Simulations with PELMO describing biocide leaching in urban soils

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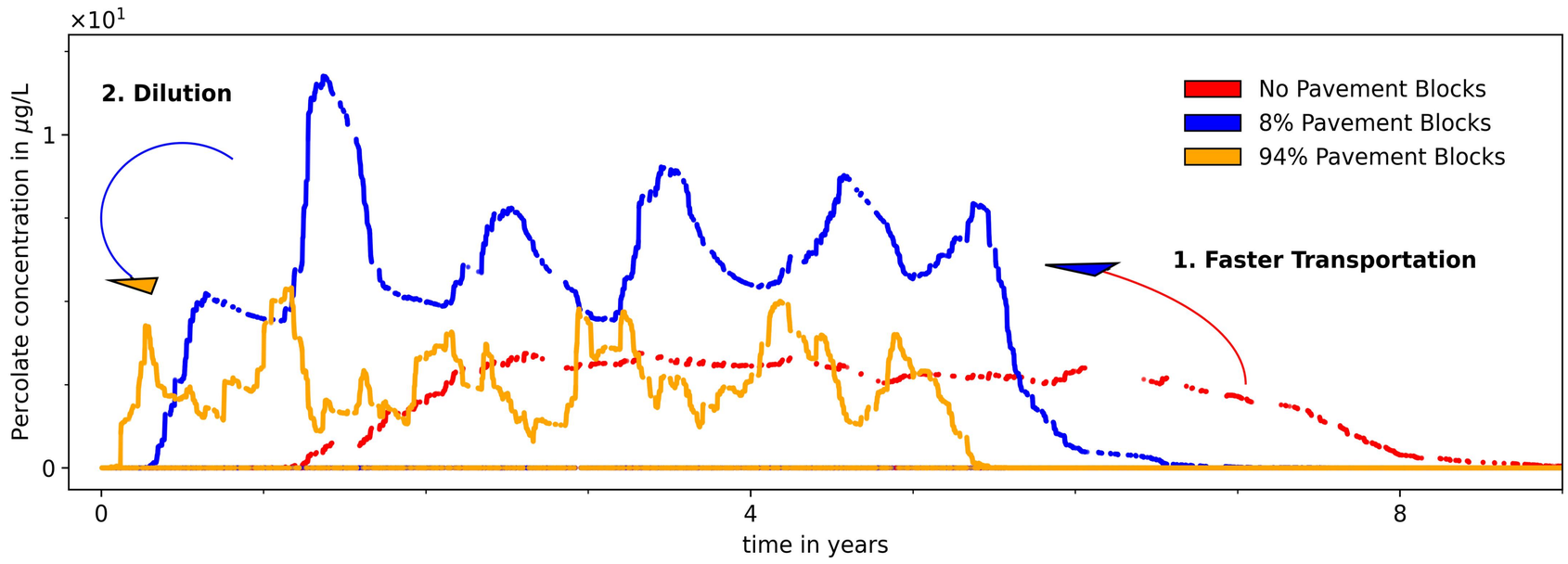
The FOCUS models[1]
- are designed to describe agricultural areas
- consider realistic worse-case scenarios
- include relevant factors such as crops, topography, soil, climate

In this study, PELMO[2] is used to assess biocides leaching from buildings.
- slightly mobile and persistent substance in permeable pavement scenario
- ➢ initial increase + eventual decrease of concentration with more water

Output from PELMO and risk assessment

PELMO calculates
- transformation and degradation of the substance through soil
- mass content in each layer over time
- volume of percolate
- percolate concentration
- average over time and locations

Compare PELMO result with concentration threshold by EFSA (concern above 0.1µg/L at groundwater level, i.e. 1 m depth) for risk assessment[4].



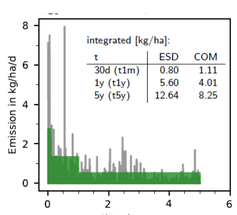
More Pavement → More water input through joints

More water input
→ faster transportation
→ higher concentration at groundwater level
Even more water input
→ dilution
→ lower concentrations

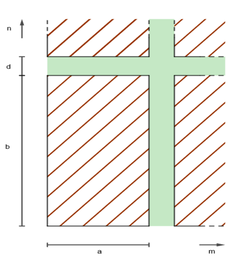
Figure 1: Percolate concentrations for varying pavement coverage. More water input results in faster transportation of the substance and higher concentrations. Even more water results in dilution effects and decreasing concentrations. (own illustration).

PELMO simulations need four input types and yields percolate concentration

Input data for PELMO



1. Substance:
   - slightly mobile and persistent.
   - Emission Scenario Document (ESD) for application scheme (constant release). Study with a more realistic emission scheme in preparation[3]



2. Soil:
   - sandy top soil layer with embedded pavement blocks disconnected by joints. High sorption in joints
   - thick sand layer below

3. Climate: Zurich, years 2001-2010.
   - pavement blocks not pervious to water
   - ➢ all water input (rainfall + wall-runoff) enters through the joints instantly

4. Crop: no crop, only bare soil

Increased water input initially increases and eventually decreases percolate concentration

Water input transports substance through soil.
- ➢ With more pavement area more water enters joints
- ➢ More water input leads to faster transportation
- ➢ Percolate concentration increases
- ➢ At some level of water input, all substance reaches groundwater level
- ➢ Further increase of water input dilutes substance
- ➢ Percolate concentration decreases

Issue: All substance transported, but concentrations are low and may be below risk assessment threshold.

Proposal for risk assessment

- Percolate concentration should not be sole quantity of interest
- Add (cumulated) leached output: indicates mass reaching groundwater level
- Define standard water volume to relate leached mass to concentration

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1 FOCUS Ground Water Work Group, 2000. FOCUS (2000) "FOCUS groundwater scenarios in the EU review of active substances" (No. EC Document Reference Sanco/321/2000 rev.2, 202pp).
2 Michael Klein, Kai Thomas, Matthias Trapp, Djamal Guerniche (2016): Protection of the groundwater against loads of plant protection products: validation of the new EU-simulation model FOCUS PELMO 4 for a reliable prediction of the leaching potential of PPP into groundwater.
3 ALU, IME, OST, UBA (2024): GRUBURG: Groundwater inputs of biocides from facades in urban areas (in preparation).
4 European Food Safety Authority, 2014. Conclusion on the peer review of the pesticide risk assessment of the active substance topramezone. *EFSA Journal* 2014; 12(2):3540, 82 pp. doi:10.2903/j.efsa.2014.3540.
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