Time Trends of Flame Retardants Additives in Cars

10 km

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Introduction

Vehicles

- Vehicles - subject to many standards to ensure safety
- Increasing amounts of time spent in cars
- Contain
  - Synthetic materials
  - Textiles
  - Electronics
- Include a whole range of additive substances - Flame retardants to meet flammability standards

Hypothesis

- Cars have high levels of plastic additives, including flame retardants
- Regulations have decreased levels of prohibited substances in newer cars, while increasing levels of substitutes

Recycling as a potential resource

- Many vehicle manufacturers aim to increase material circularity
- Up to 60% recycled plastic material used in the interior
- Potential for reintroduction of restricted hazardous substances in recycled plastics

External influence

- extreme conditions, unique among indoor environments - can affect emissions or degradation of substances:
  - Sunlight (possible influence of UV in close proximity to the glass)
  - Sudden temperature changes and wide temperature ranges

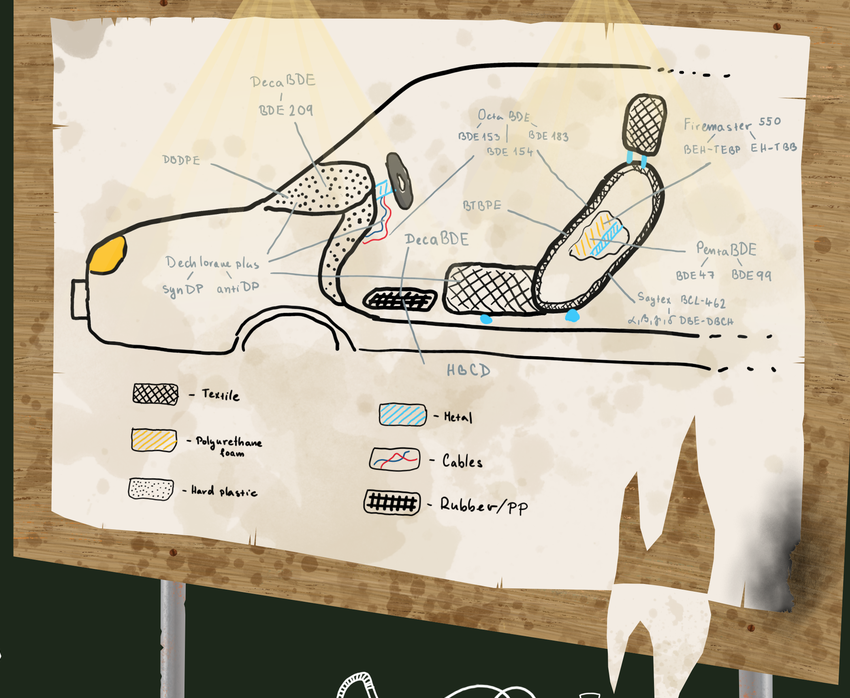
Key outcomes

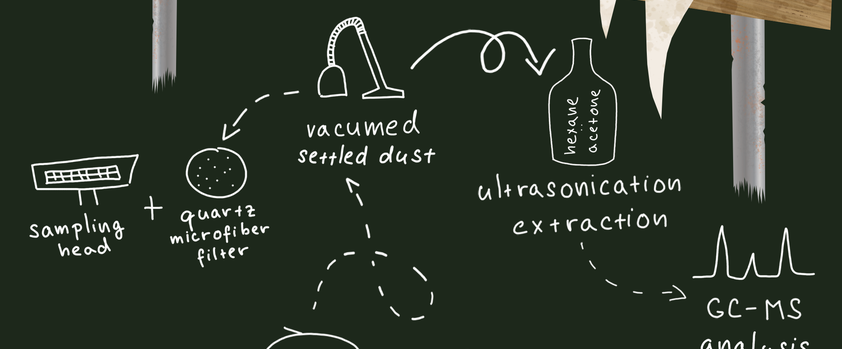
Importance of composite samples - variations in levels in different car parts

Levels of FRs in car dust generally higher that most other indoor environments

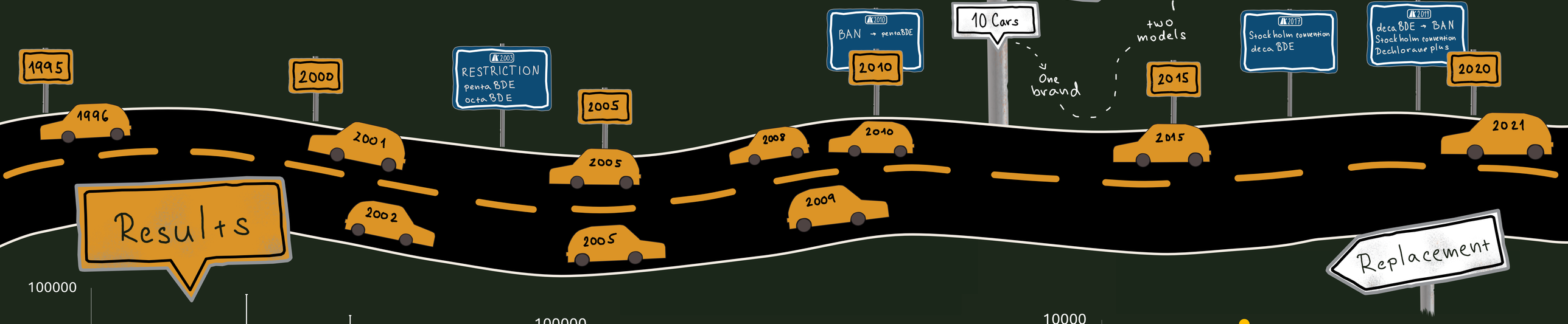
The increasing trend of using recycled materials with potentially unknown additive content

Lag time between regulation and implementation: Decreases from recent regulation of decaBDE not yet evident in cars

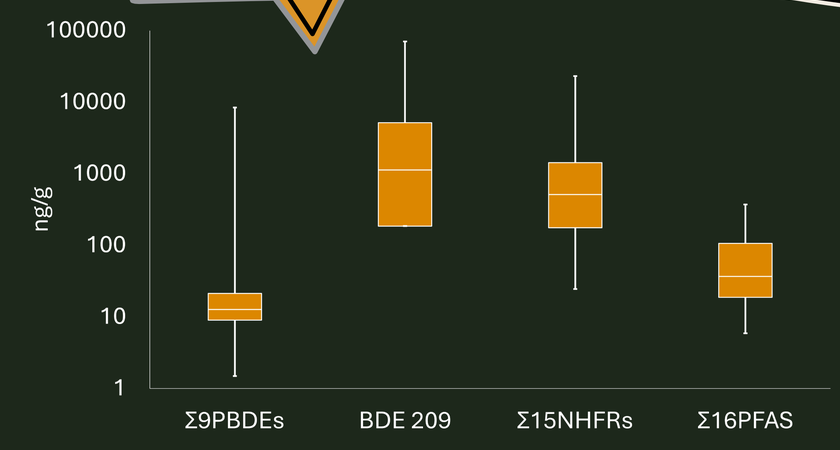




Methods



Results



Variations in levels in dust within car

- Brominated FRs detected in all dust from all vehicle parts
- BDE-209 consistently highest in vehicles
- PFAS detected in 9 of 10 cars at ng/g levels

Highest in dashboard dust:

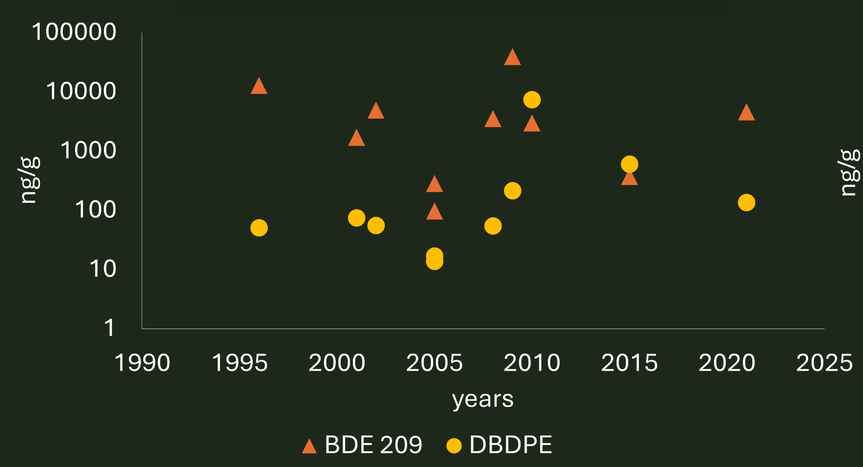
- PFAS
- DBDPE

Highest in trunk dust:

- BTBPE

Highest in seat dust

- pentaBDE and octaBDE components
- BEH-TEBP and EH-TBB
- DBE-DBCH

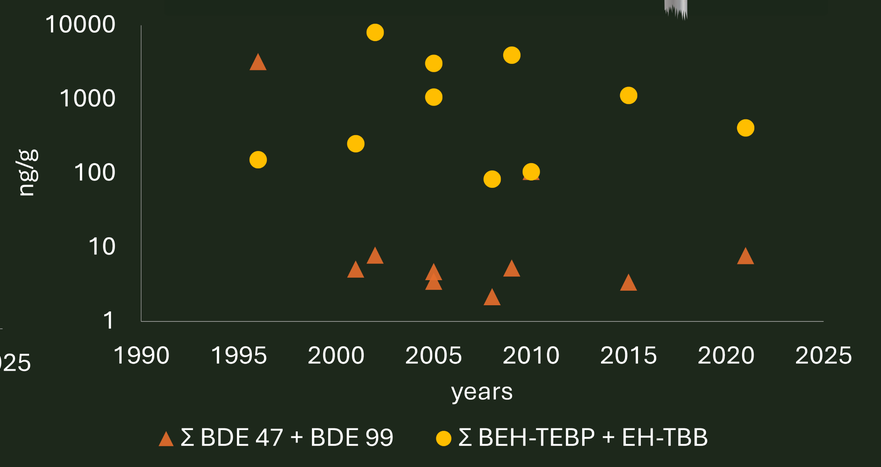


Hypothesis: DBDPE as replacement for decaBDE

- No time trends evident
- No clear evidence of replacement
- BDE 209 still in use – restrictions contain exemptions for the automotive industry

Higher temperatures and presence of sunlight on the dashboard can affect compounds:

- **decaBDE** - possible debromination
- **Dechlorane plus (antiDP and synDP)** - Difference in isomer ratios from technical mixture observed on dashboard



Hypothesis: Firemaster 550 (BEH-TEBP+EH-TBB) as replacement for pentaBDE

- Large decrease in pentaBDE levels from 1996 to 2001
- PentaBDE remains consistently detected in dust in newer cars
  - Possible debromination of decaBDE
  - Possible presence in recycled plastics

Replacement

Acknowledgements

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