

# Silicone wristbands as passive samplers for personal exposure assessment of legacy persistent organic pollutants: A pilot study

## Introduction

- Persistent organic pollutants (POPs) are a diverse group of chemicals characterized by toxic properties, resistance to degradation, bioaccumulation, and widespread transport through air and water.
- Despite global regulatory efforts, POPs are persistent in the environment, resulting in widespread contamination long after restrictions are in place. The continuous, ubiquitous exposure of individuals to these environmental chemicals highlights the critical need to assess personal exposure to legacy POPs, making it an emergent exposome-related research topic.

## Aim of this study

- This pilot study presents a novel approach using silicone wristbands (SWBs) as **passive samplers** for the measurement of **time-weighted average exposure** to legacy POPs, including organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs).

## Methods

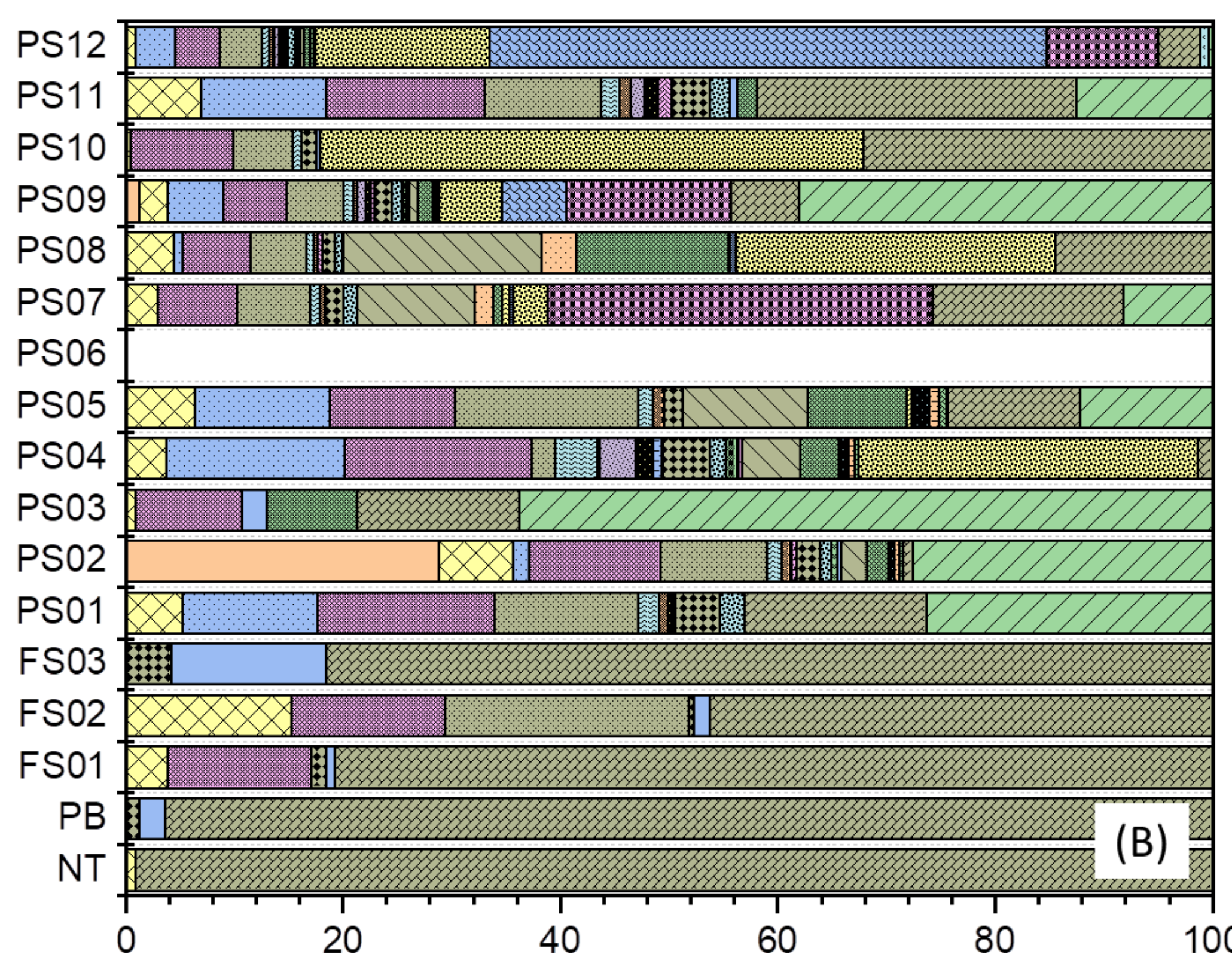
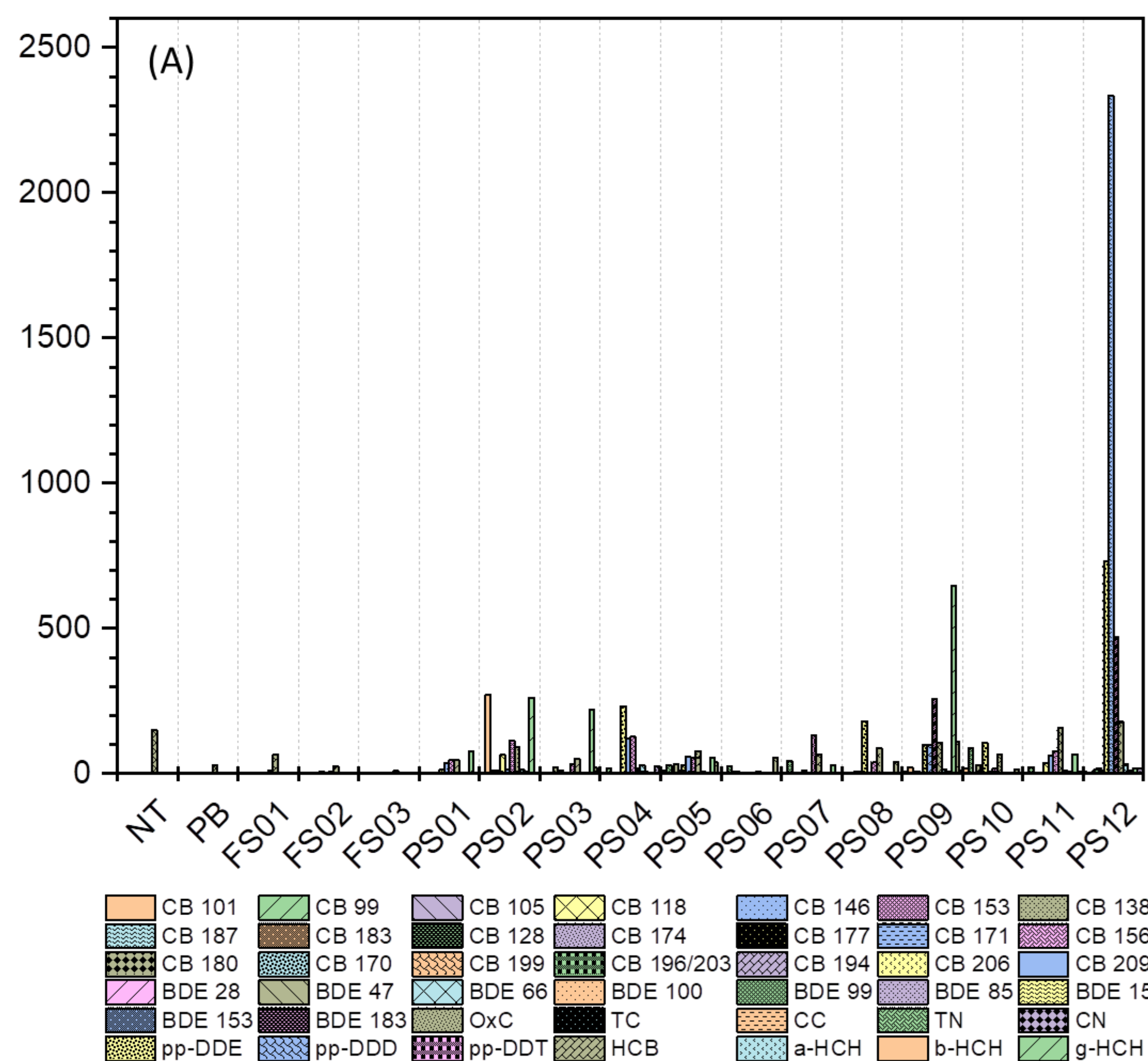
- SWBs were cleaned before deployment using solvent extractions<sup>1</sup>, and then worn by participants (n = 12) for a week (Fig. 1).
- Three more field samplers (FS) were also deployed during the week to monitor the micro-environment contamination pattern.
- SWBs were then cut into pieces, extracted and cleaned up using SPE. Targeted method was applied for analysis on a GC-ECNI/MS

1. Yin, S., et al. 2023. *Environ Res* 224, 115526.



Fig. 1. Workflow of the pilot SWB sampling project

## Results and Conclusions



\*Results of PS06 was not available due to the interference of the polychlorinated alkane congeners with carbon chain length of C<sub>10</sub> to C<sub>13</sub> (PCAs-C<sub>10-13</sub>).

Fig. 2. Bar charts (A) of the legacy POPs in SWB samples (in pg/g wb) and the proportional contribution (B) to the total POPs concentration by chemicals.

- The results (Fig. 2) showed that **hexachlorobenzene (HCB)** was consistently detected in all samples.
- The median concentration of  $\Sigma$ POPs among the study population reached up to 150 pg/g wb.
- **CB 153** (median 54 pg/g wb) and **BDE 99** (24 pg/g wb) were found to have the highest concentrations of PCBs and PBDEs, respectively, among all worn SWBs.

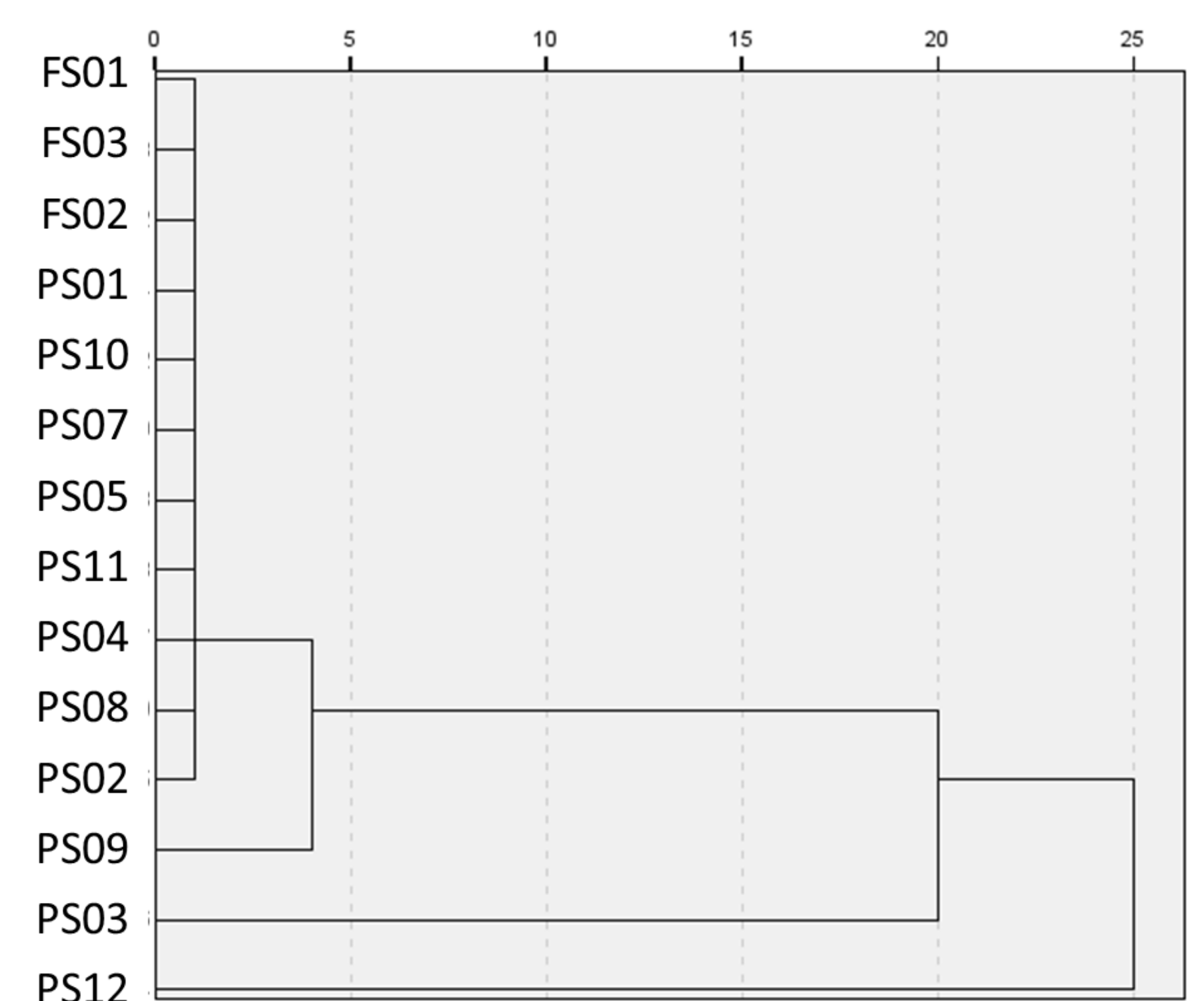
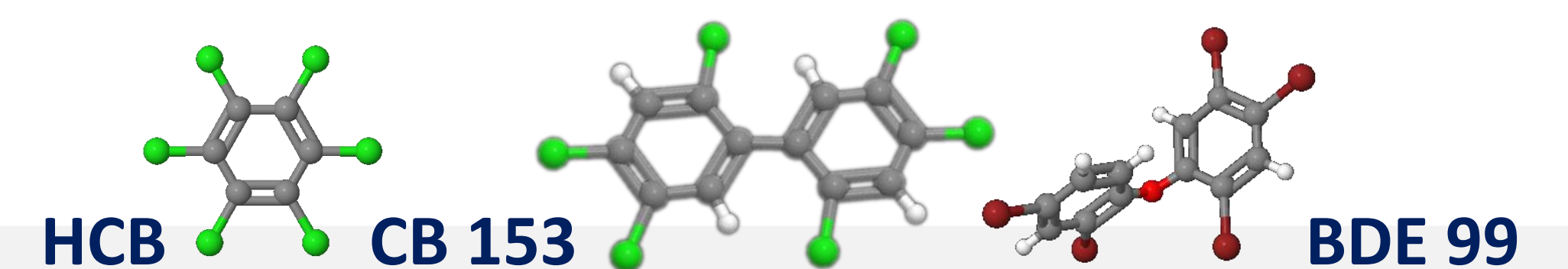


Fig. 3. Dendrogram of the worn wristbands (n=11) and Field samplers (n=3) by hierarchical clustering analysis

- Hierarchical clustering analysis (Fig. 3) shows that the SWBs worn by participants PS03, PS09 and PS12 stand out as outliers
- The rest of the worn SWBs show **similar exposure patterns** to FSs used in **indoor and outdoor microenvironments**.



- ✓ Different external exposure patterns were observed among the study participants.
- ✓ Exposure to legacy POPs mostly can be traced back to the contamination in the microenvironment.

## Future Perspectives

- ❖ Establish a universal sampling protocol for SWB-based personal exposure monitoring in general population and occupational settings.
- ❖ Improve exposure assessment methods and enhance our understanding of the impact of environmental pollutants on human health.
- ❖ Provide participants with individual exposure reports, thereby supporting population intervention aimed at minimizing unintentional environmental chemical exposures.

