floor
 - Filter
 - Sock/thimble
 - Bag
 - Above floor
 - Filter
 - Resident collected
 - Floor
 - Vacuum cleaner bag

- **Chemical groups studied**
 - **Polybrominated diphenyl ethers (PBDEs)**
 - **Emerging flame retardants (EFRs)**
 - **Organophosphate esters (OPEs)**
 - **Phthalates**

Indoor air sampling – active low volume sampling for BFRs/EFRs



Active low volume air sampling with solid phase extraction (SPE)



Good for more volatile compounds
e.g. OPEs, phthalates

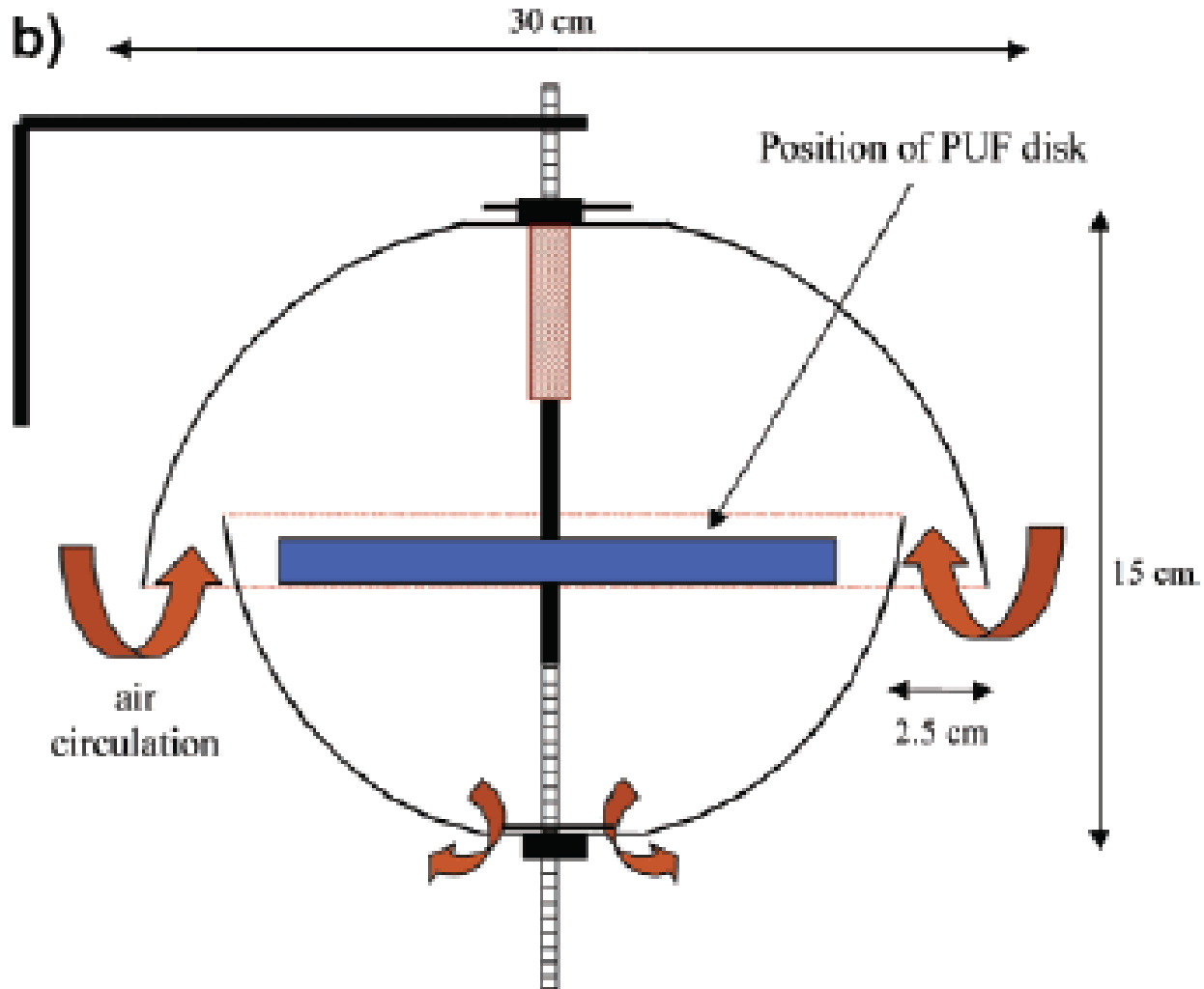
Active air sampling indoors



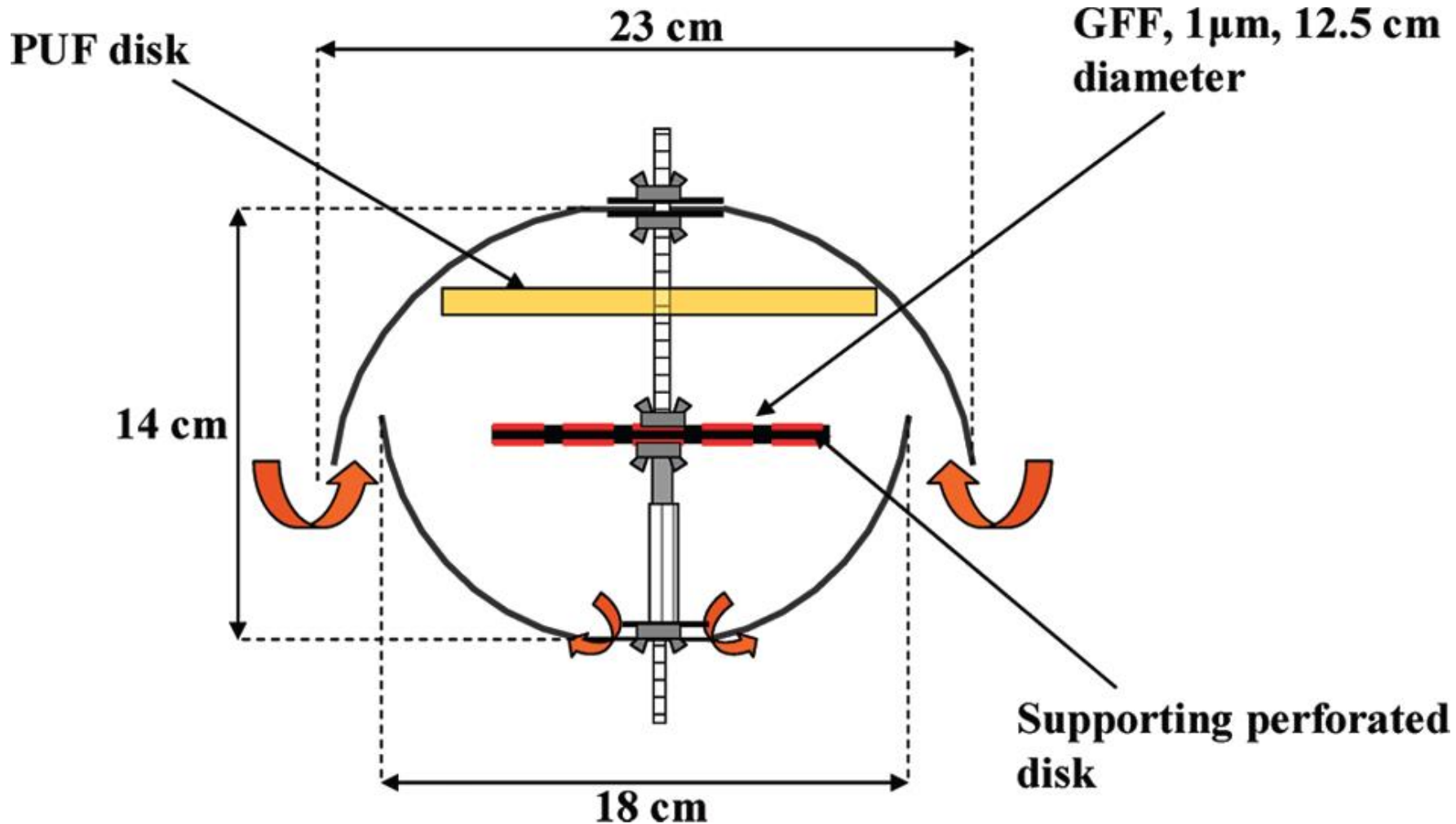
← 4 sampling trains

← Pump

Passive air sampler – BFRs/EFRs



Passive air sampler – BFRs/EFRs



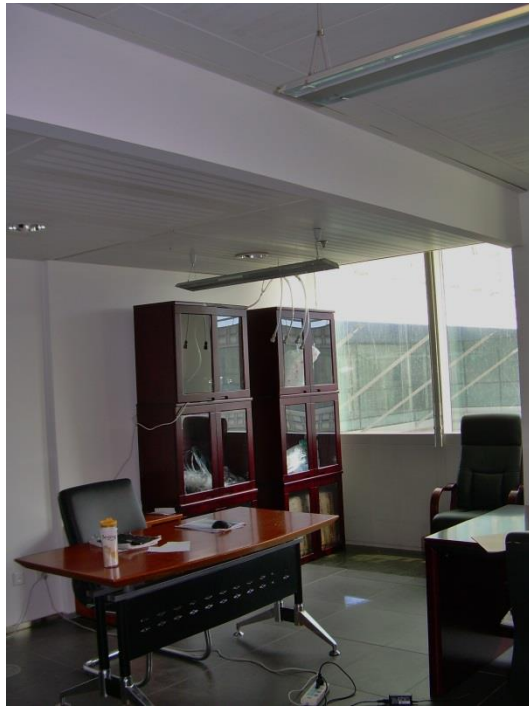
Passive air samplers



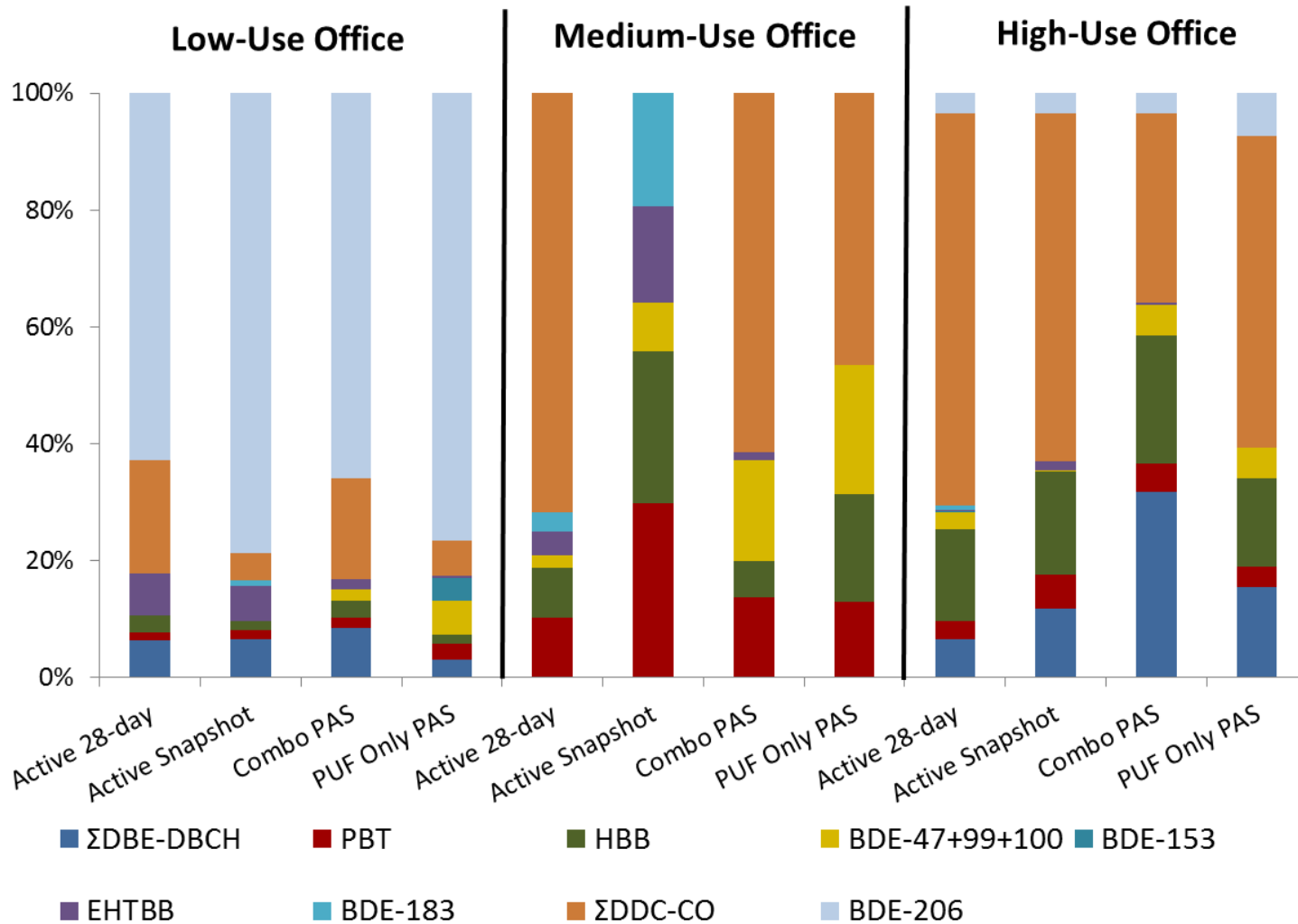
Comparison – passive vs active air samplers

- **Beijing – Tsinghua University**
 - 3 offices in one building
 - Each office sampled for 28 days
 - 3 consecutive months
- **Four air sampling methods in each office**
 - Passive with PUF only
 - Passive with PUF and GFF (Combo)
 - Active – pump turned on for 2 h daily
 - Mimics passive samplers
 - Active – pump turned on for 2.5 days (snapshot)
 - At end of each 28 day period

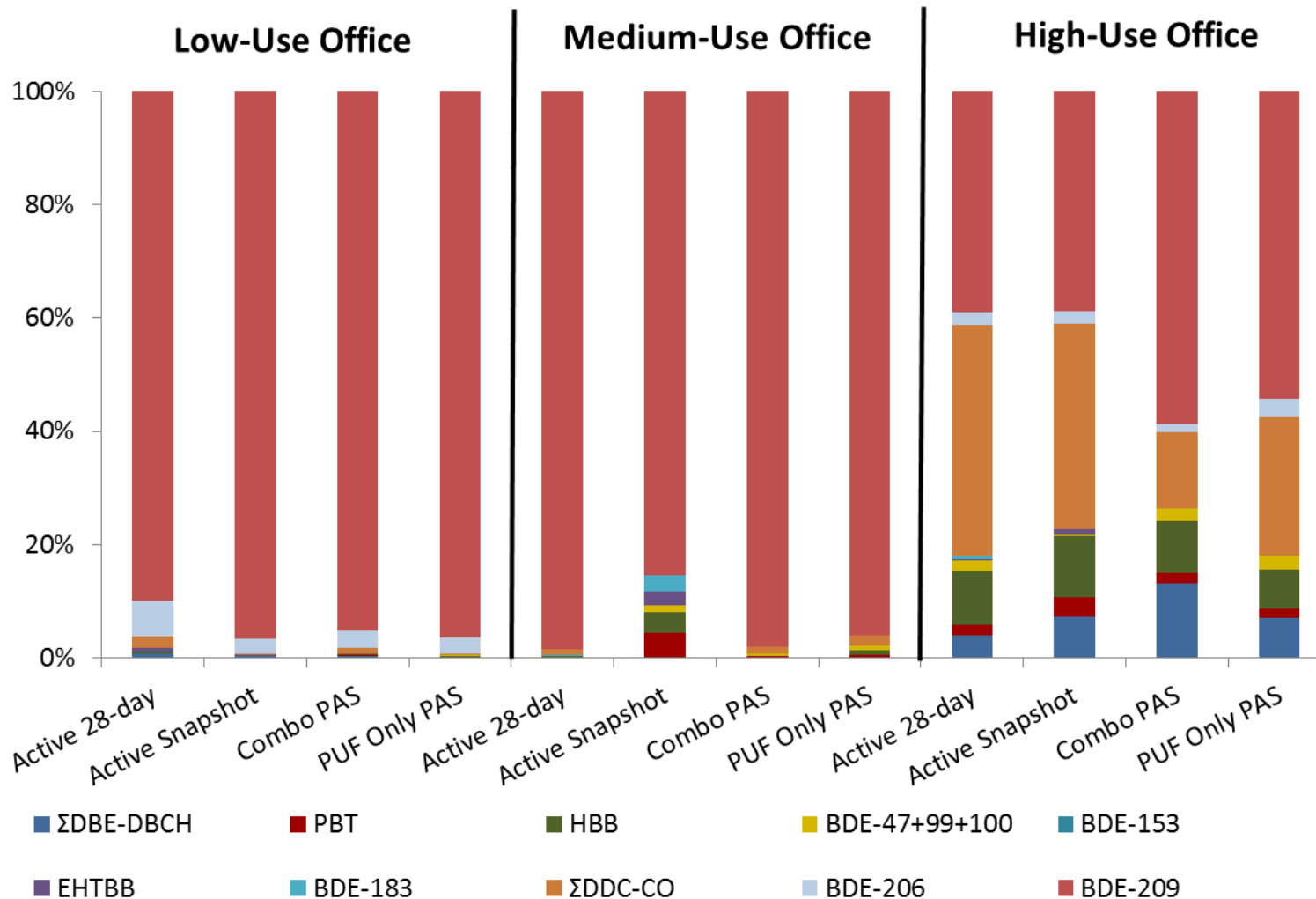
Three offices – low, medium and high use



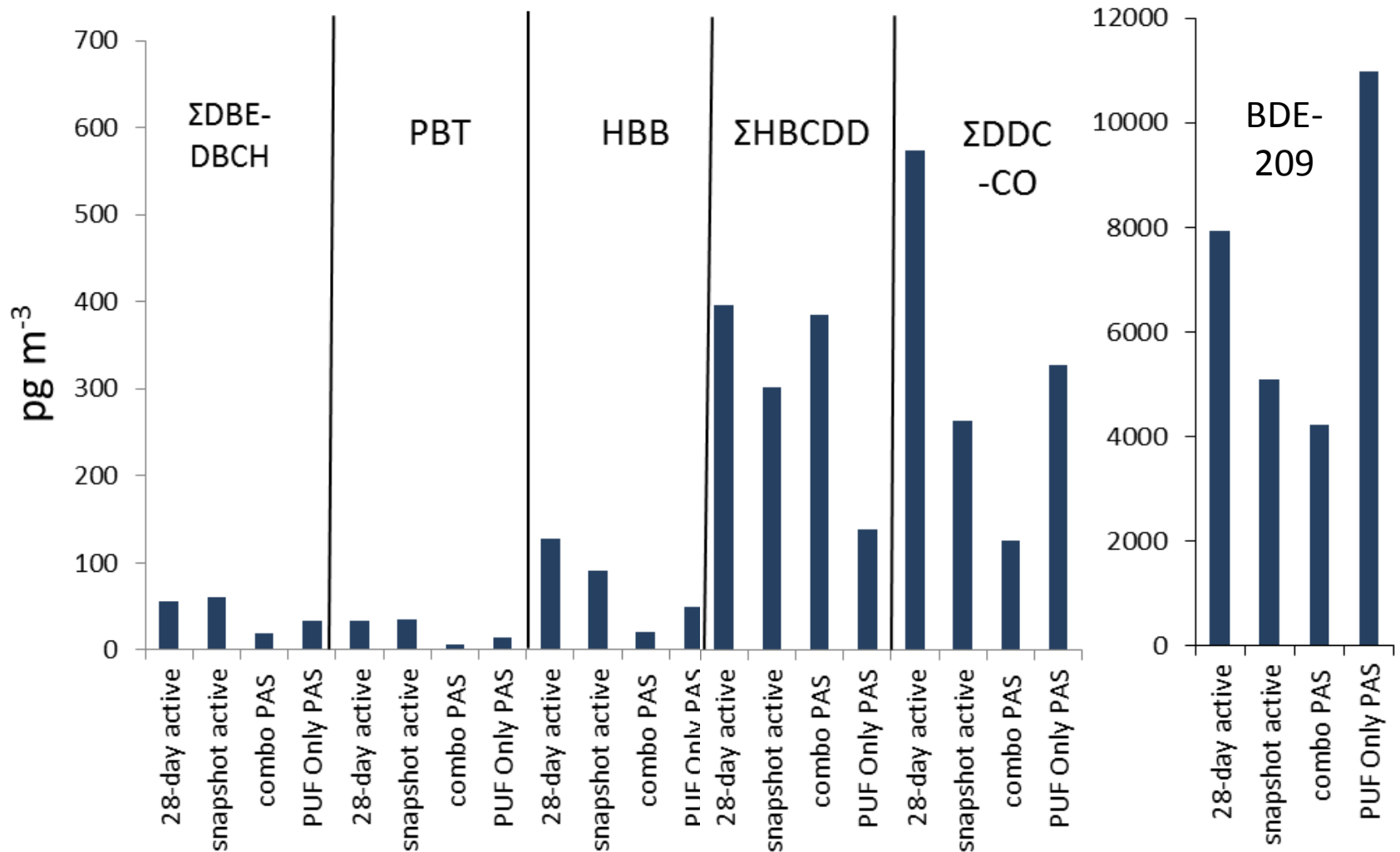
Comparison – fingerprint of BFRs/EFBRs (excl BDE-209)



Comparison – fingerprint of BFRs/EFBRs (with BDE-209)



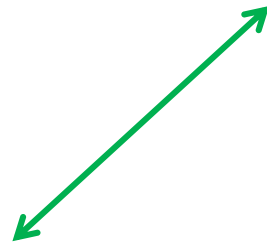
Passive vs active air samplers – FR concentrations



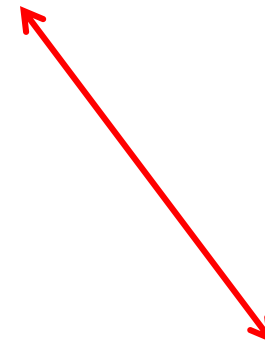
Dust sampling methods



Researcher collected –
surfaces above 1 m



Researcher collected –
floor



Vacuum cleaner bag –
resident collected floor



Dust sampling

Filter



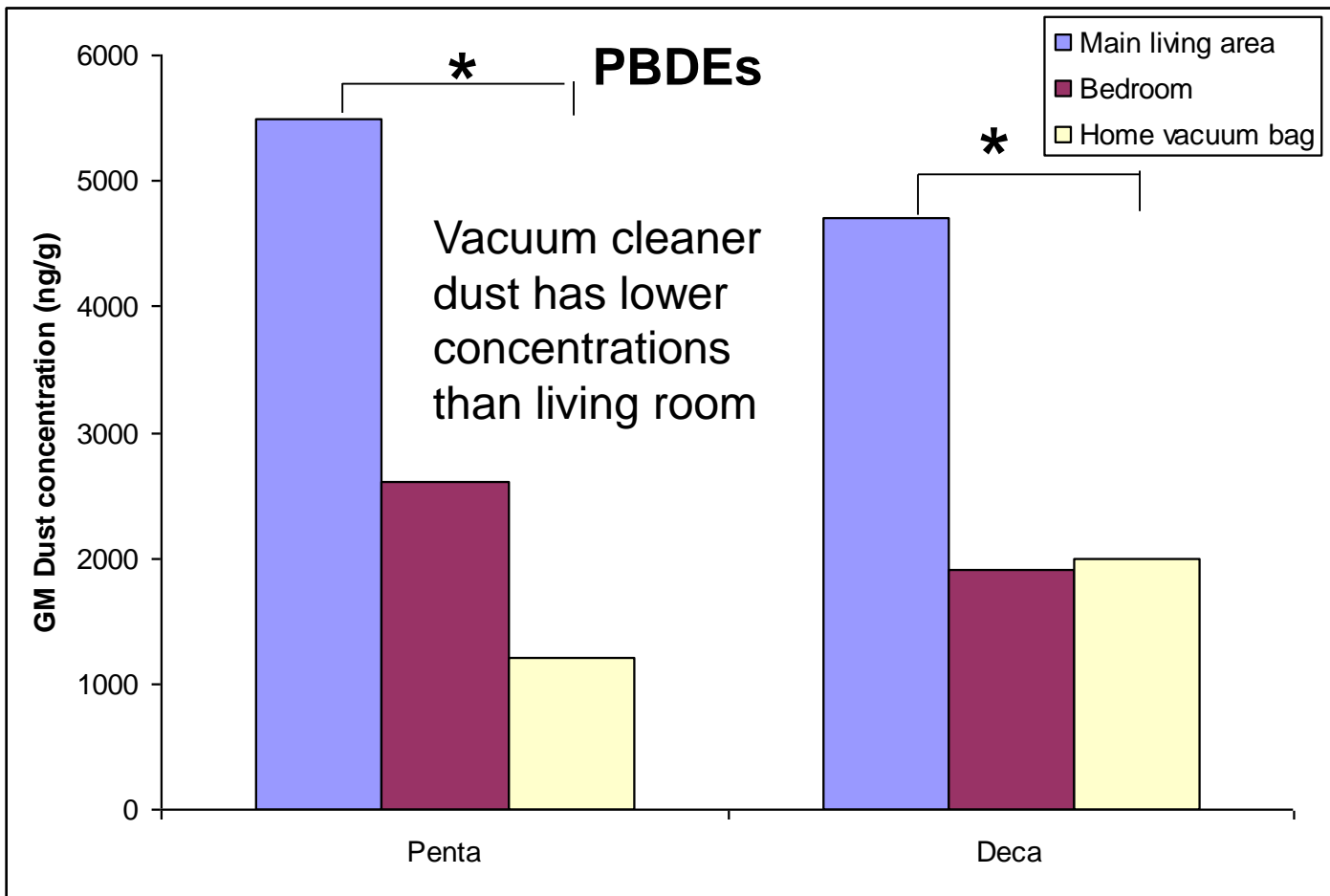
Sock/thimble



Specialized bag

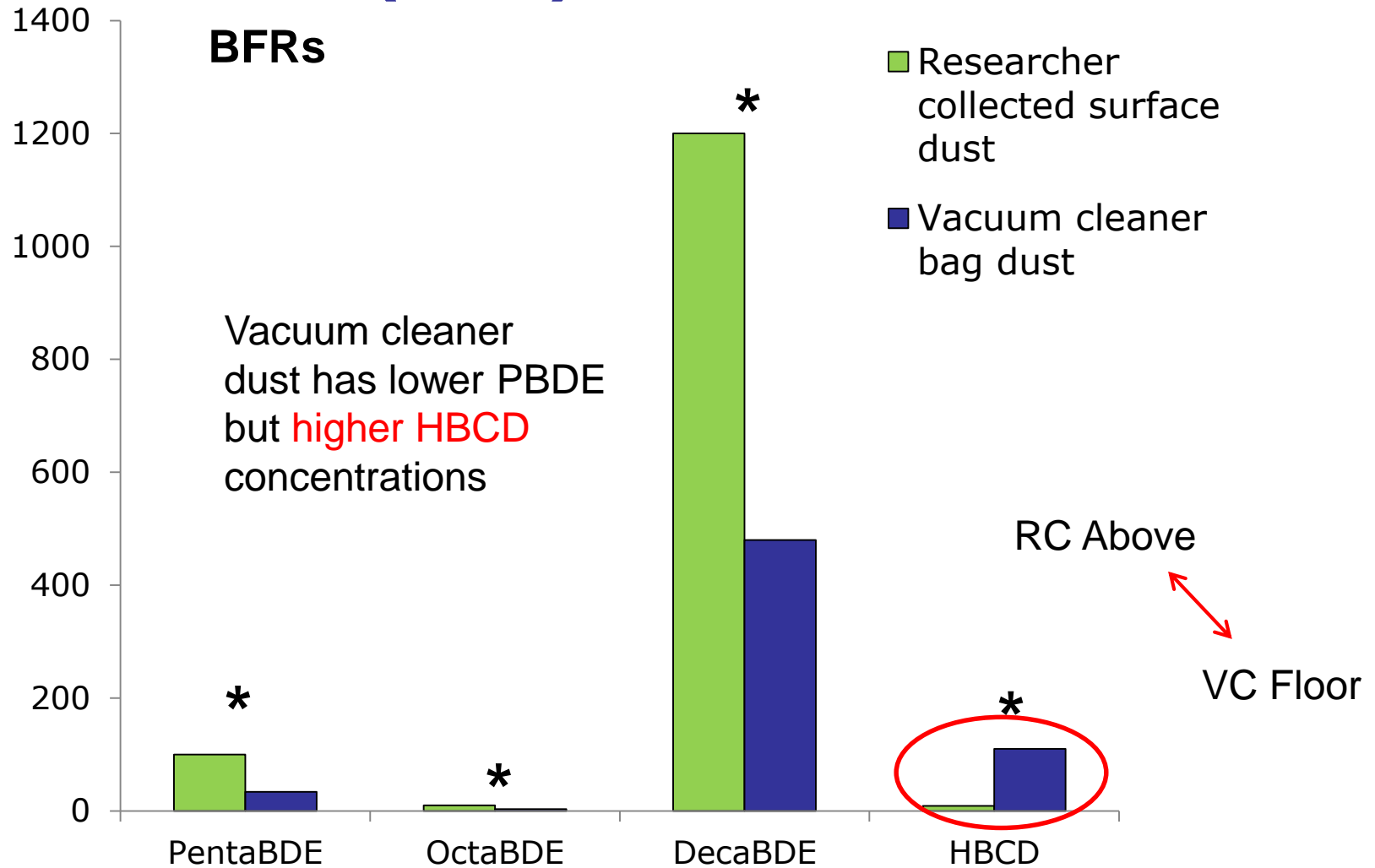


Vacuum cleaner bag vs researcher collected floor dust (cellulose thimble) n=20

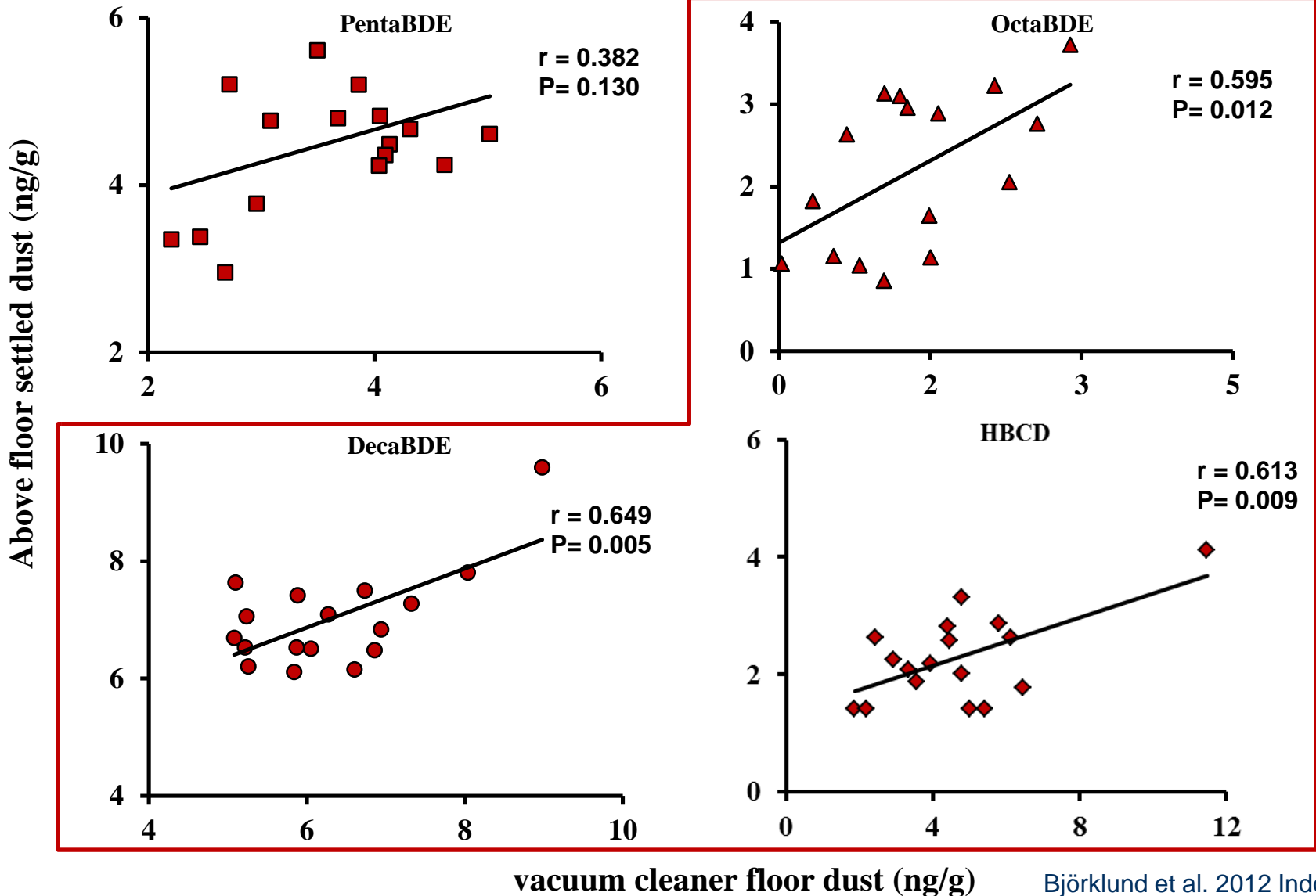


Allen et al.
2008 ES&T

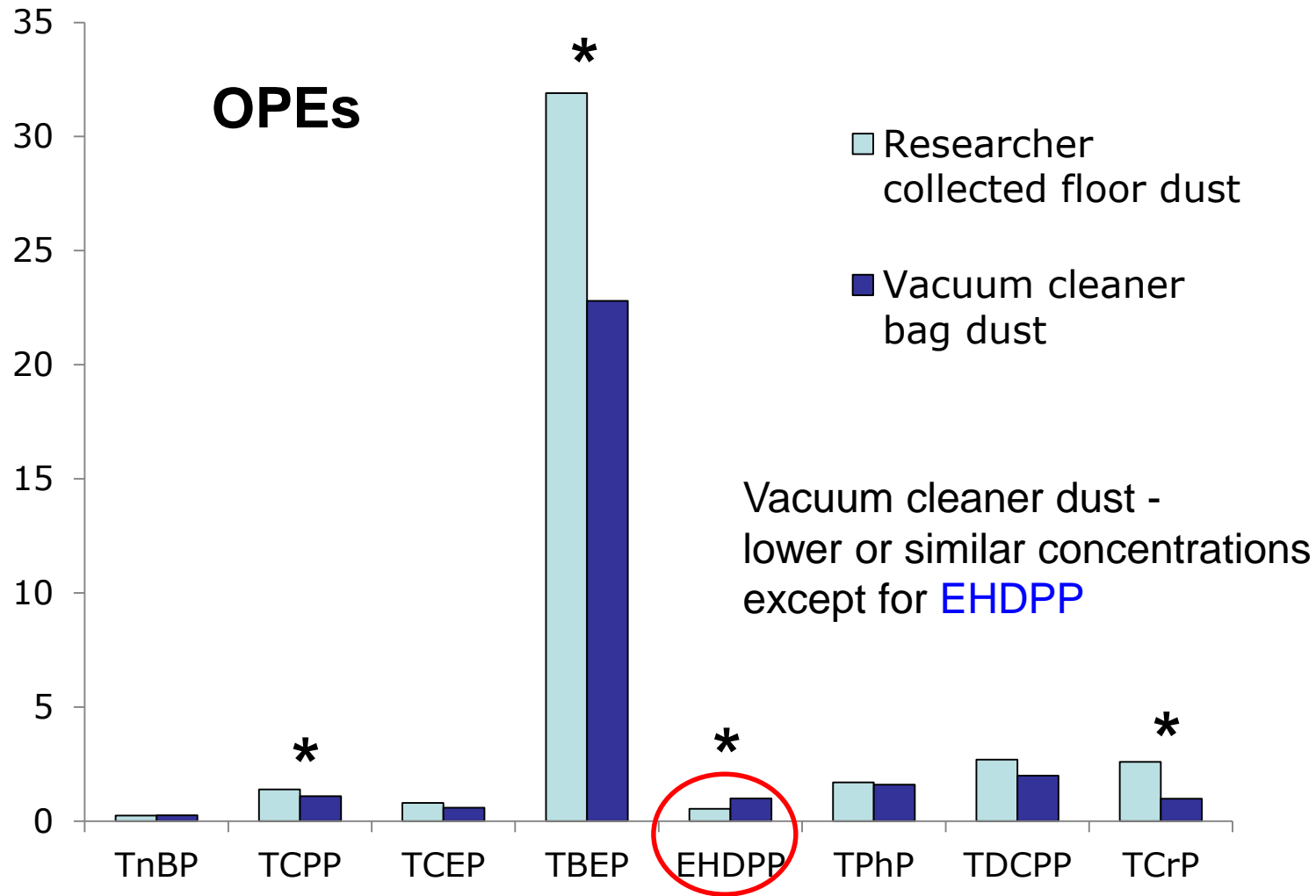
Vacuum cleaner bag floor dust vs researcher collected above floor dust (filter) n=18



Vacuum cleaner bag vs researcher collected floor dust (filter)

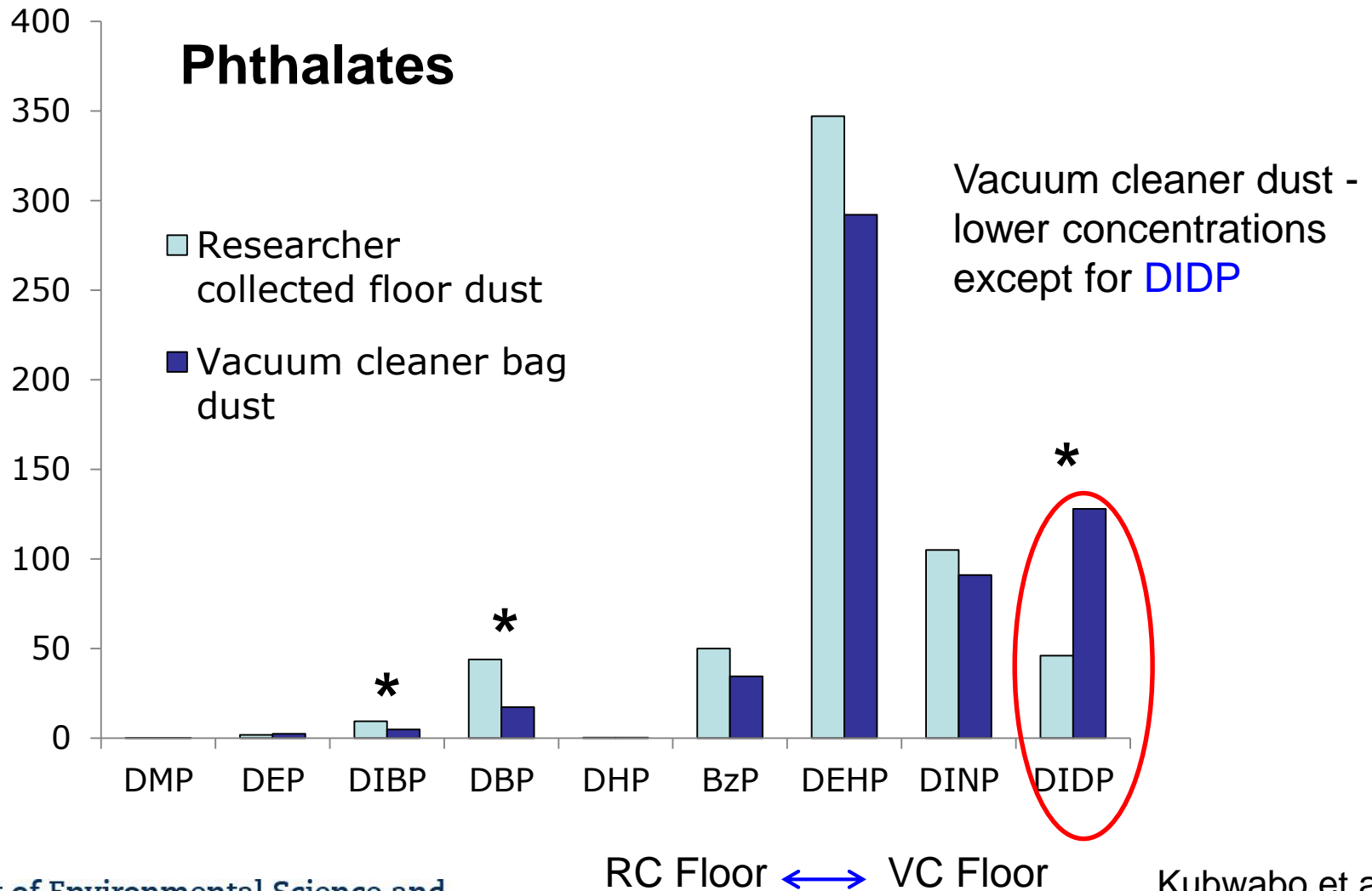


Vacuum cleaner bag vs researcher collected floor dust (bag) n=134



RC Floor ↔ VC Floor

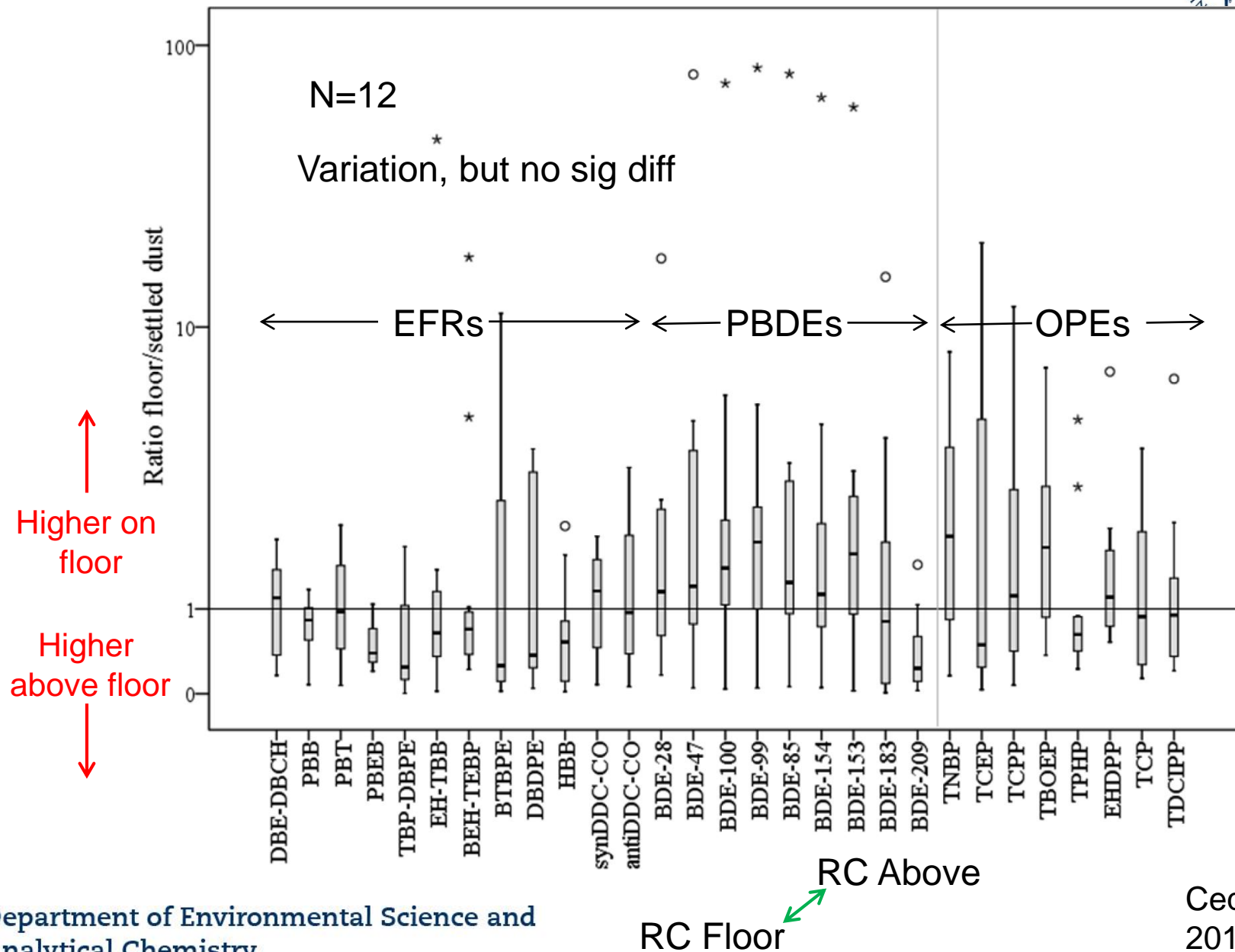
Vacuum cleaner bag vs researcher collected floor dust (bag) n=28



Researcher collected floor and above floor dust (filter)



Stockholm University



Conclusions

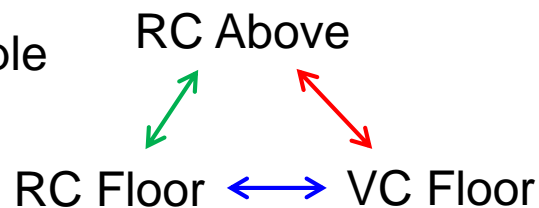
- **Indoor air sampling methods**
 - Active and passive give reasonably similar results (within a factor of 2-4)
 - Uptake rates needed for new chemicals
 - Active sampling more quantitative
 - Need better understanding of particle behavior in passive samplers

Conclusions – dust sampling

	Vacuum cleaner floor		Res. coll. above floor	
	Higher in VC	Lower in VC	Higher in AF	Lower in AF
Res. collected floor	EHDPP DIDP	PentaBDE DecaBDE Some OPEs Some phthalates	EFRs BDE-209 OPEs	PBDEs OPEs
Res. collected above floor	HBCD		—	—



All 3 sample types



Conclusions

- **Dust sampling methods**
 - **There are differences!**
 - **Need more understanding of:**
 - **dust processes**
 - **dust particle size effects**
 - **sources (floors)**

Acknowledgements



Thanks to Justina Björklund, Seth Newton, Ulla Sellström from ACES, Stockholm University, Stuart Harrad, William Stubbings, Sandra Brommer from University of Birmingham, Gang Yu, Congqiao Wang, Wu Min, Yang Yue, Wang Lifang, Jinhua Mo and Yinping Zhang from Tsinghua University. The Swedish Research Council Formas, EU Marie Curie ITN project INFLAME, and MC IRSES project INTERFLAME are gratefully acknowledged for funding.



The Swedish Research Council Formas

Committed to excellence in research for sustainable development

INTERFLAME

INFLAME

Questions?