Uncertainty analysis at the catchment scale for higher-tier BPR and REACH risk assessments

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Content

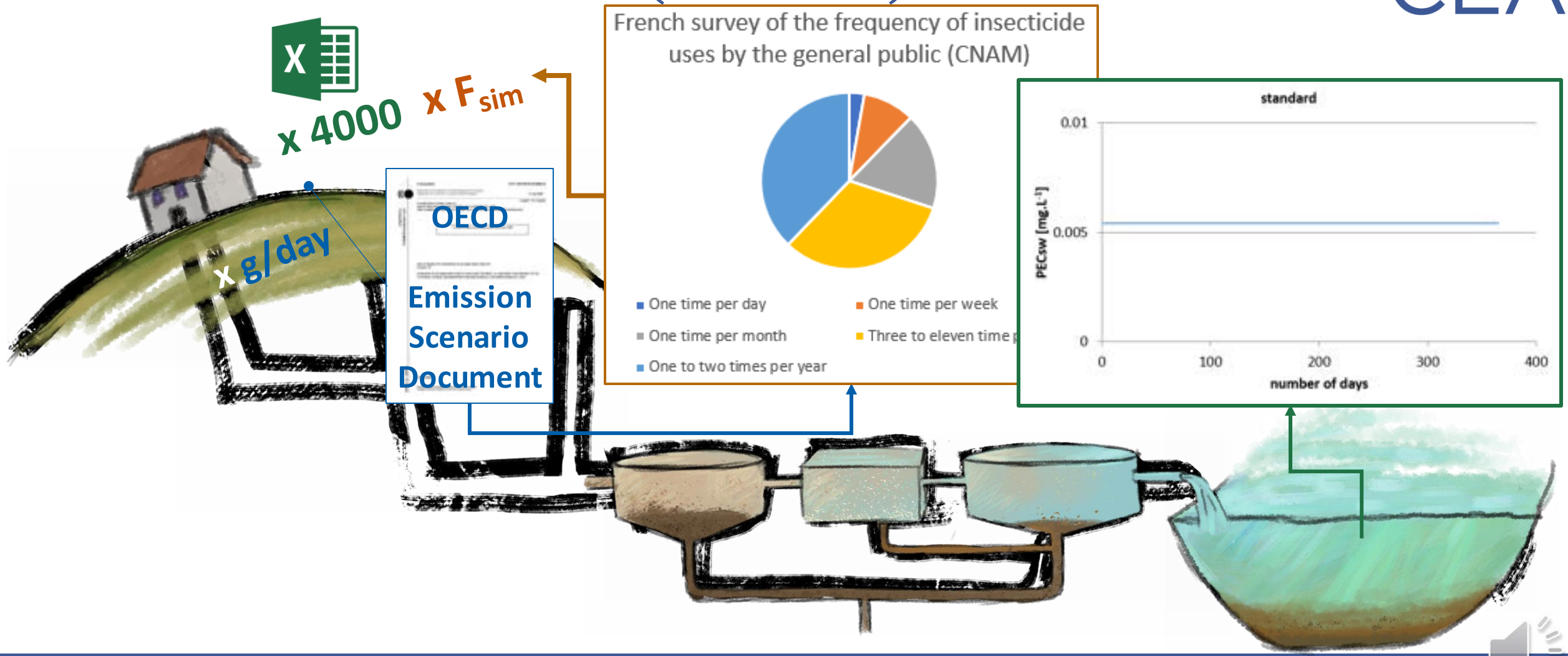
- Selected example scenario
- Reducing uncertainty
  - Reviewing the concept (methodological uncertainty)
  - Refining to increase realisms (technical uncertainty)
    - Fate processes
    - Product uses
    - Product composition and user behaviour

Standard scenario

Household insecticide (BPR PT18)

Standard scenario

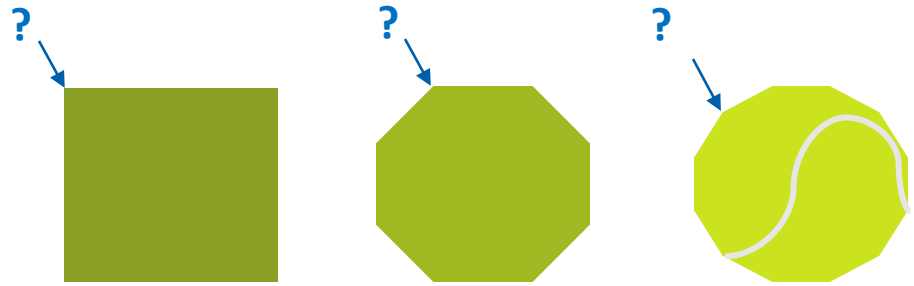
Household insecticide (BPR PT18)



Standard scenario
Review

Pro	Cons
- Simple to implement - Conservative - Can be used as benchmarks to 'evaluate' products	- Not an accurate prediction - Difficult to appropriately integrate new information (e.g. Risk Management Measures) and judge their impact quantitatively

- BPR and REACH guidance are open to higher-tier refinements if an uncertainty analysis is carried out
- To start on this, we need to:
  - Understand uncertainties
  - Increase realisms



There are many types of uncertainty
(definition not covered here - see Jeroen P. van der Sluijs (2017))

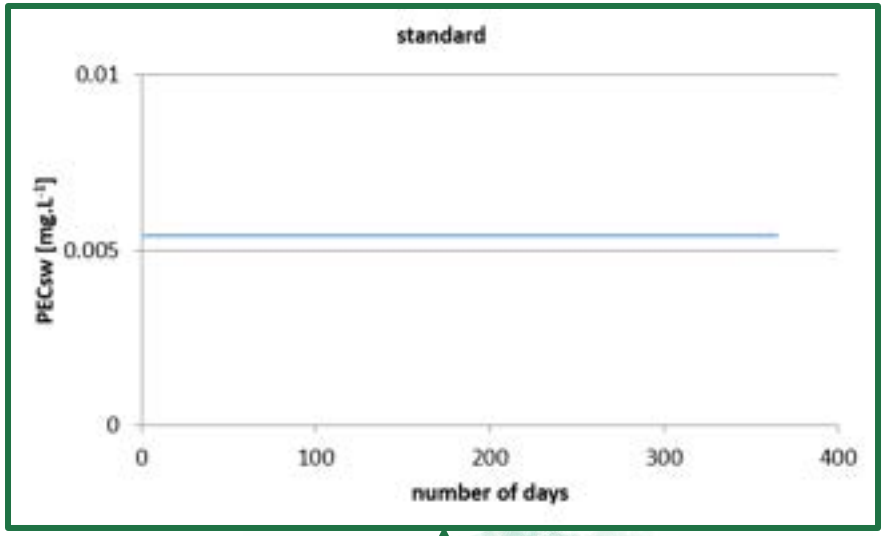
Standard scenario

Standard result

x 4000 x F_{sim}

What uncertainties can we identify and tackle?

Uncertainty #1: actual daily variation?



Reviewing the concept

From deterministic to object-based

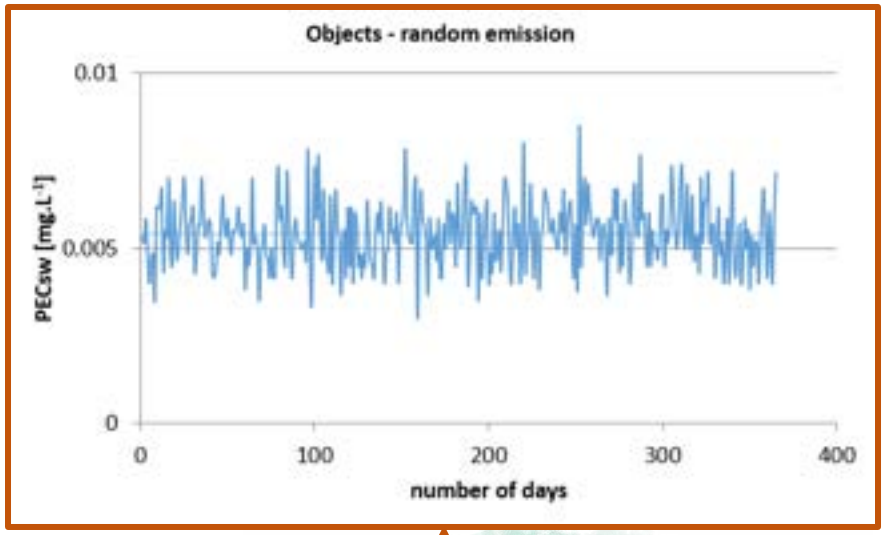
~~400~~ x F_{sim}

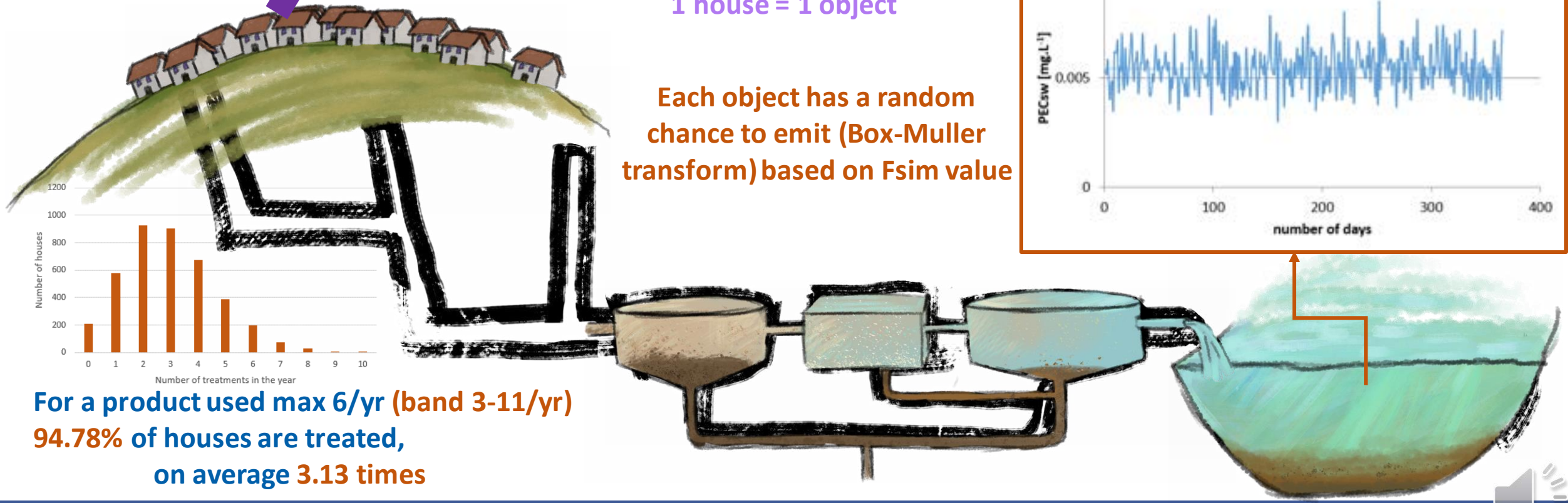
Using object-oriented programming to model emissions

1 house = 1 object

Each object has a random chance to emit (Box-Muller transform) based on Fsim value

Uncertainty #2:
What if this is not random?





For a product used max 6/yr (band 3-11/yr)
94.78% of houses are treated,
on average 3.13 times

Reviewing the concept

From universal to story-based

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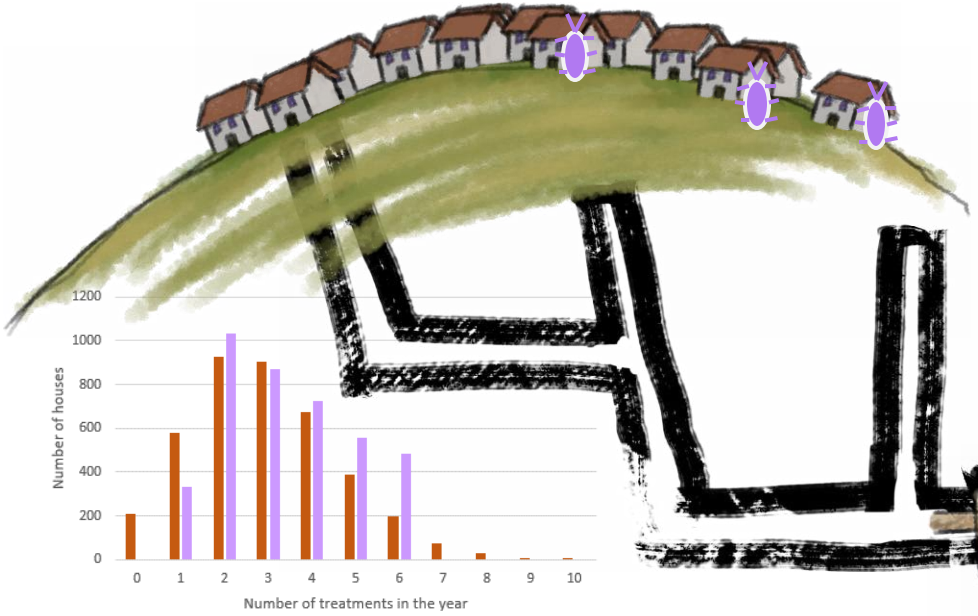
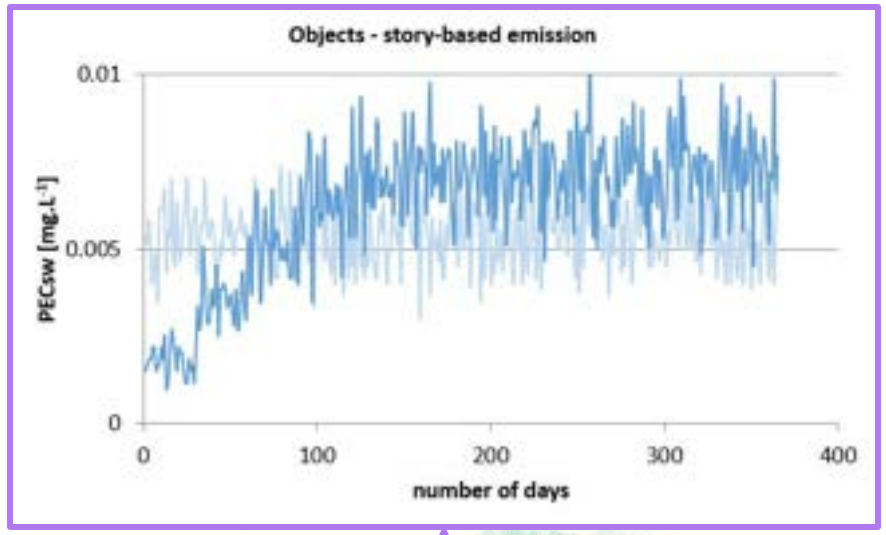
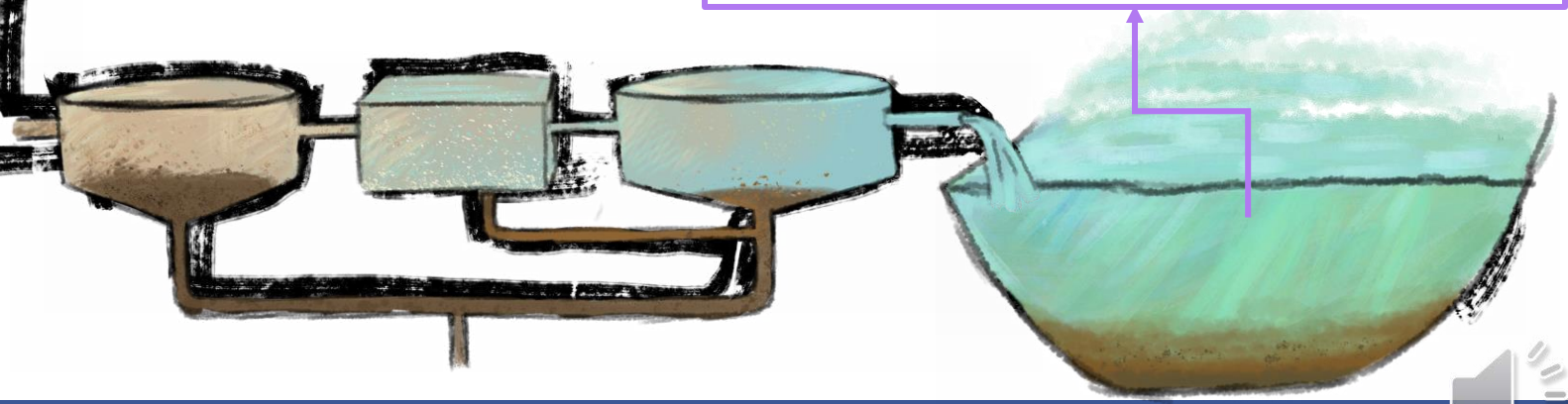
$F_{infestation}$ ~~x A_{sim}~~



~~Each object has a random chance to emerge (Box-Muller transform) based on Asim value~~

Each object has a story





For a product used max 6/yr ~~(band 3 11/yr)~~
100% of houses are treated,
on average 2.96 times

Refining to increase realism
Integrating overlooked processes

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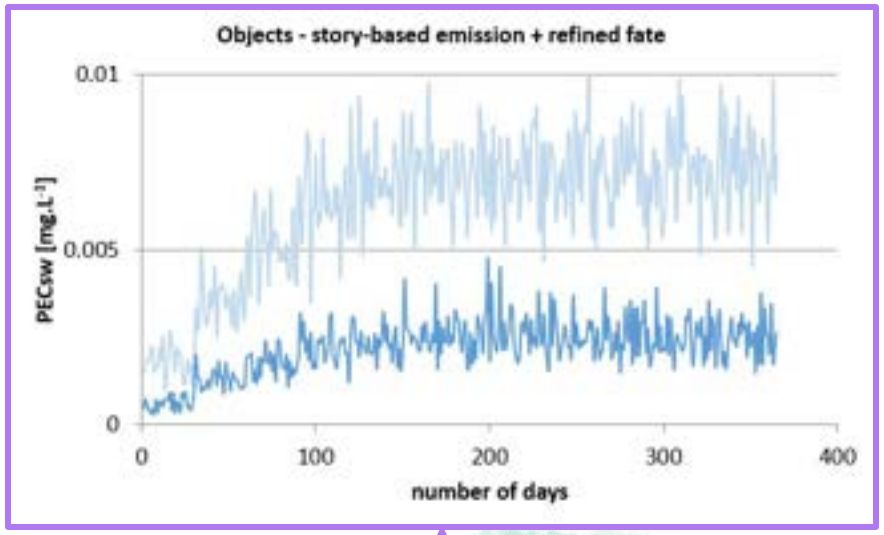
Uncertainty #3:
Moving away from defaults to measured values
e.g.: substance recovery (adsorption)

Provides insights on the potential impact of overlooked processes



Refining to increase realism
from the worst-case use to multiple uses

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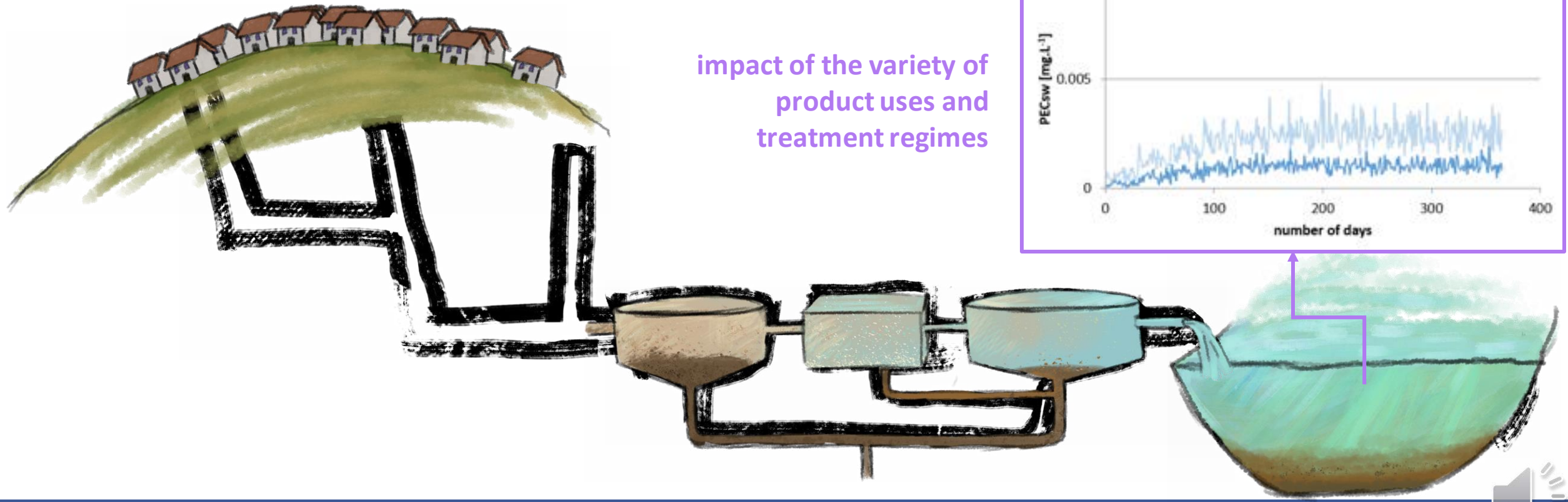
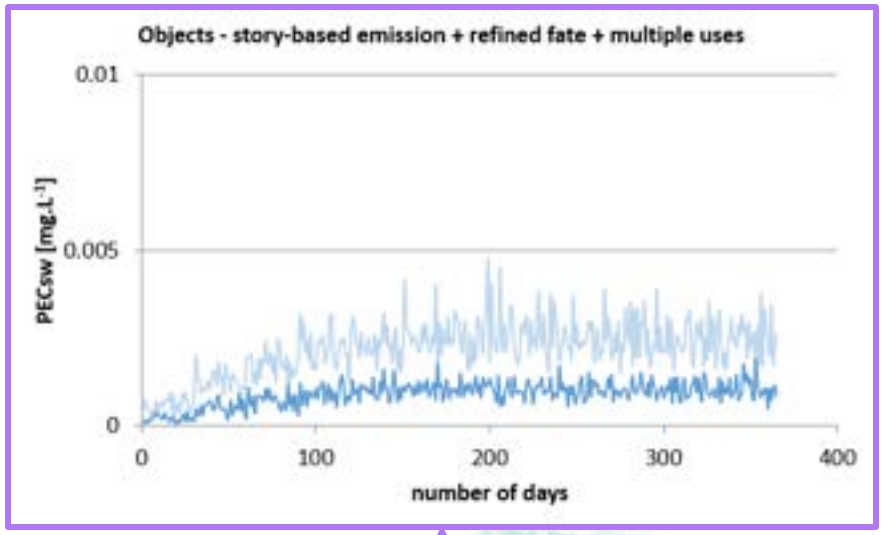
Uncertainty #4:
Moving away from single worst-case use
e.g.: alternate uses of the same product



impact of the variety of product uses and treatment regimes



Refining to increase realism
from single-substance to mixtures

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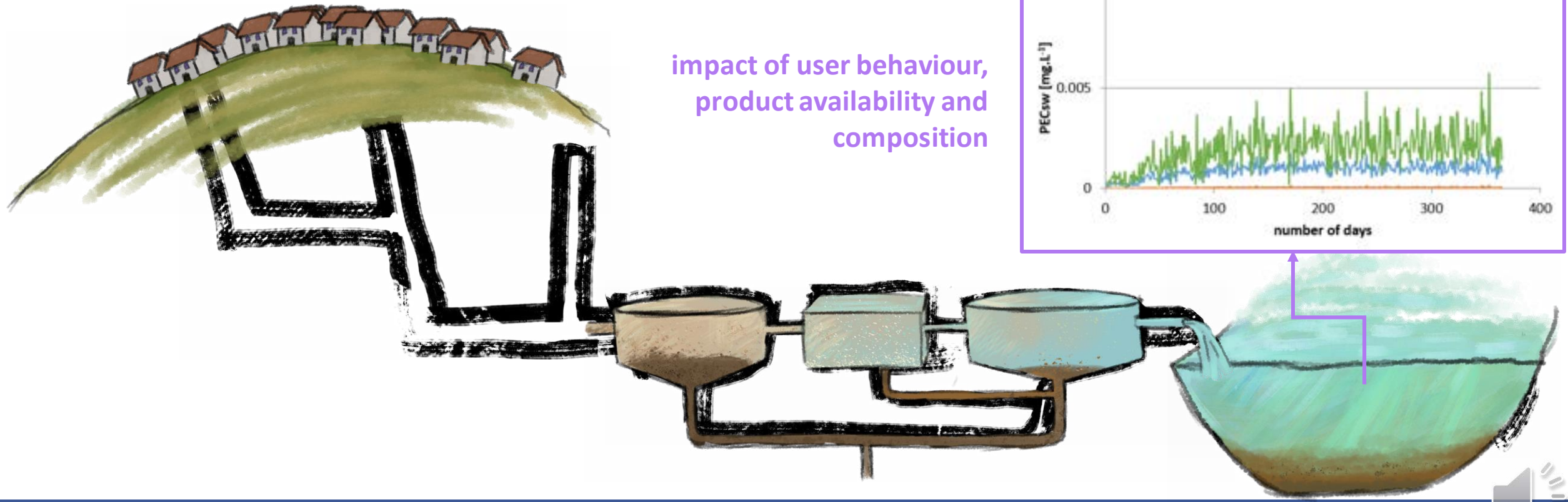
Uncertainty #5:
Moving away from single substance
e.g.: co-formulants or alternative products



impact of user behaviour, product availability and composition

Perspectives

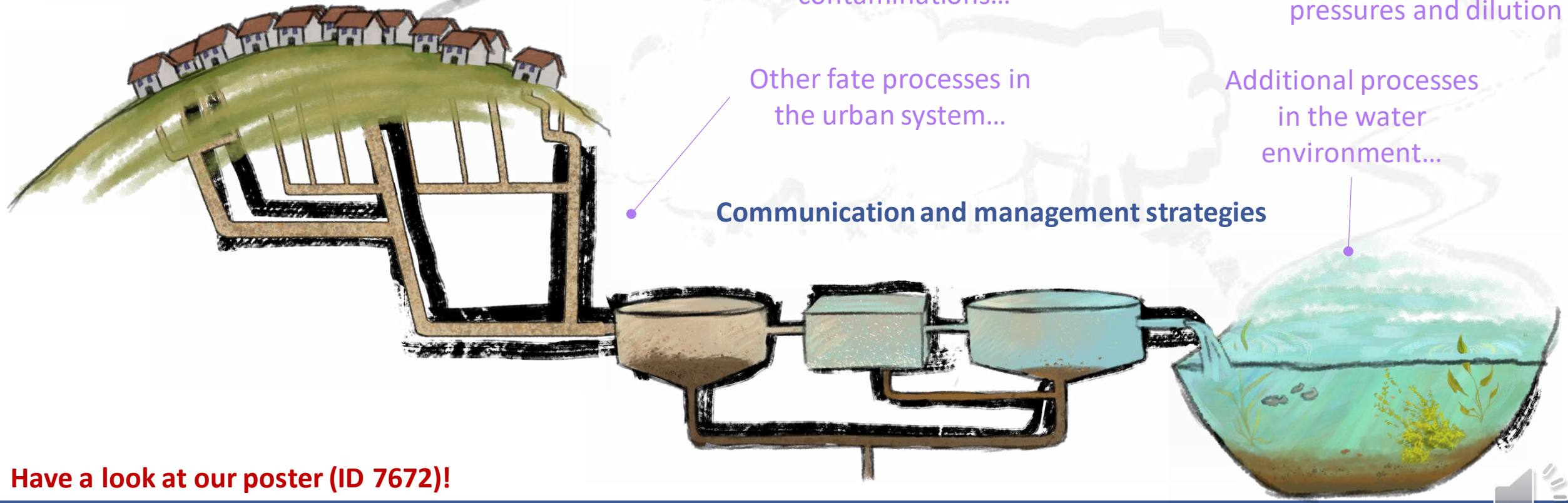
Other uncertainties/complexities not covered in this presentation

Other type of urban catchments, user and cleaning behaviour, resistance, cross-building contaminations…

Interactions from the wider environment, other catchments, seasonal pressures and dilution

Other fate processes in the urban system…

Additional processes in the water environment…



Communication and management strategies

Have a look at our poster (ID 7672)!

References:

Jeroen P. van der Sluijs (2017)
The NUSAP approach to uncertainty appraisal and communication; Chapter 29 p.301-310 in C.L. Spash (Ed.) Routledge Handbook of Ecological Economics: Nature and Society. Routlegde: London. ISBN-13: 978-1138931510.

Any questions?

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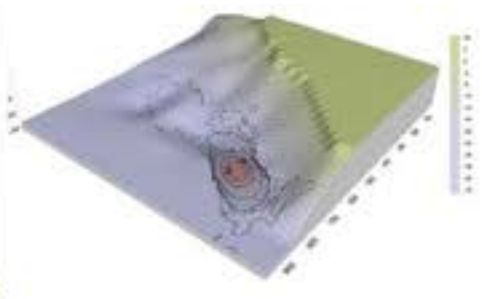

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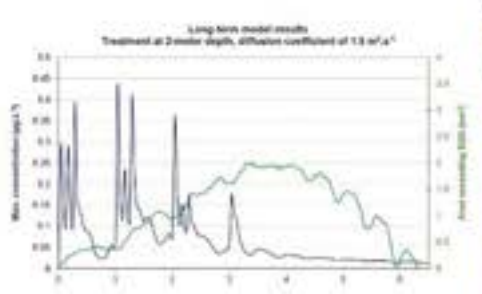
PROVIDING NOVEL SOLUTIONS FOR AN INCREASINGLY DEMANDING REGULATORY WORLD