Chemical exposures in the home: Identifying sources to inform interventions

Robin E. Dodson, Sc.D., M.S.

Silent Spring Institute

Importance of the home environment

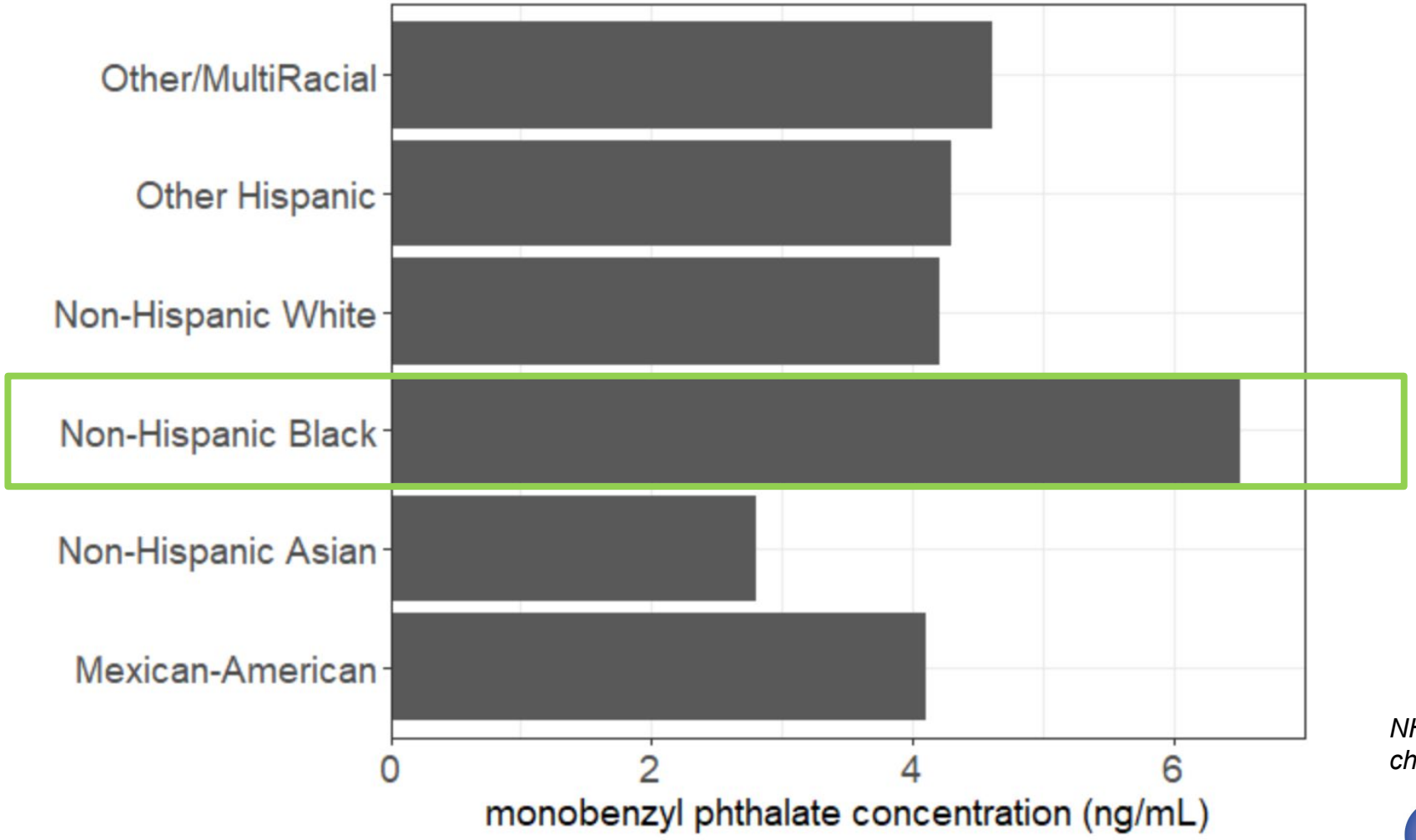
- We spend >90% of our time indoors
- Indoor air concentrations 2-100x higher than ambient concentrations
- ‘Traditional’ indoor pollutants
    - Particulate matter (PM)
    - CO
    - NOx
    - Mold/allergens
    - Lead
    - Radon
    - Volatile organic compounds (VOCs)

Other important indoor chemicals

- Phthalates
- Parabens
- Antimicrobials
- Bisphenols
- Ethanolamines
- Fragrance chemicals
- UV filters
- Flame retardants
- PFAS

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

Not everyone is exposed equally



NHANES cycle 2015-2016; children 6-12 years

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

Moving environmental justice indoors

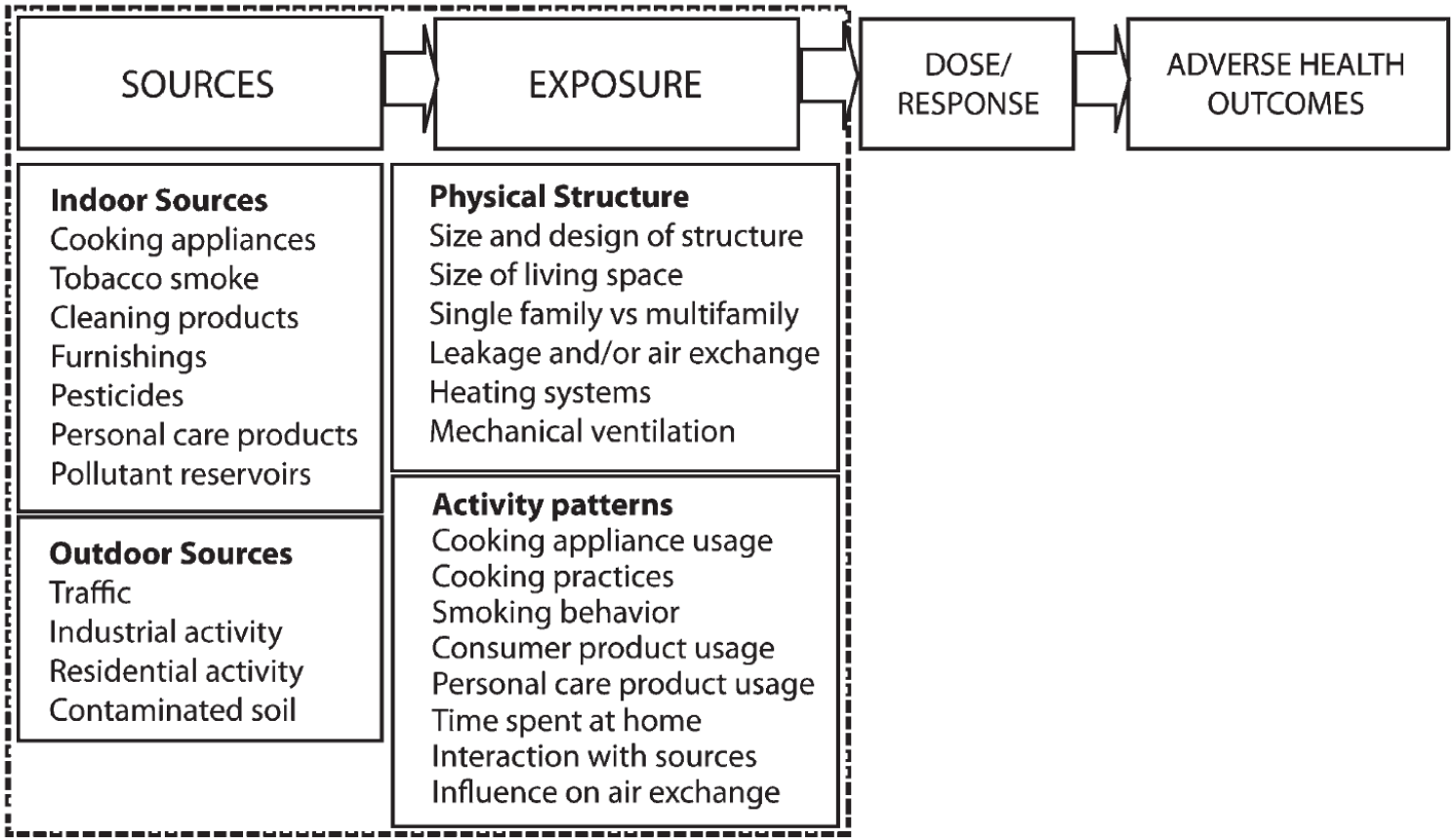


FIGURE 1—Conceptual framework—contributors to indoor environmental exposure.

Adamkiewicz et al. 2011. Moving environmental justice indoors: understanding structural influences on residential exposure patterns in low-income communities. Am J Public Health. 101 Suppl 1:S238-45.

Consumer product chemicals are found throughout indoor spaces

Many consumer product chemicals of health concern are **semivolatile organic compounds**, so they readily partition between surfaces, indoor air, and house dust

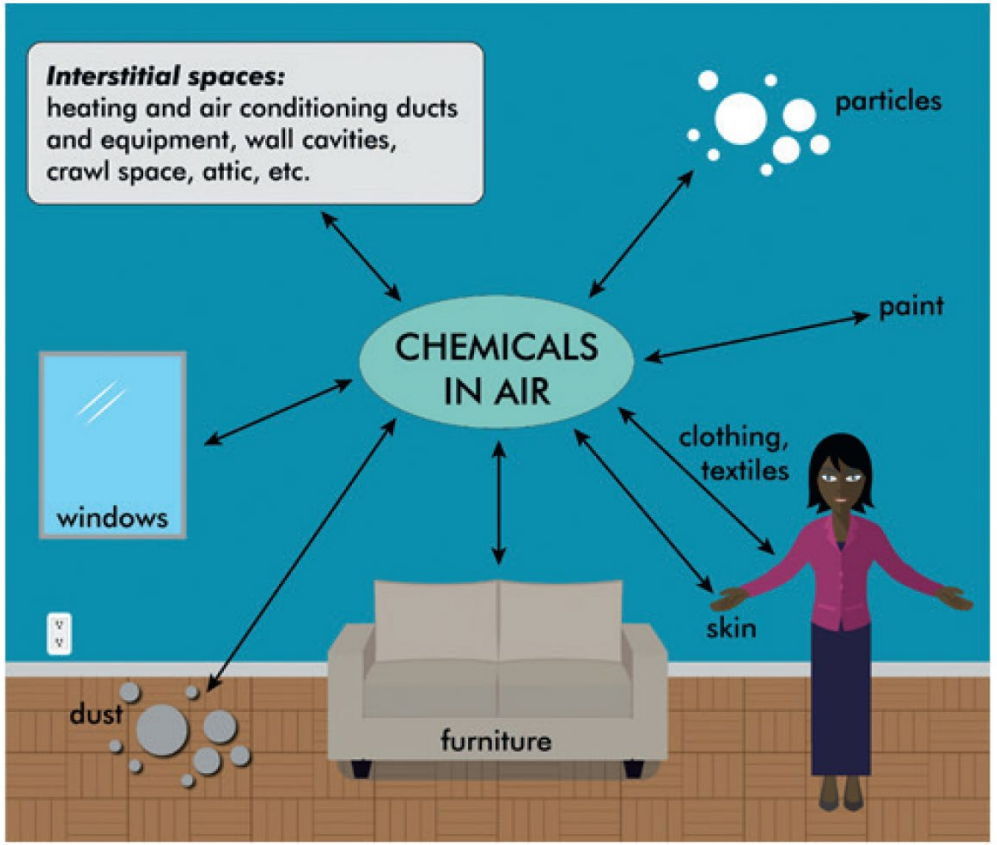
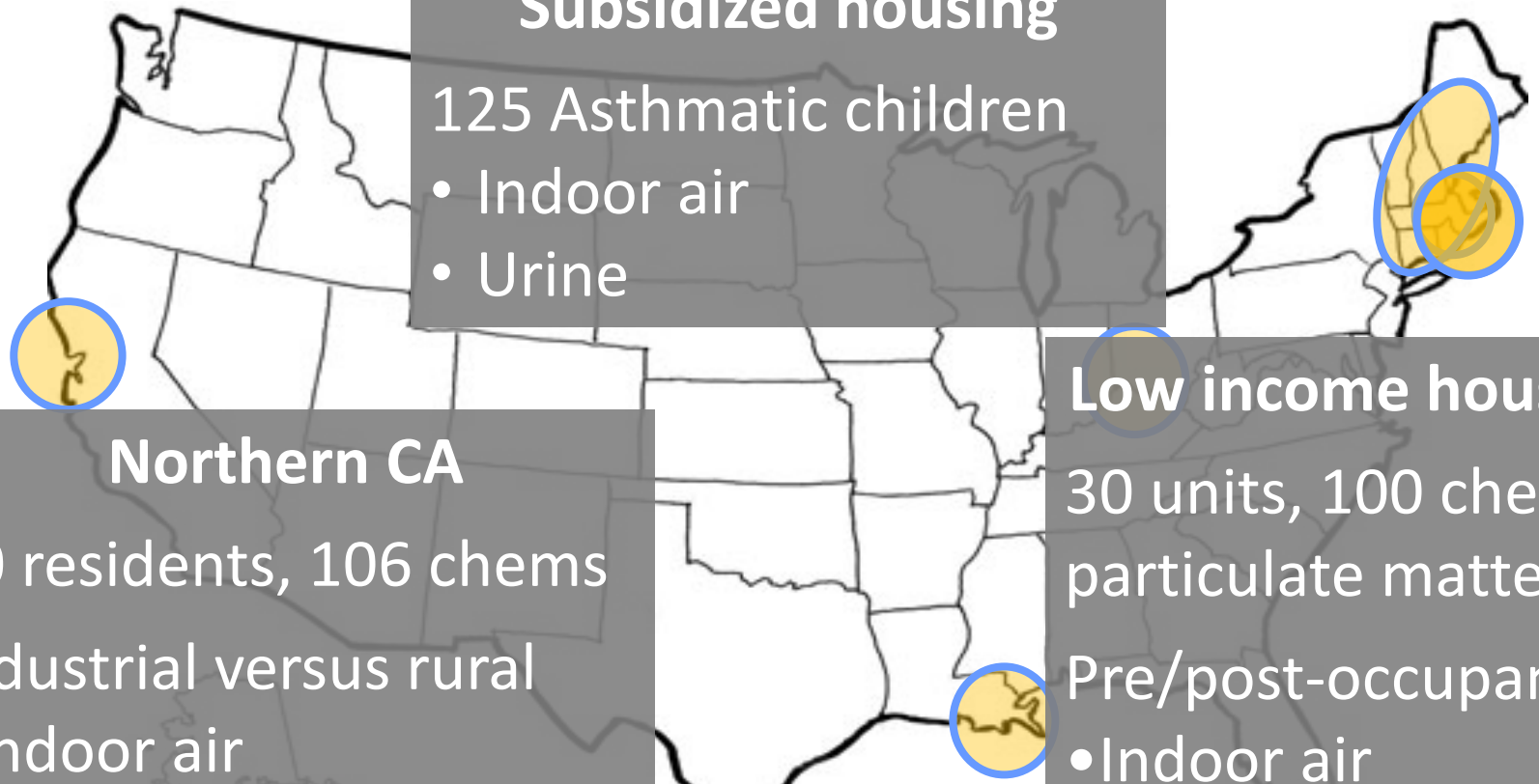


FIGURE 3-2 Chemicals can partition among a number of different reservoirs in the indoor environment.
SOURCE: Modified from Weschler and Nazaroff (2008).

National Academies of Sciences, Engineering, and Medicine 2022. Why Indoor Chemistry Matters. Washington, DC: The National Academies Press. https://doi.org/10.17226/26228.

Indoor Exposure Studies



Subsidized housing

125 Asthmatic children

- Indoor air
- Urine

College campuses (2 studies)

2/4 universities, 47/43 flame retardants

- Common room and classroom dust

Northern CA

50 residents, 106 chems

Industrial versus rural

- Indoor air
- Outdoor air
- House dust

Low income housing

30 units, 100 chems, particulate matter

Pre/post-occupancy

- Indoor air
- Floor wipes

Cape Cod

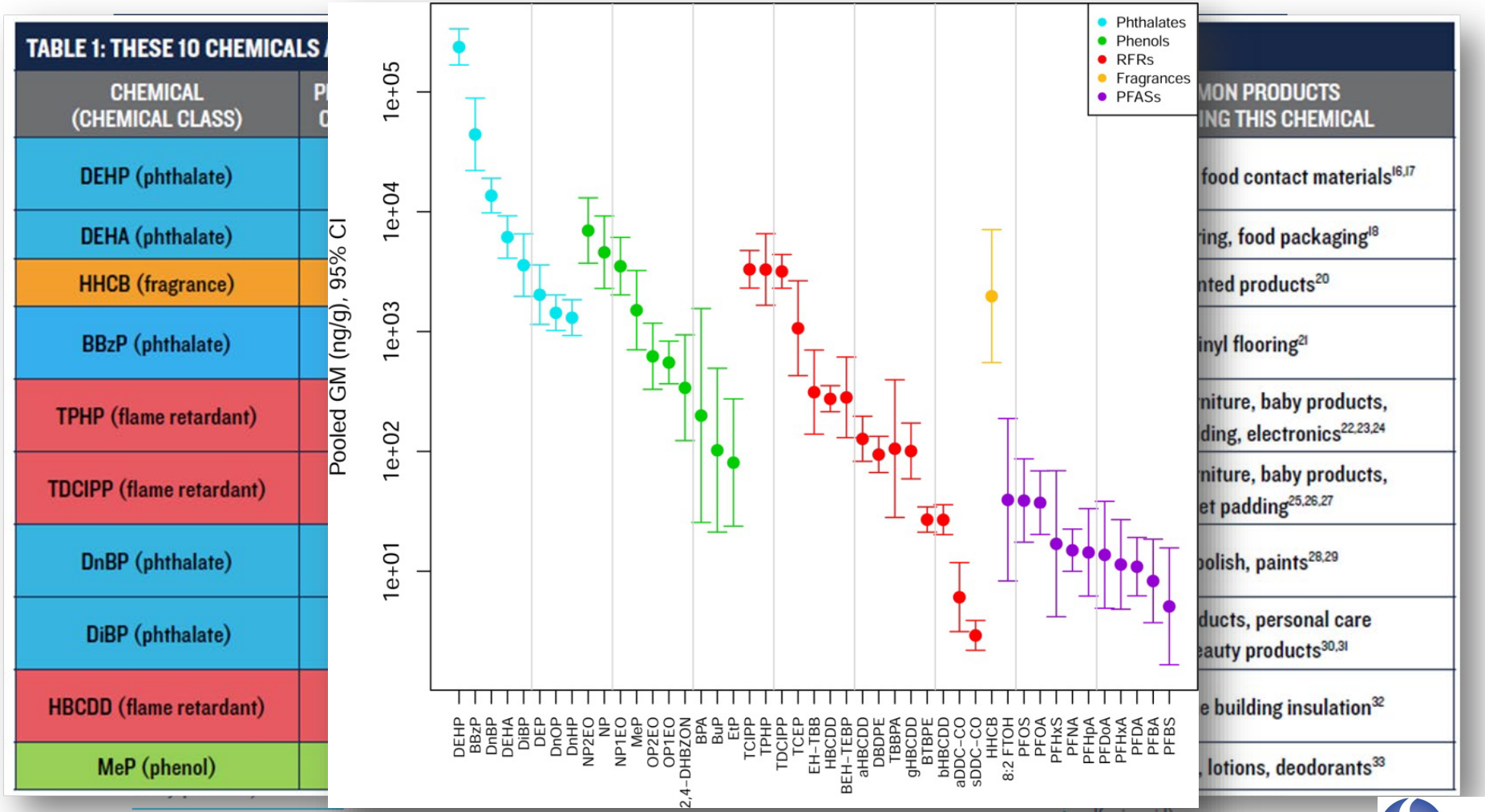
120 households, 89 chems

- Indoor air
- House dust
- Urine

Rudel et al. 2003; Rudel et al. 2010; Dodson et al. 2015; Dodson et al. 2017; Dodson et al. 2017; Rodgers et al. 2021; Schildroth et al. 2022

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

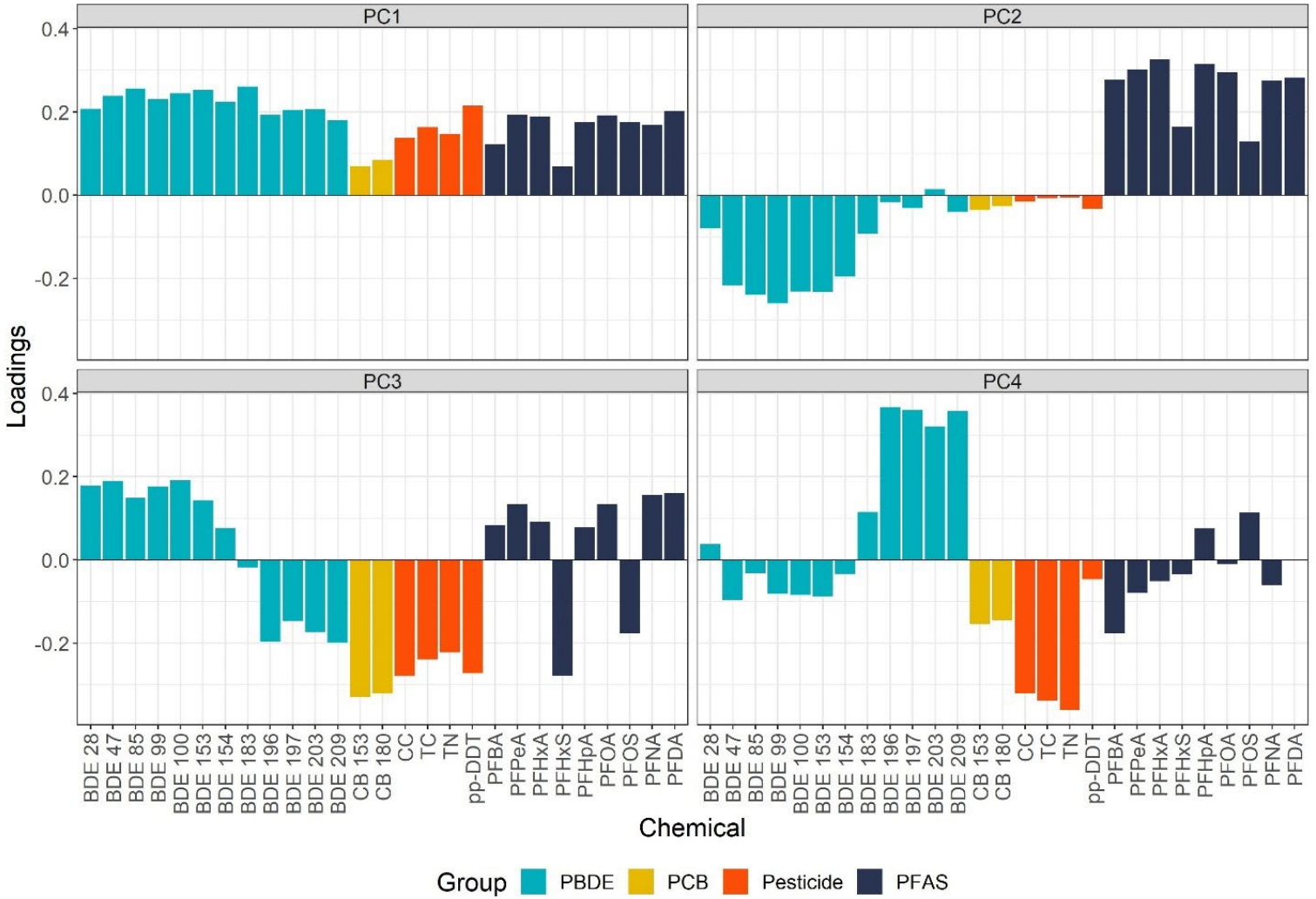
Consumer product chemicals are in our homes: Household dust



Mitro et al. 2016. Consumer Product Chemicals in Indoor Dust: A Quantitative Meta-analysis of U.S. Studies. Environ Sci Technol. 50(19):10661-10672.

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

Chemical mixtures in classroom dust

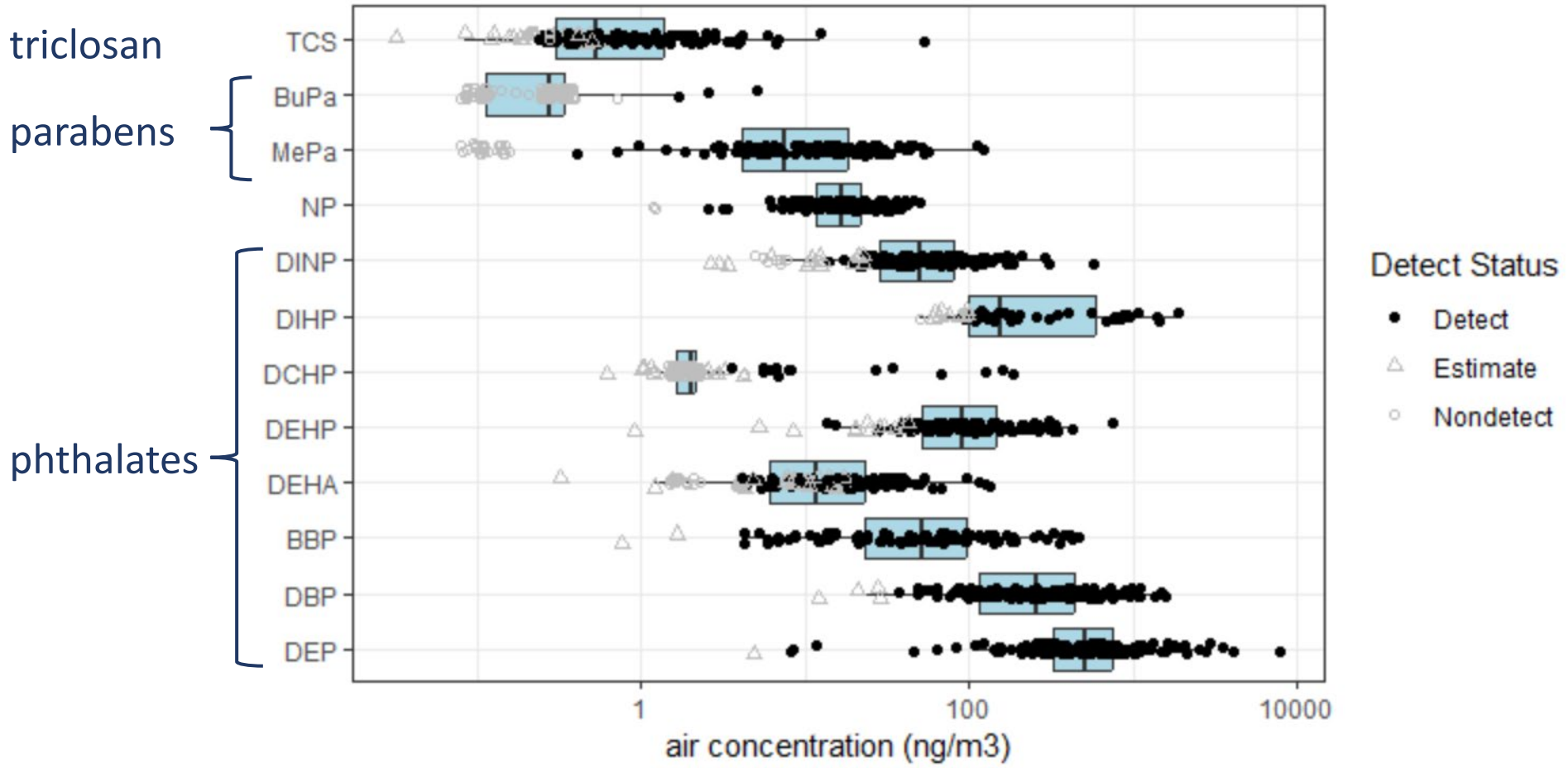


	carpet	no. of upholstered furniture	years since last furnished
PC-1	2 (-0.4, 4.4)	-0.00042 (-0.0076, 0.0067)	0.051 (-0.078, 0.18)
PC-2	**1.9 (0.19, 3.6)**	-0.00077 (-0.0059, 0.0043)	-0.074 (-0.17, 0.018)
PC-3	-0.13 (-1.7, 1.4)	-0.0046 (-0.0092, 0.000032)	0.024 (-0.059, 0.11)
PC-4	0.57 (-0.6, 1.7)	0.0033 (-0.0002, 0.0068)	-0.026 (-0.089, 0.036)

Schildroth et al. 2022. Per-and polyfluoroalkyl substances (PFAS) and persistent chemical mixtures in dust from U.S. colleges. Environ Res. 206:112530.

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

Consumer product chemicals are in our homes: Indoor air



Dodson et al. in preparation

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

Identifying sources informs interventions: "Move In" Study

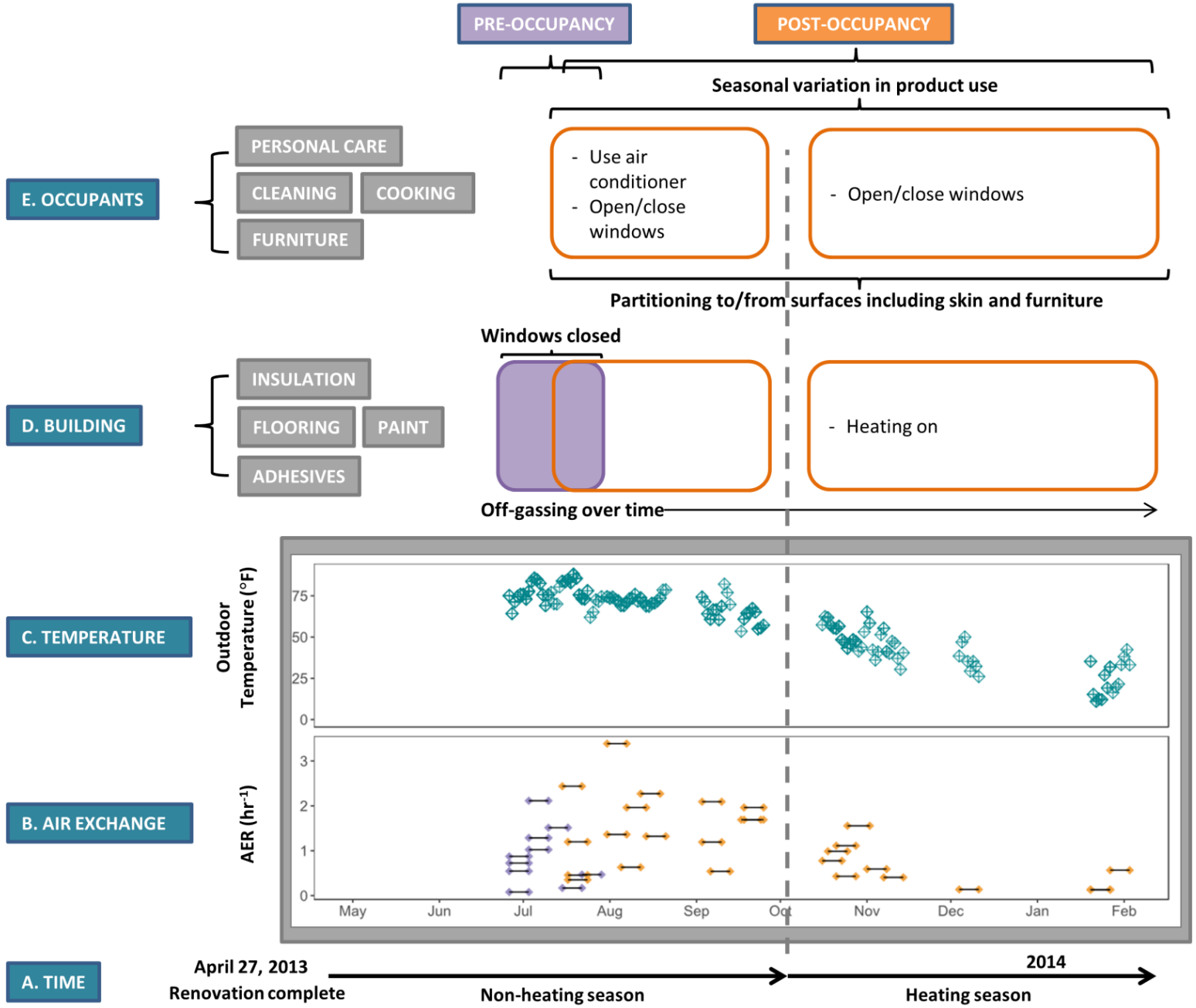
Bergmeyer.com

- Federal subsidized housing development in Boston's South End
- Originally built in 1950s
- 56 units (of 422) underwent HUD-funded renovations
  - Mostly focused on energy efficiency
  - USGBC's LEED Homes certification
  - HERS tier II rating of 65

Dodson et al. 2017. Chemical exposures in recently renovated low-income housing: Influence of building materials and occupant activities. Environ Int.109:114-127.

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

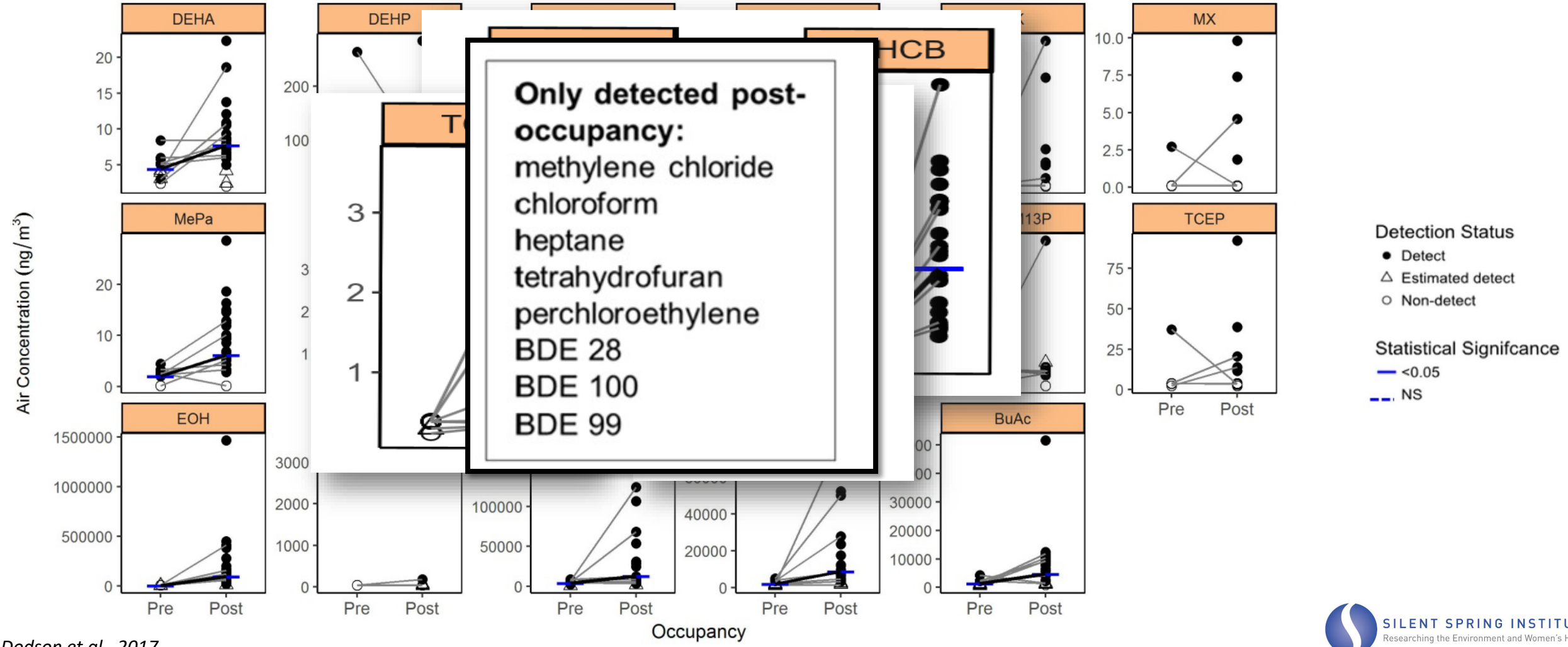
Multiple factors influence indoor air concentrations



Dodson et al., 2017

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

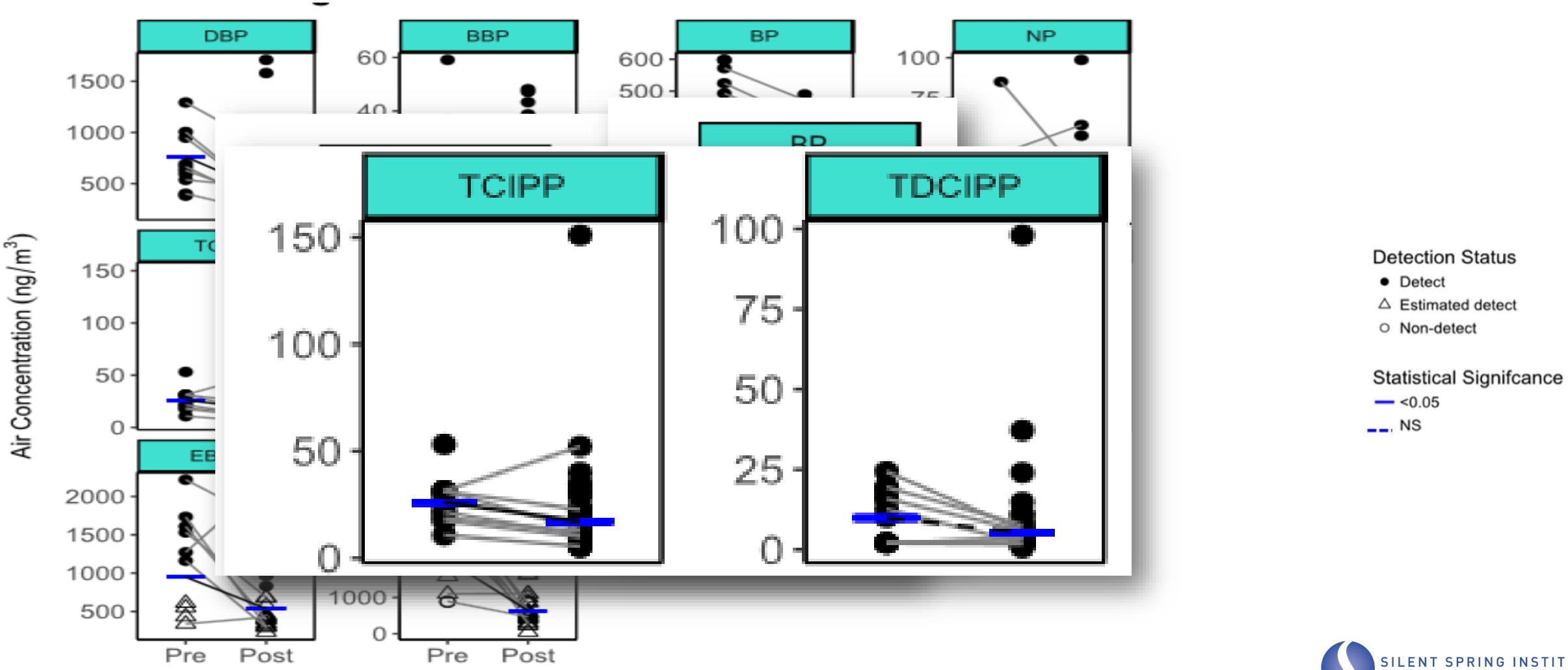
Chemicals related to occupancy



Dodson et al., 2017

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

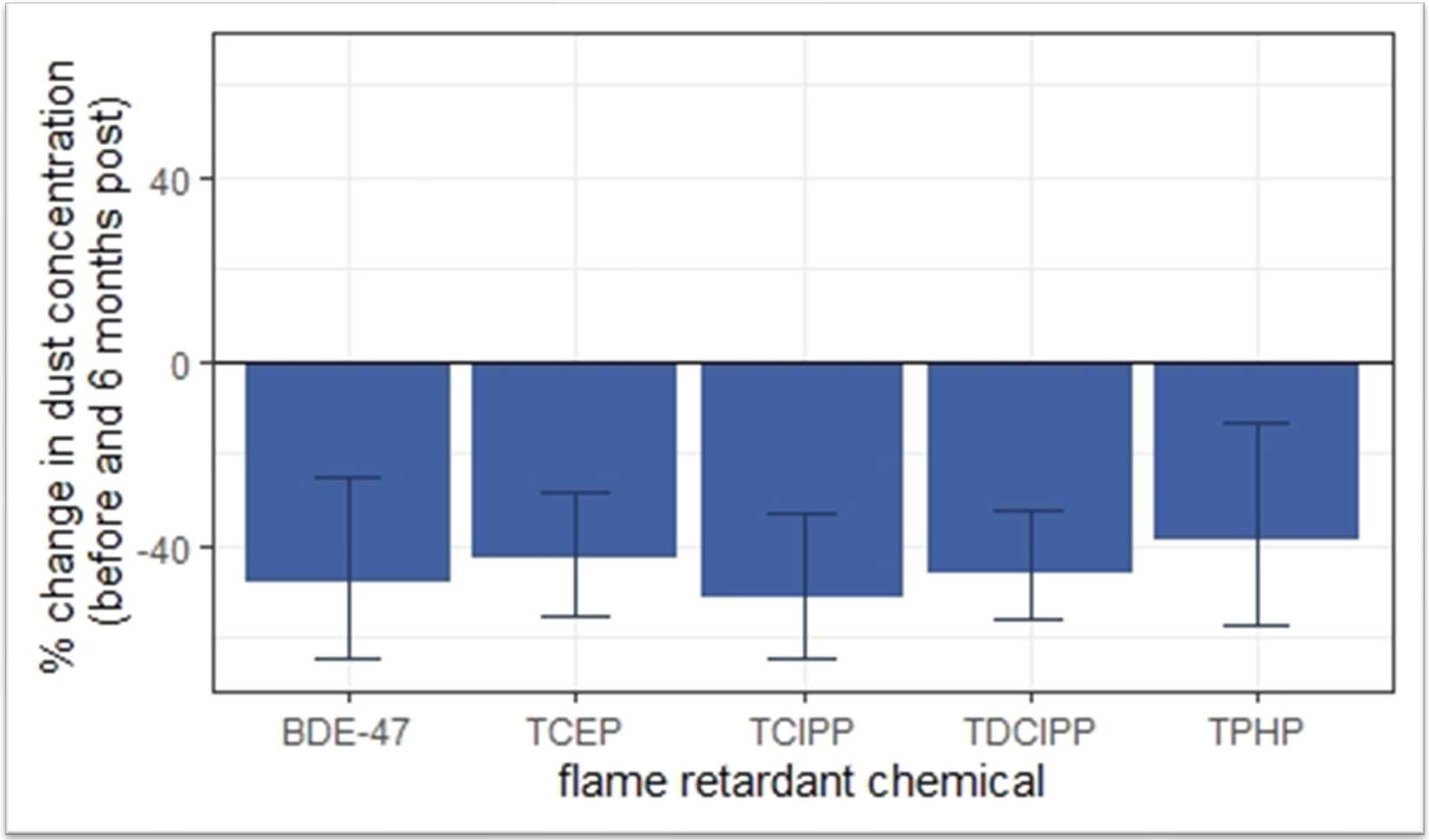
Chemicals influenced by the building



Dodson et al., 2017

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

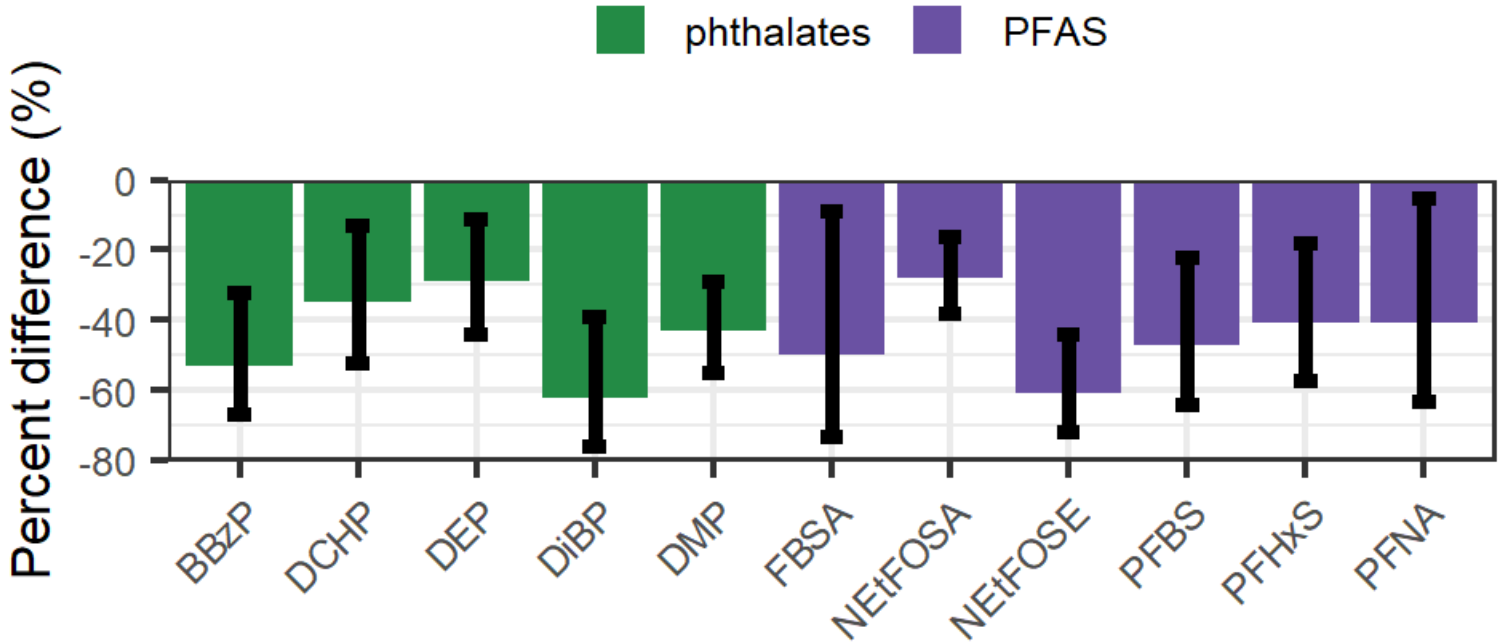
Replacing furniture significantly reduces flame retardant exposures



Rodgers et al. 2021. Do flame retardant concentrations change in dust after older upholstered furniture is replaced? Environ Int. 153:106513

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

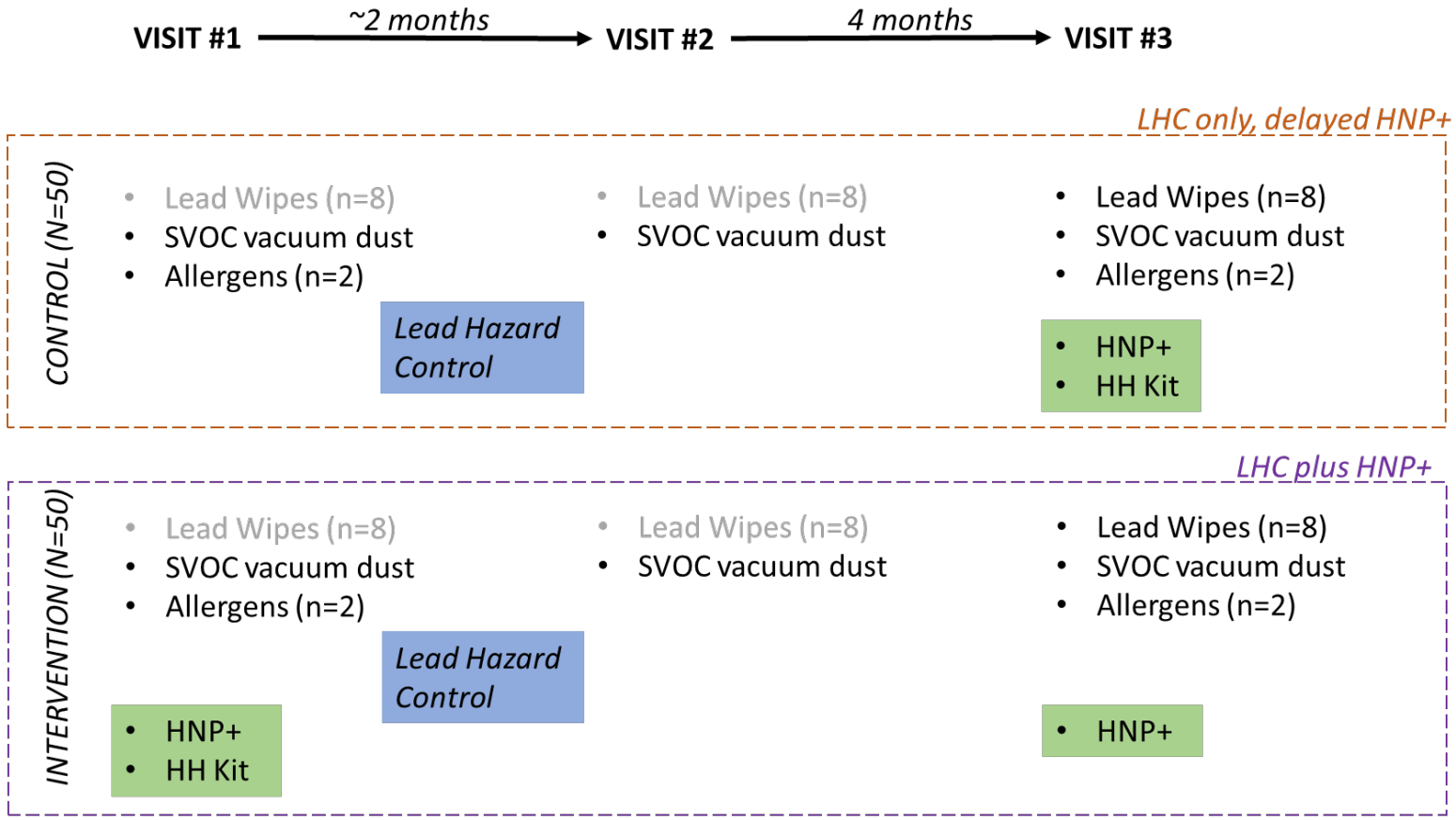
Popular COVID air filter reduced indoor air PFAS and phthalate concentrations in classrooms



Dodson RE et al. 2022. Does Using Corsi-Rosenthal Boxes to Mitigate COVID-19 Transmission Also Reduce Indoor Air Concentrations of PFAS and Phthalates? Environ Sci Technol.

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

Influence of Lead Hazard Control/housing rehabilitation on other exposures in the home

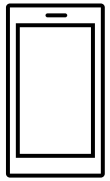


Funded by HUD HHTS (MAHHU0060-20) and Konar Foundation

ROC HOME

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

So, what can you do to limit exposures?

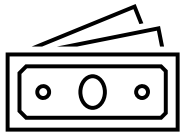


Consumers: individual choices, consumer campaigns

Detox Me
BY SILENT SPRING INSTITUTE

Institutions: purchasing specifications

HEALTHY GREEN CAMPUS



Retailers/Manufacturers: Restricted Substances Lists (RSLs), certifications, marketing advantage


NOTICE

THIS ARTICLE MEETS THE FLAMMABILITY REQUIREMENTS OF CALIFORNIA BUREAU OF ELECTRONIC AND APPLIANCE REPAIR, HOME FURNISHINGS AND THERMAL INSULATION TECHNICAL BULLETIN 117-2013. CARE SHOULD BE EXERCISED NEAR OPEN FLAME OR WITH BURNING CIGARETTES.

The upholstery materials in this product:
____contain added flame retardant chemicals
_X_contain NO added flame retardant chemicals
The State of California has updated the flammability standard and determined that the fire safety requirements for this product can be met without adding flame retardant chemicals. The State has identified many flame retardant chemicals as being known to, or strongly suspected of, adversely impacting human health or development.

Red List Free

Regulations: standards change, right-to-know laws, chemical bans

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

Collaborators

Silent Spring Institute
Ruthann Rudel
Julia Brody
Kathryn Rodgers
Julia Udesky
Katie Boronow

ROC HOME
Katrina Korfmacher
Cait Sharma
Amanda Reddy
Olivia Waysack
Jacob Hall

Other Collaborators
Gary Adamkiewicz
Marty Alvarez
Joe Braun
Kate Manz
Samantha Schildroth
Mark Strynar
Adrian Covaci
Debbie Bennett
Susanna Mitro
Veena Singla
Ami Zota
Kristin Isaacs
John Wambaugh

Robin Dodson
dodson@silentspring.org

www.silentspring.org

Download Detox Me (free, English/Spanish, iOS/Android)

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health