

Global Inventory of PBDEs; from Production, Use and Waste to Environment

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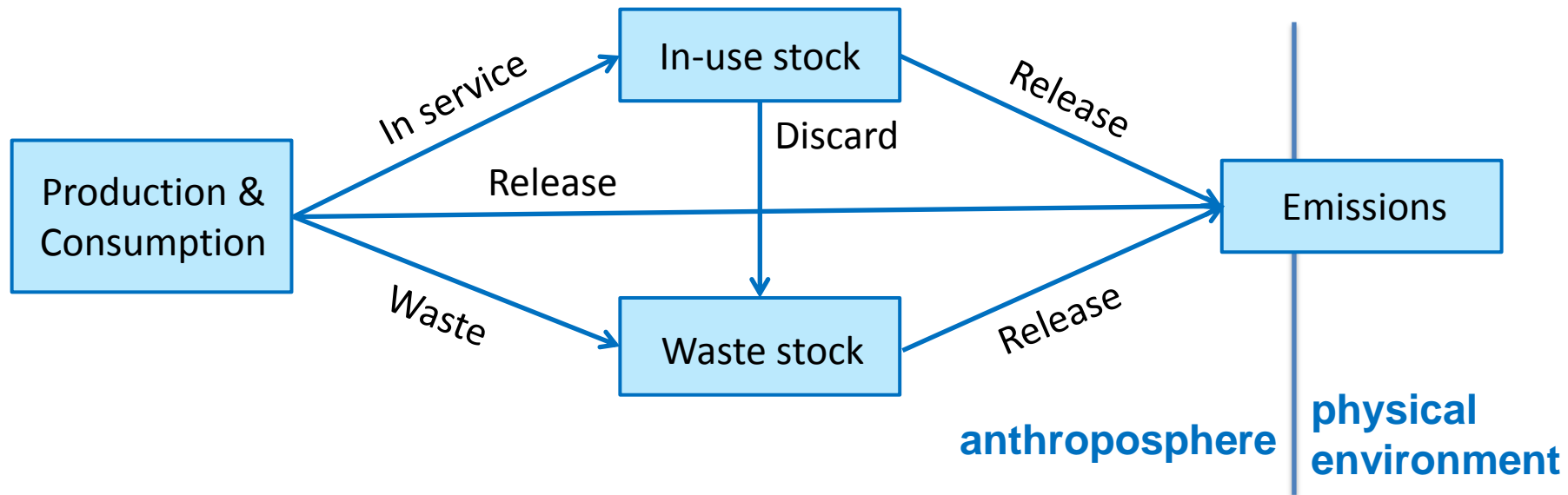
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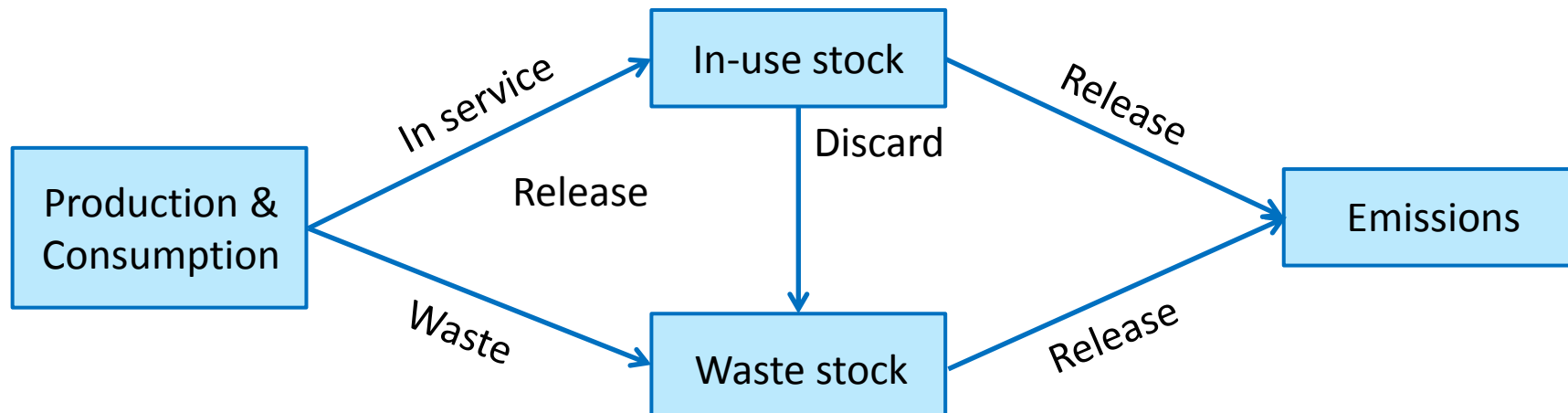


Polybrominated diphenylethers (PBDEs)



Questions

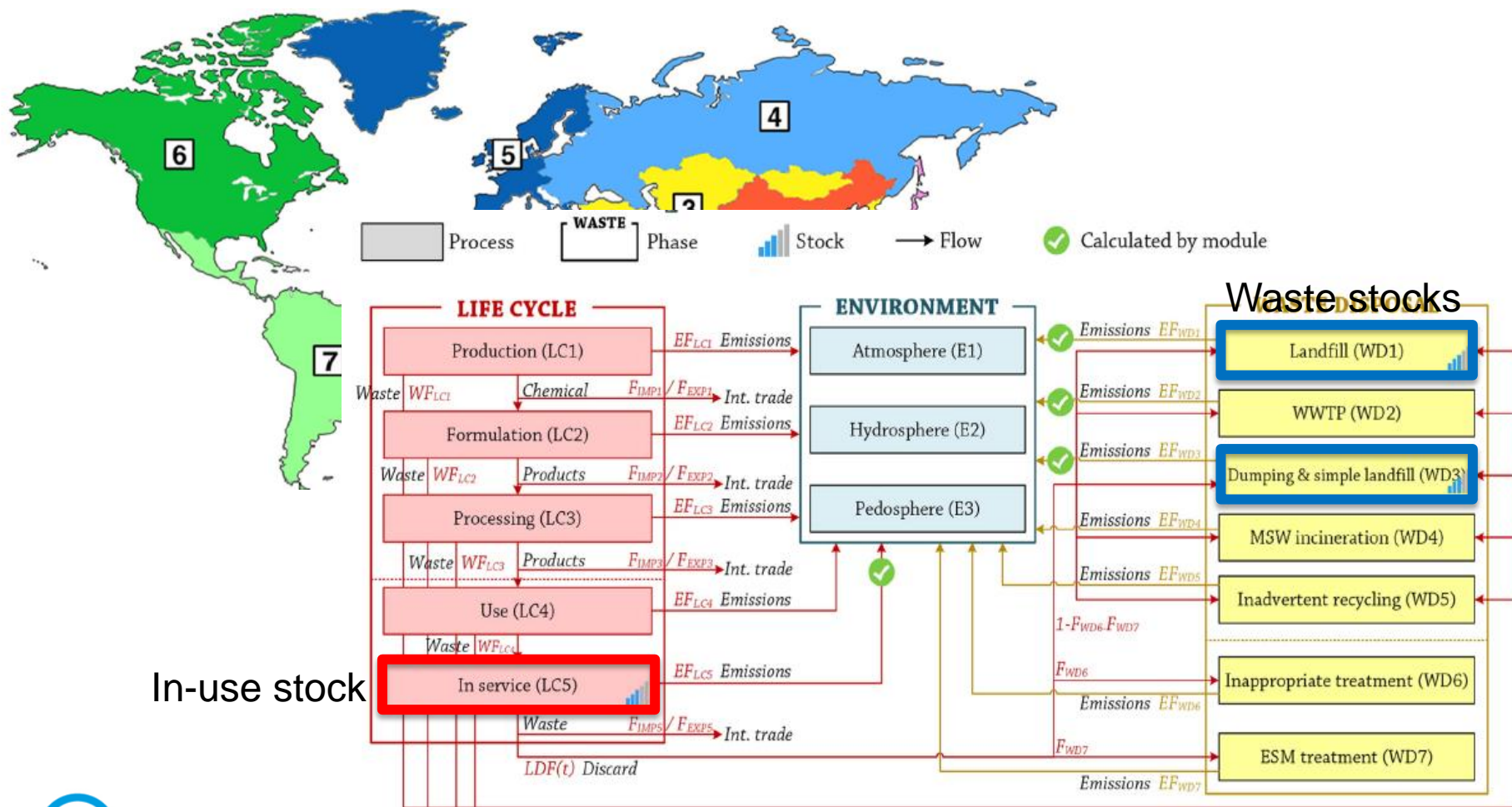
- Can we predict the environmental fate of chemicals in products by understanding their “anthropospheric” fate (e.g., in the human society)?
- Will the emission of chemicals follow the production of these chemicals?
- How long after the phase-out of PBDEs will their emission discontinue?



- **CiP-CAFE model:** fate of PBDEs in the anthroposphere
 - Global production & consumption of commercial mixtures of PBDEs
 - Assessing anthropospheric fate of Σ_6 PBDE (-28, 47, 99, 153, 183, 209)
 - Identifying and quantifying the major pathways of Σ_6 PBDE emissions
 - Establishing the temporal evolution of Σ_6 PBDE emissions at the global scale
- **BETR-Global model:** fate of PBDEs in the physical environment
 - Evaluating emission scenarios: modelled vs. measured atmospheric concentrations (background)

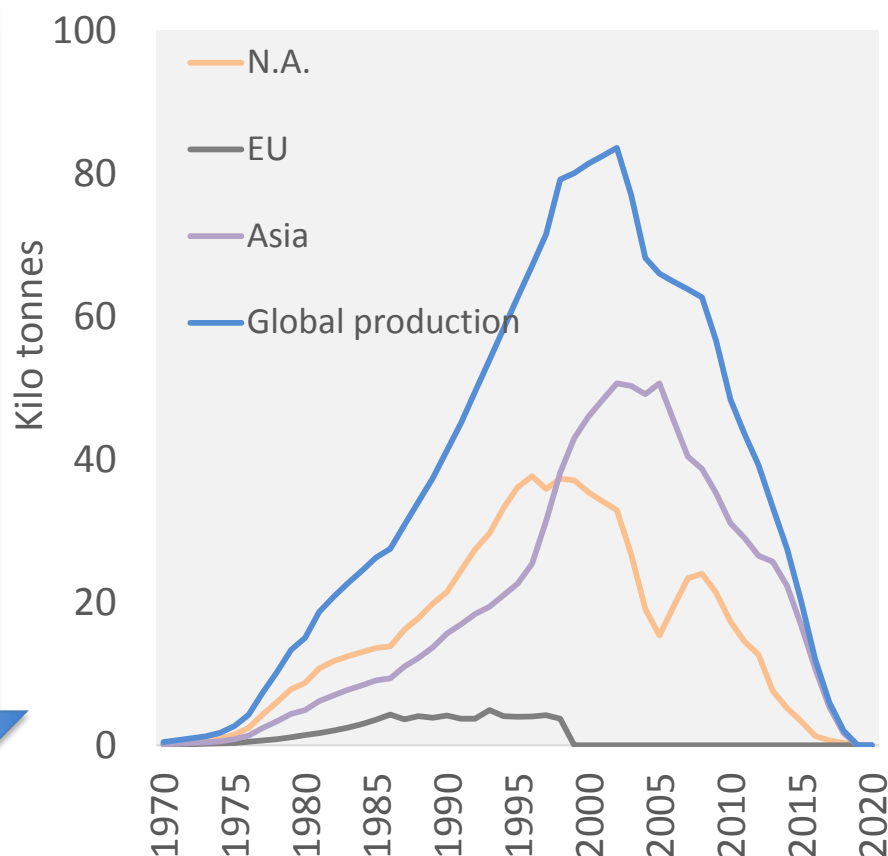
CiP-CAFE

Chemical in Products-Comprehensive Anthropospheric Fate Estimation

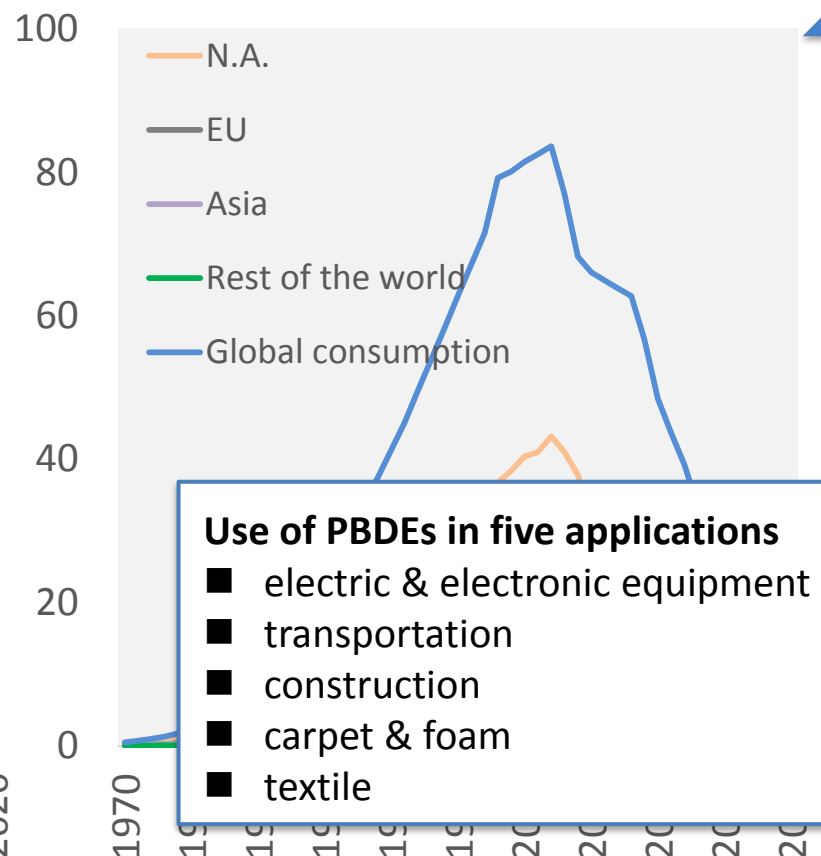


Σ_6 PBDE production & consumption

Production



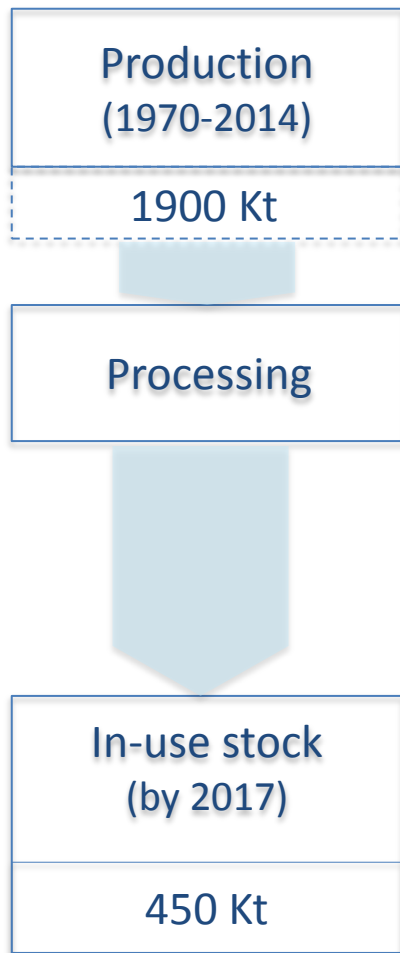
Consumption



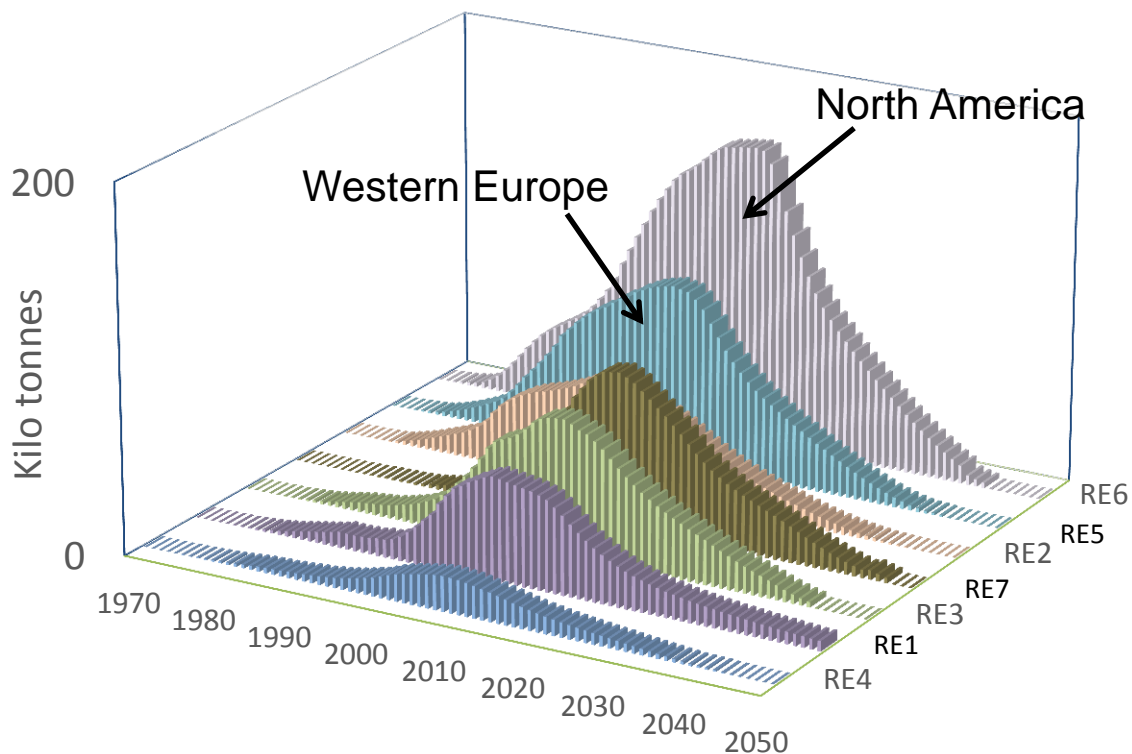
Use of PBDEs in five applications

- electric & electronic equipment
- transportation
- construction
- carpet & foam
- textile

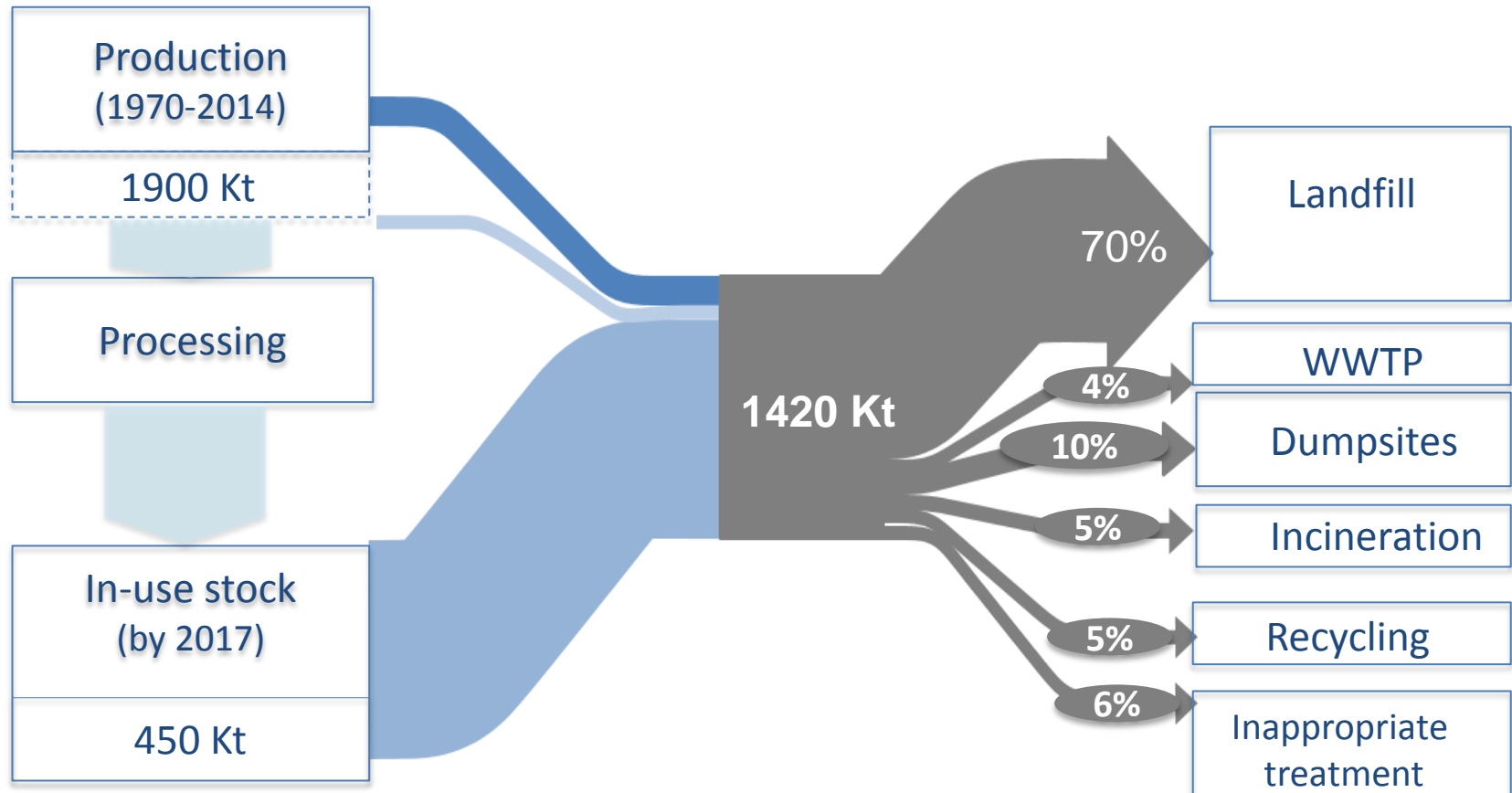
From production to in-use stock



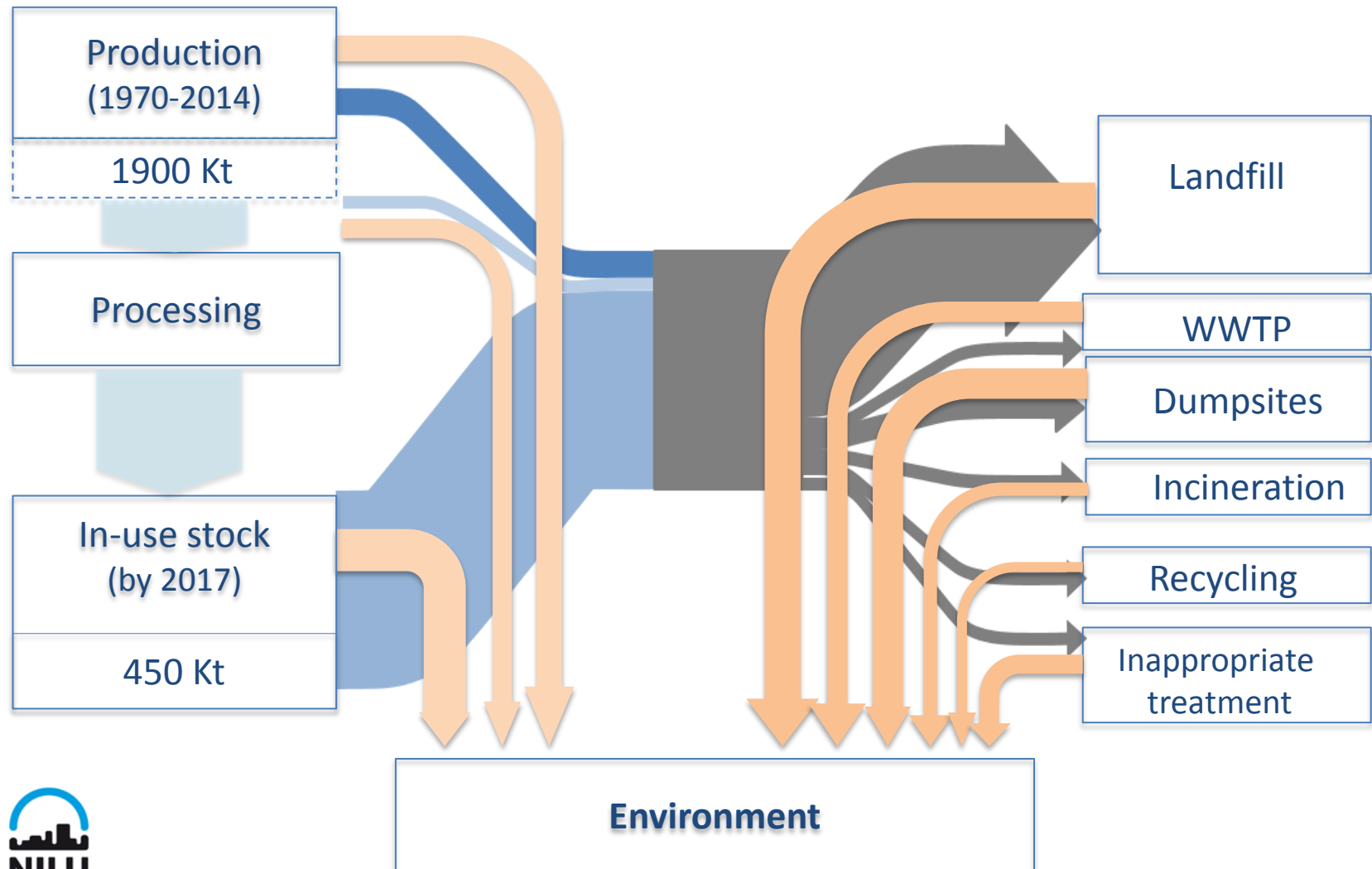
Regional Σ_6 PBDE in-use stock



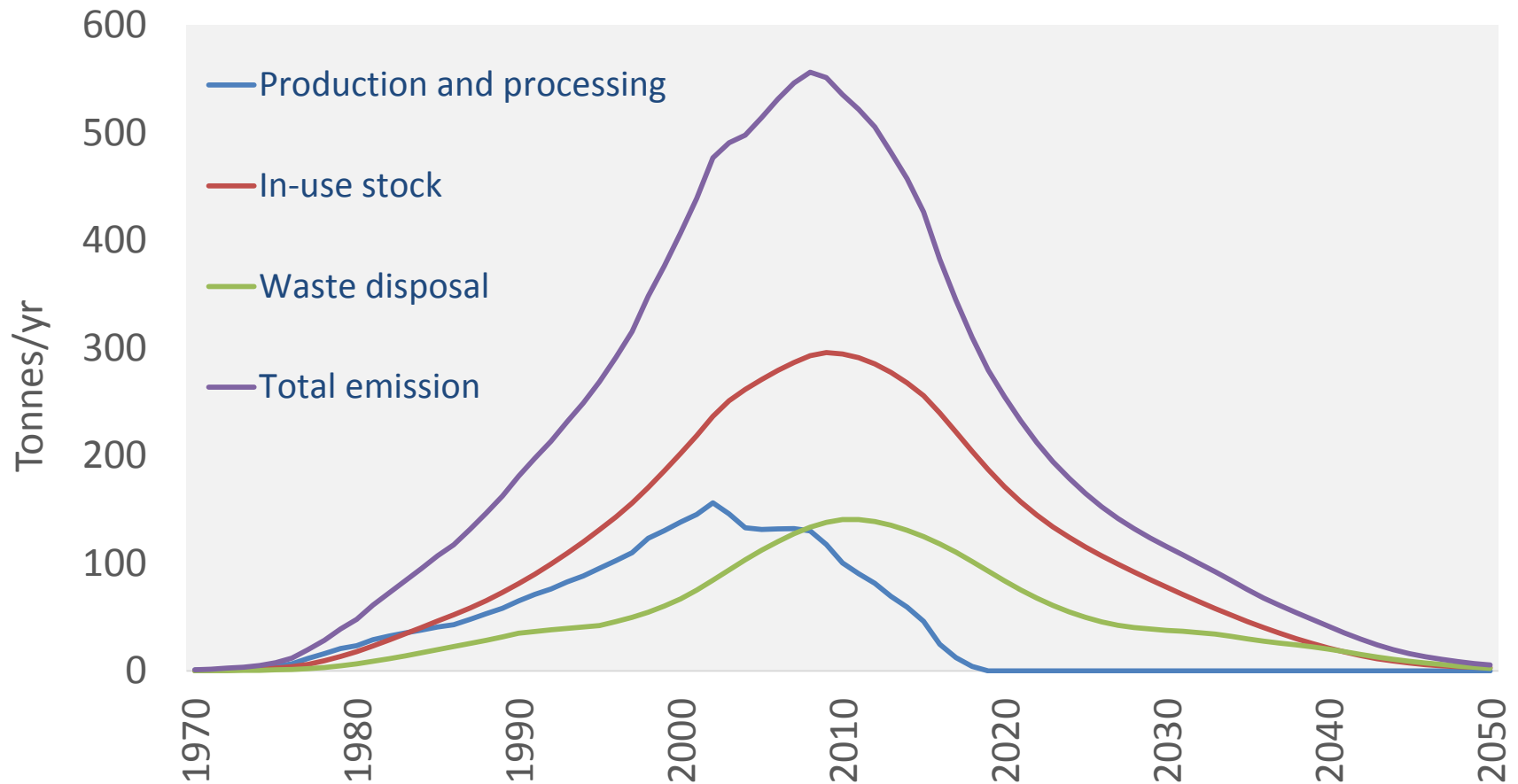
From in-use stock to waste stream



From production to environment

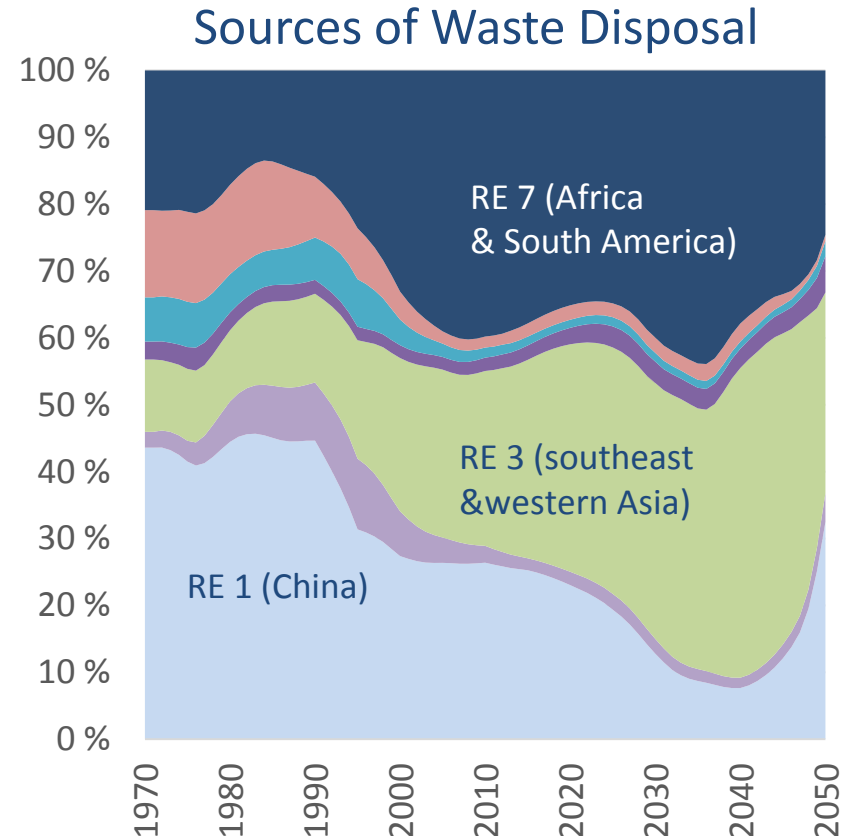
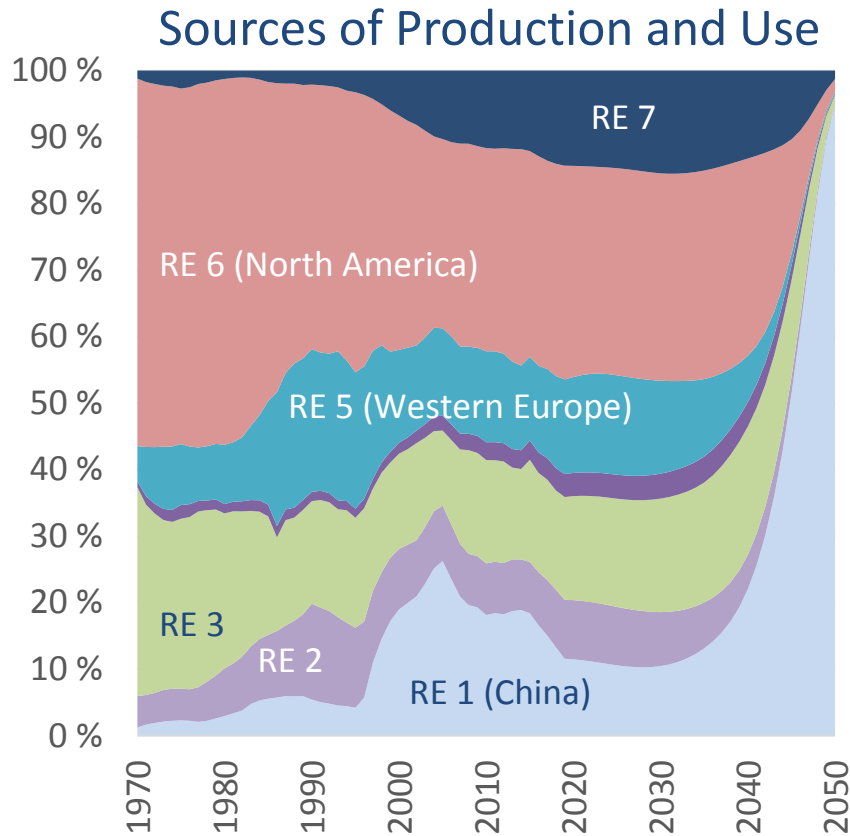


Global atmospheric emissions of Σ_6 PBDEs



- The stock of PBDE containing products is the major source of PBDE atmospheric emission

Regional contribution to Σ_6 PBDEs emission



- Developed countries: production and use

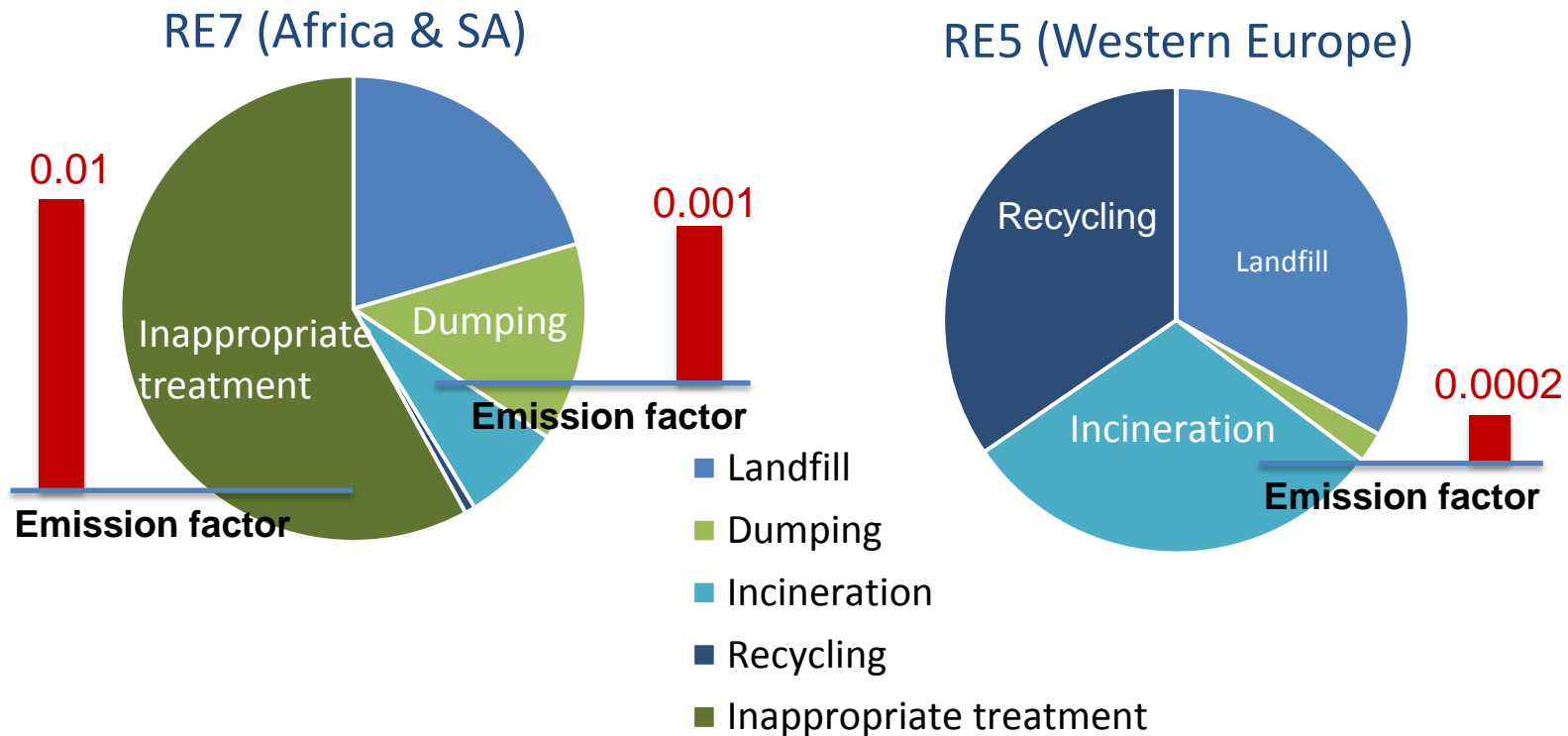
- Less developed countries: waste disposal



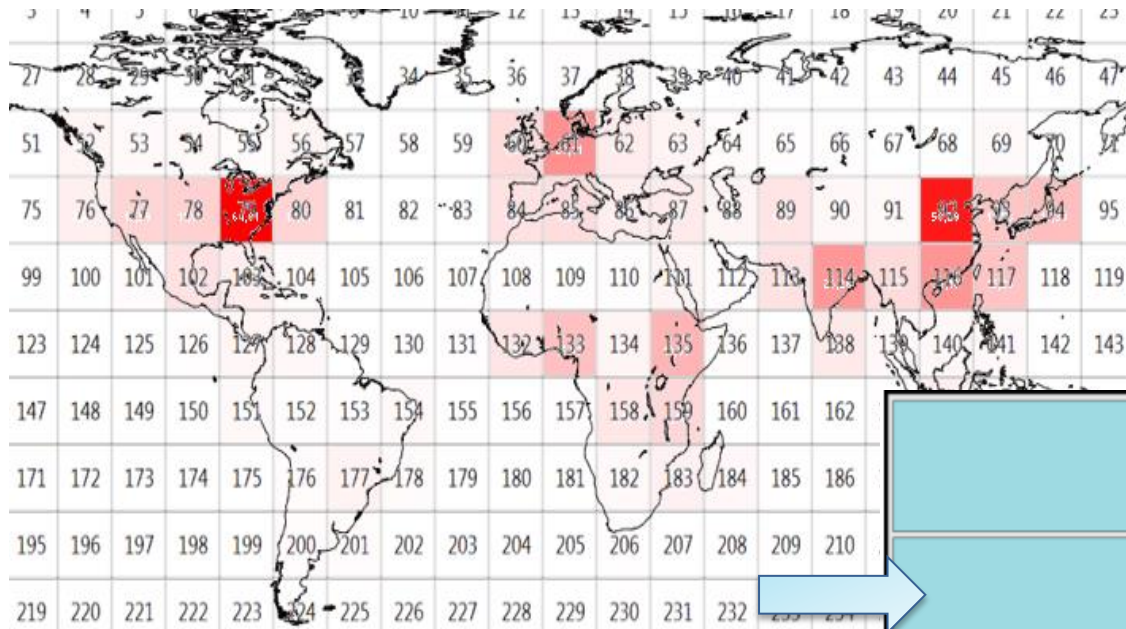
Primarily from uncontrolled landfills and inappropriate waste treatment

Regional contribution to Σ_6 PBDEs emission

Percentage of waste disposal options for municipal solid waste (in 2015)

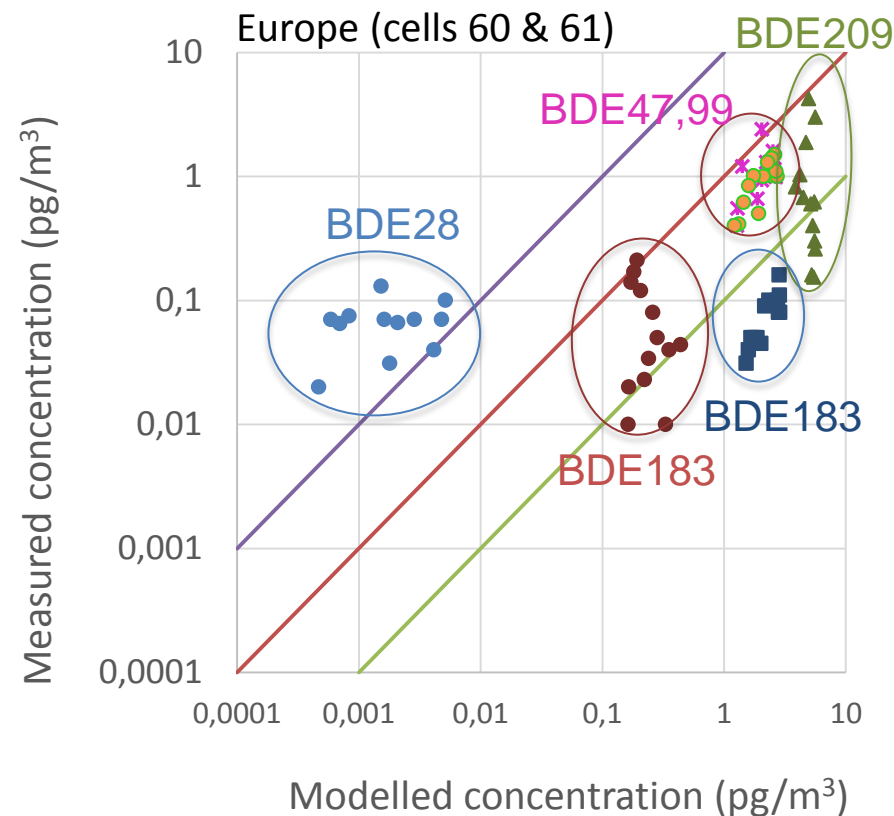
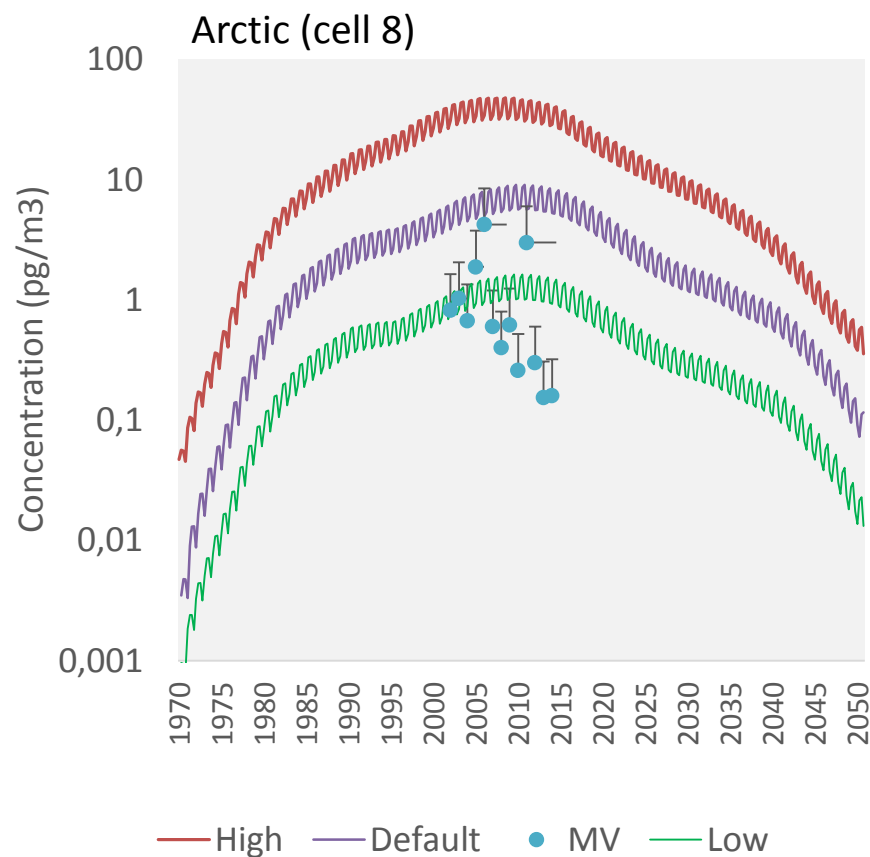


Atmospheric concentration



Arctic atmospheric concentration Σ_6 PBDEs

Modelled vs Measured



Summary

- A good understanding of the anthropogenic fate of PBDEs is a prerequisite to rationalize their environmental fate
- A CiP-CAFE model has been successfully parameterized and applied to estimate global historical emissions of \sum_6 PBDE
- The main historical source of \sum_6 PBDE to air in more developed countries comes from the in-use stock
- A transition towards \sum_6 PBDE emissions from uncontrolled landfills and inappropriate waste treatment in less developed countries could be predicted
- Preliminary comparisons between predicted modelled (BETR-Global) and measured concentrations in Arctic (background) suggest our global historical emission scenarios are reasonable
- Further work will focus on further evaluation of key uncertainties and implication for chemical management strategies

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Thank you for listening!

