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# Assessment of multi-contaminant concentrations in indoor dust and air from four European countries

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## INTRODUCTION and OBJECTIVES

- ✓ Ingestion and inhalation of dust and indoor air: significant pathways of human exposure to several classes of organic compounds on a daily basis<sup>1</sup>.
- ✓ Main sources: emission from indoor consumer products (e.g. furniture, carpets, electronic devices) by evaporation and/or abrasion<sup>2</sup>.
- ✓ Bans and restrictions applied to certain groups: introduction of new compounds to the market. For these alternatives, we have limited information concerning their impact on the quality of the indoor environment<sup>3</sup>.
- ✓ **SHINE project** (Target and non-target Screening of cHemicals in the Indoor enviroNment for human Exposure assessment): assessment of presence and levels of PFRs, legacy and emerging BFRs, PFASs, CPs, pesticides, legacy and alternative plasticizers (LPs and APs) in the indoor environment by target analysis and suspect screening.



## MATERIALS and METHODS



- ✓ Dust and air samples from **homes, offices, and preschools** (day care) from 4 EU countries (Belgium - BE, The Netherlands - NL, Sweden - SE and Ireland - IR) were collected between December 2016 and February 2017.
- ✓ **Target analysis**: PBDEs, eBFRs, PFRs, LPs, and APs were determined by GC-MS; HBCDDs, TBBP-A and PFASs were assessed by LC-MS; Pesticides were analyzed by both GC-MS and LC-MS; CPs were investigated by LC-QTOF-MS.
- ✓ **Suspect screening** of the same samples to identify additional contaminants and combinations of chemicals (LC-QTOF-MS).

## RESULTS and DISCUSSION

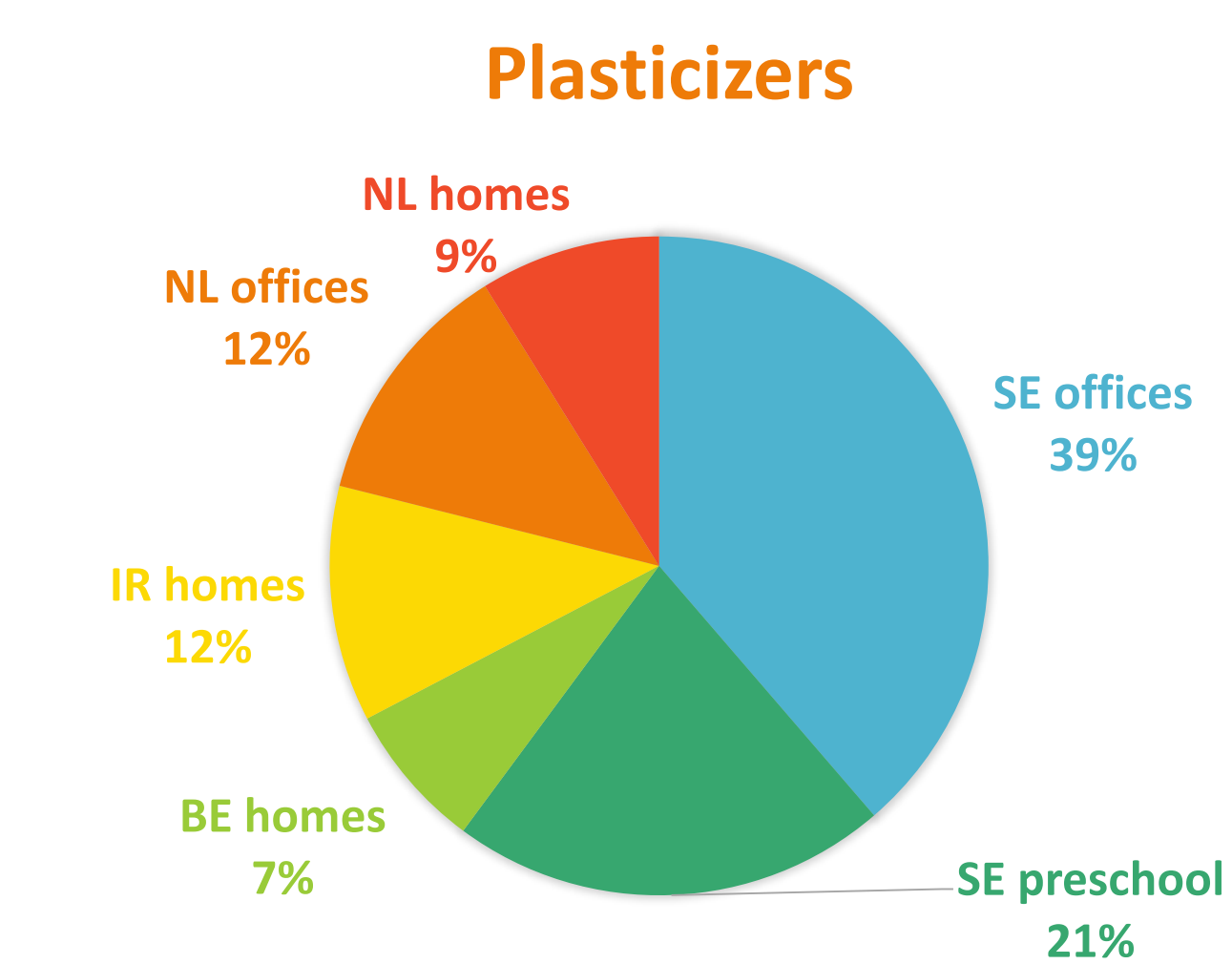


Fig. 1 Mean pattern of plasticizer contamination in dust samples from the considered countries and indoor environments

- ✓ Indoor environments from SE resulted the most contaminated with plasticizers (60%) (Fig. 1).
- ✓ AP concentrations in dust > LPs, indicating the gradual replacement of LPs with a new generation of plasticizers.
- ✓ (PVC) flooring material could be a main source of contamination, especially in offices, preschools and other public places.

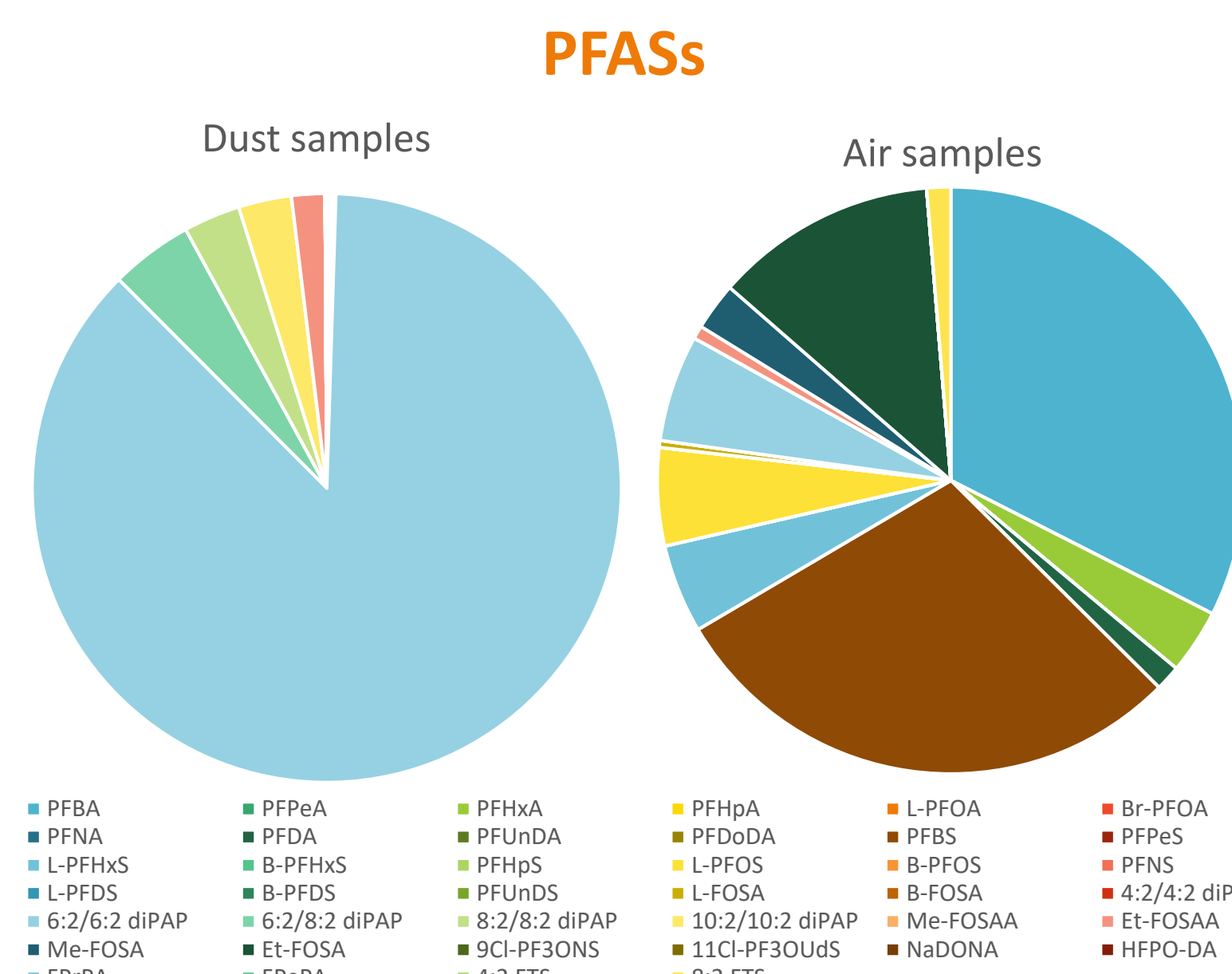


Fig. 2 Mean qualitative pattern of PFAS contamination in SE dust and air samples

- ✓ Offices in the Netherlands displayed the highest median concentrations of PFASs and exceeded those in indoor dust from Dutch houses.
- ✓ Perfluorobutane sulfonate (PFBS) predominated amongst the targeted PFASs in all but Swedish office dust (Fig. 2).

## Suspect screening by LC-QTOFMS

- ✓ 48 compounds - identified in ESI (+) mode with detection frequency of 86%
- ✓ 15 compounds in ESI (-) mode with detection frequency of 15-20%.

## CPs

- ✓ CPs (especially medium chain) were detected in higher levels in Swedish and Dutch offices.

Concentration of CPs in indoor dust (ng/g)

Country	SCCPs	MCCPs	LCCPs
NL	27-22890	190-133480	<1-1310
BE	580-9830	3140-32380	3-790
IR	1030-55295	7920-103475	290-9140
SE	400-40270	8880-349015	<1-6640

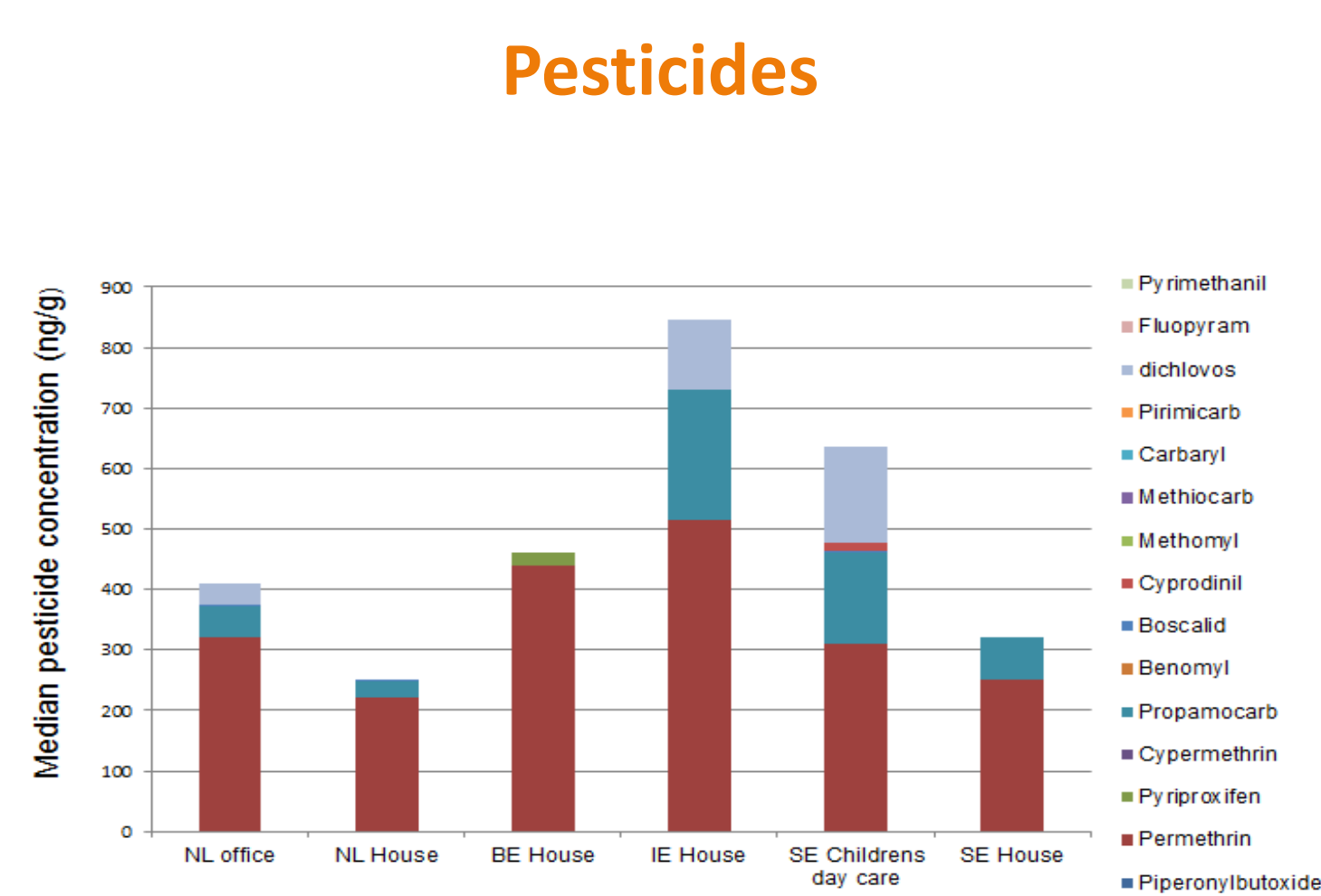


Fig. 3 Pesticides detected in indoor dust per country/location type

- ✓ Permethrin was the pesticide with the highest detection rate and with the highest concentration (Fig. 3).
- ✓ Dust from houses in NL was less contaminated than houses from BE, IR, SE.

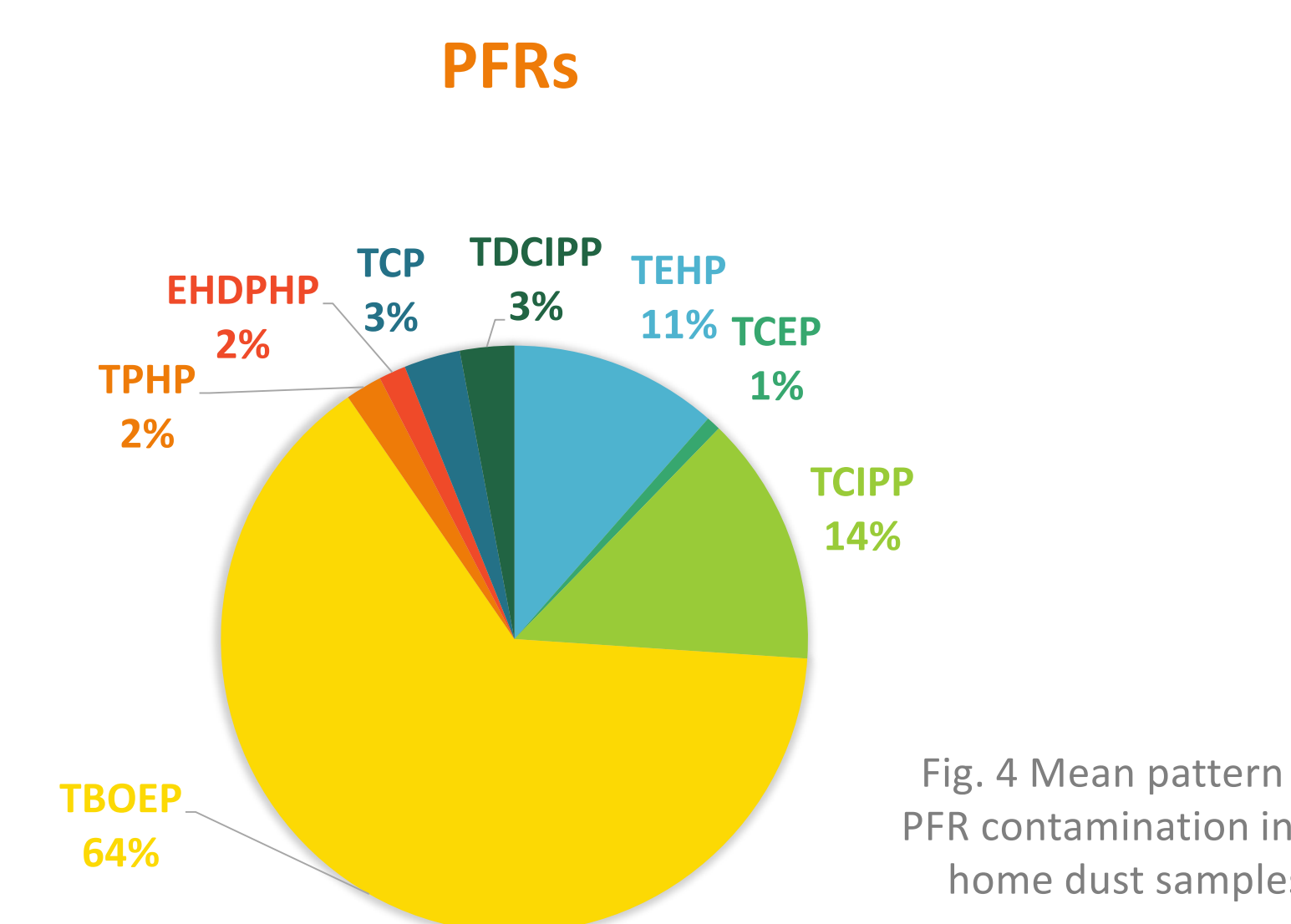


Fig. 4 Mean pattern of PFR contamination in BE home dust samples

- ✓ PFRs were detected in higher concentrations in BE, NL and SE home indoor environments
- ✓ Major PFR contributors: TBOEP > TCIPP > TEHP (Fig. 4)

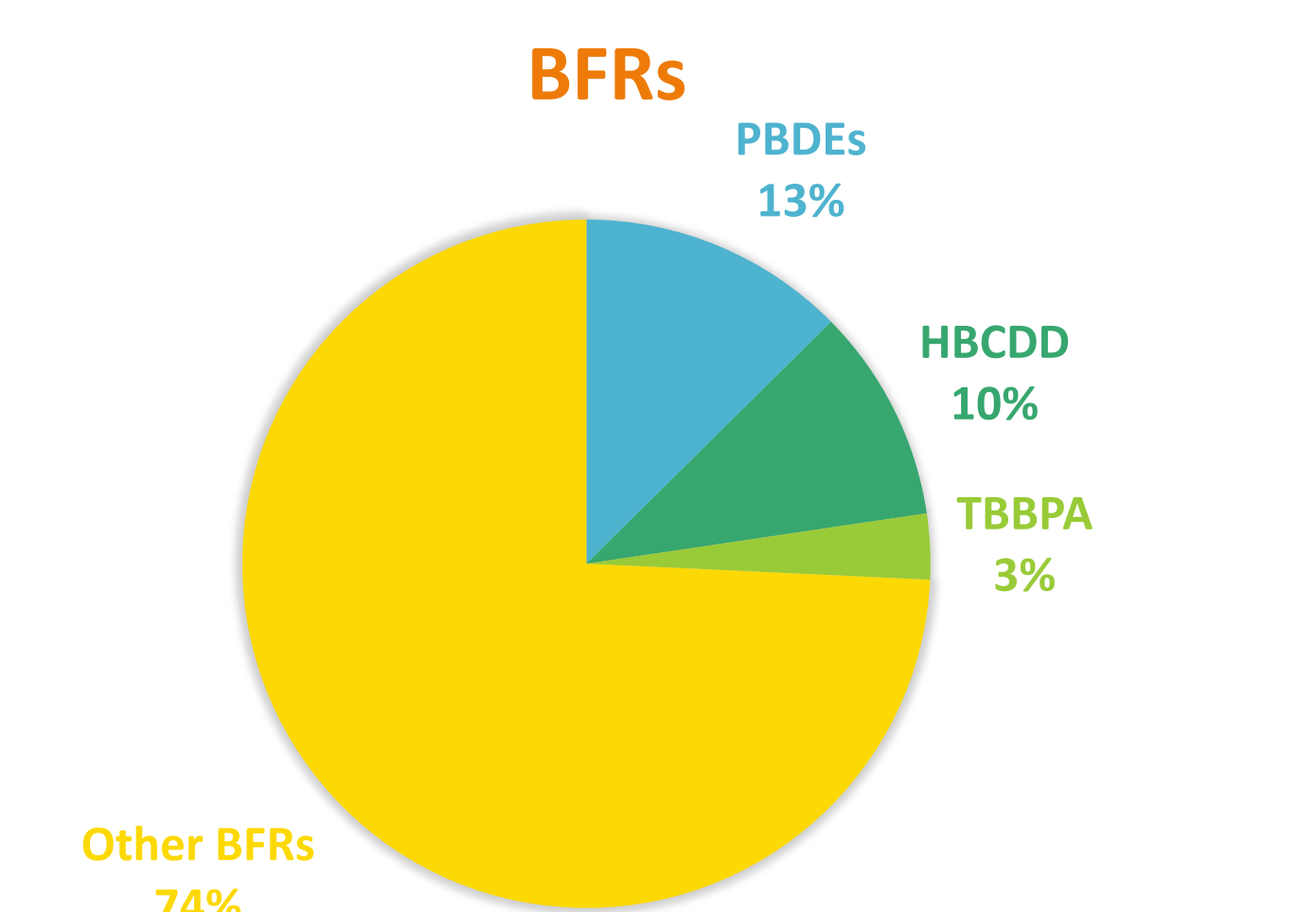


Fig. 5 Mean contributions of the targeted BFRs in BE home dust

- ✓ Overall major BFR contributors: BDE-209 > DBDPE >  $\gamma$ -HBCD > TBPH >  $\alpha$ -HBCD > TBBP (Fig. 5)
- ✓ Irish samples had the highest loads of BFRs.

## CONCLUSION

This study confirms the **ubiquitous presence of BFRs, PFRs, and PFASs in European homes and offices** and indicates the continued existence of **substantial differences in contamination levels and patterns between different EU countries.**

## ACKNOWLEDGEMENTS

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